

# Food and predation in suburban Sparrowhawks *Accipiter nisus* during the breeding season

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(Med et dansk resumé: Bynære Spurvehøges *Accipiter nisus* føde og prædation i yngletiden)

## Introduction

Feeding habits of the Sparrowhawk *Accipiter nisus* have been widely studied. Previous European studies have been summarized in Glutz et al. (1971) and by Newton (1986).

Schnurre (1937) identified prey remains at two Sparrowhawk nests in urban parks of Berlin. Later studies on the diet of suburban Sparrowhawks have been concerned with hawks that nested outside urban areas, but made forays into built-up areas (Klaas 1943, Grössler 1953, Kramer 1954, Schnurre 1974, Opdam 1978, Friemann 1979), or with winter diet (Kramer 1952, Mönke 1968).

In recent years, mainly after 1980, records of Sparrowhawks breeding in towns and large cities have increased (see Newton 1986). In Denmark, in 1982, a breeding attempt was recorded in Copenhagen, and within a few years 4-5 pairs were breeding within the city limits (Olsen 1986). In Århus, Sparrowhawks have been recorded breeding inside the built-up area since 1979, when the area was searched for the first time (Frimer, in prep.). The question of whether the prey bird stock of this new and still expanding habitat is sufficiently rich for Sparrowhawks to breed successfully, should be posed in relation to this colonization.

This study examines the food of Sparrowhawks in the suburbs of Århus during the breeding season. The main purpose is to present data on the composition of the diet in a suburban environment, to compare the food and predation

of Sparrowhawks nesting inside the built-up area with that of hawks living in woods adjacent to the urban residential area, and to examine changes in prey delivery in a Sparrowhawk family during the nestling period.

## Study area

The study took place in an area of 58 km<sup>2</sup> covering the southern suburbs of Århus (254,000 inhabitants in 1986) and the adjacent woodland (Fig. 1). The area is bounded on the east side by the coastline of Århus Bay.

One extensive forest and two smaller forests together cover 9.44 km<sup>2</sup>. The northern third is park-like and engulfed in residential areas and gardens; the southern part is surrounded by arable land with scattered farms and small villages.

About 80% of the forested area is deciduous dominated by 90-160 years old beech *Fagus sylvatica*, with regularly distributed stands of oak *Quercus robur*, birch *Betula pendula* and ash *Fraxinus excelsior*, the remaining 20% being stands of coniferous trees, mainly common spruce *Picea abies*. The recreational use of the forest area is intense, and both forest and agricultural land are intensively managed. Meadows and marshes are scarce.

In the four-year study period 1984-1987, the annual number of Sparrowhawk breeding pairs

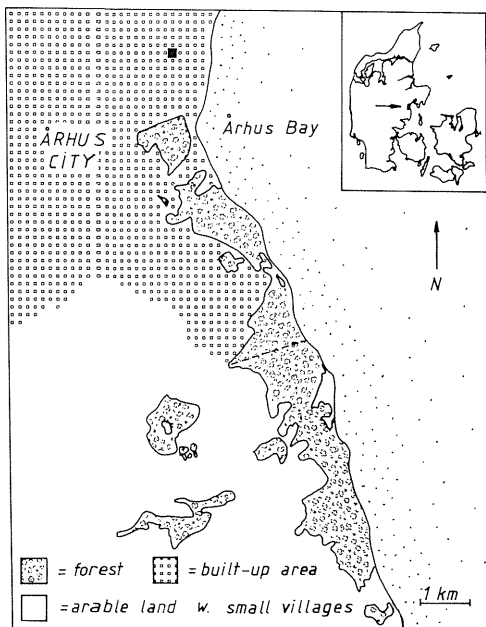


Fig. 1. Map of the study area. Black square indicates city center. Dots indicate water. (---) city boundary. Undersøgelses-området. Sort firkant angiver bycenterum. Prikker angiver vand. (----) bygrænse.

was 7-8, of which 3-4 lived inside the city boundary. The hawks nested in the parks and forests, and hunted in the nearby surroundings.

## Materials and methods

Prey remains were collected during the breeding season March to August. In this period Sparrowhawks regularly carry items to plucking posts near the nest.

The prey is usually plucked on a stump or on a bare patch of the forest floor, but in urban (i.e. disturbed) areas plucking on a low thick horizontal branch of a tree seems to be more common. See also Kramer (1954) and Friemann (1979). When plucking small birds, the hawk leaves only the feathers, but from birds the size of a thrush and larger it will often leave bill and legs as well. From rodents, fur or skin with fur and, occasionally, the tail is left.

Both male and female hunt in the mating and nestbuilding period, but from the start of incubation to the time when the young are about 12

days old, the male does all the hunting; thereafter the female starts to hunt again.

The nesting sites were regularly visited (usually weekly) and carefully scanned. In 1985 one nesting site was visited almost daily. All prey remains were collected and identified with the help of museum-skins, a collection of flightfeathers and identification guides by Svensson (1984) and Brown et al. (1987).

In some cases, insufficient remains were found to distinguish between certain species pairs (Willow Warbler – Chiffchaff, Chaffinch – Brambling and House Sparrow – Tree Sparrow). On a few occasions prey remains led no further than to genus (*Turdus*, *Parus*).

Weights of prey were calculated, allowing for the proportion of fledglings (not fully grown) in the sample, assuming that fledglings weighed two-thirds of the weight of an adult, as suggested by Newton & Marquiss (1982).

Confusion between kills of Sparrowhawk and the closely related Goshawk *Accipiter gentilis* was unlikely, as the latter is absent from the area. Method and biases have been discussed by Newton & Marquiss (1982).

## Results

### Composition of diet

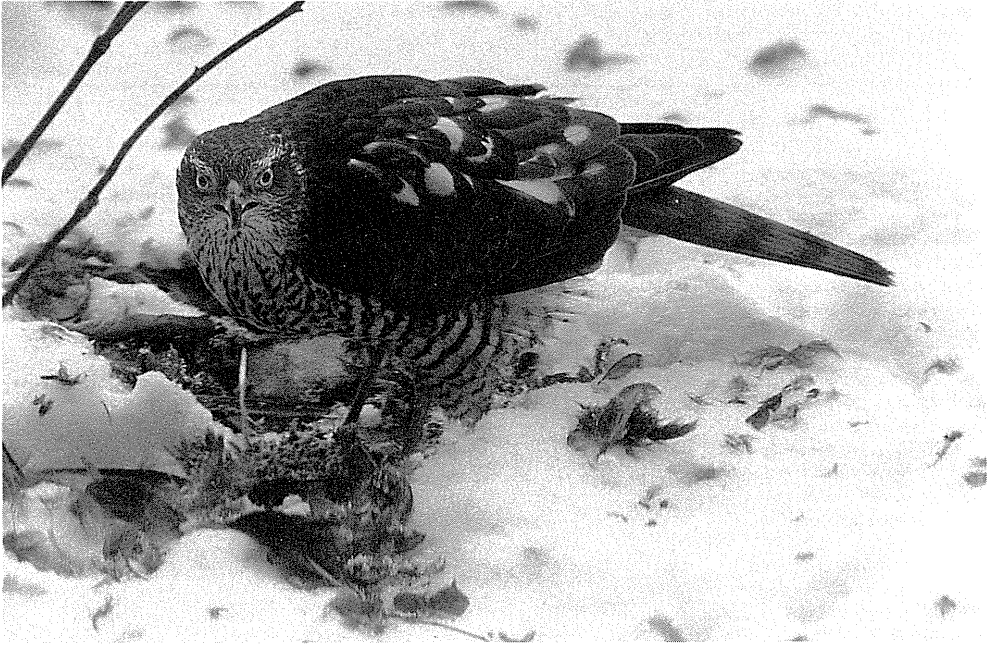
A complete list of prey items found is given in Tab. 1.

In all, 51 species of birds and 2 of mammals were recorded. Of the 1881 prey items found, birds comprised 99%, rodents the remaining 1%. Seven species each formed more than 5% of the food and together these species comprised about 72% of all items; 16 species formed more than 1% of the food, and together they comprised about 87% of all items.

Expressed by weight, only four species exceeded the 5% level, with Blackbird and Woodpigeon as the most important, followed by House Sparrow and Tree Sparrow. Together they formed 59% of the total prey weight.

Summer visitors were regularly taken throughout the season except for Willow Warblers; 78% of these were found in May, when they appeared in large numbers in the area. Also Goldcrests were mainly taken in May (73%).

Two male Sparrowhawk yearlings were recorded among prey items, both killed in the early spring, presumably by females.



*Solsorten er vægtmæssigt det vigtigste byttedyr for Spurvehøgen. Foto: Lars Borup.*

Among rodents, the partly diurnal Bank Voles were most frequently taken.

Composition of diet showed no notable differences between the years in the study period. However, 12 of the 13 recorded rodents were found in 1987 when these animals seemed to appear in increased numbers in the area, presumably because of rich crops of mast in 1986.

#### **Differences in composition of diet between urban and rural environments**

In all, 47 prey species (1195 specimens) were recorded in the urban zone and 46 species (686 specimens) in the rural zone (Tab. 1). In both habitats, seven species each formed more than 5% of the food, according to number.

As could be expected, the House Sparrow dominated in the urban zone, forming 22% of the food, while in the rural zone the Tree Sparrow was the most important species, making up 16% of the food.

A very considerable fraction of the prey species recorded occurs in the prey list of both habitats. Also, the "dominating" species (>5% by number) were mostly the same in both habitats; however, in the urban zone they constituted a higher proportion of the prey items (78%) than they did in the rural zone (62%).

When comparing the proportions of prey spe-

cies simultaneously by means of a  $\chi^2$ -test, the food composition of the two habitats differed significantly ( $\chi^2=190.3$ ,  $P<0.001$ ,  $df=32$ ) (species comprising less than 0.4% of the total number of items were pooled). Individual food items were compared to all other items in the two habitats by  $2 \times 2$   $\chi^2$ -tests. Nine species differed significantly (Tab. 2). The higher proportion of House Sparrows in the diet of Sparrowhawks in the urban zone was highly significant; Blue Tits and Nuthatches were also taken more frequently in this area. In the rural zone, mainly Linnet, Swallow and Skylark appeared in higher frequencies, but also Fieldfare, Pied Wagtail and Chaffinch differed significantly. The Fieldfare, being a very rare breeder in the area, was mainly preyed upon during the period of spring migration.

Blackbirds, which are known to exist at higher densities in gardens and city parks than in rural habitats (Batten 1973, Møller 1976, Hansen 1978, Mulsow 1980, Bezzel 1985), constituted a higher proportion of the sample from the urban zone than from the rural zone, but the difference was not significant. The same was true for Greenfinch and Great Tit.

Some of the prey species occurred in numbers sufficiently large to allow further analysis. In Fig. 2 the proportions of some species in the diet of Sparrowhawks breeding in the extensive

Tab. 1. Frequency of prey species in the food of Sparrowhawks, 1984-1987.  
*Frekvensen af byttearter i Spurvehøgens føde, 1984-1987.*

	% by number <i>Antal i %</i>			% by weight <sup>a</sup> <i>Vægt i %</i>
	Urban zone <i>By-zone</i>	Rural zone <i>Land-zone</i>	Both habitats <i>Begge habitater</i>	Both habitats <i>Begge habitater</i>
House Sparrow <i>Passer domesticus</i>	22.1	9.2	17.4	11.20
Tree Sparrow <i>Passer montanus</i>	16.0	16.2	16.1	8.34
Great Tit <i>Parus major</i>	12.0	9.8	11.2	4.25
Blackbird <i>Turdus merula</i>	9.8	7.6	9.0	20.03
Greenfinch <i>Carduelis chloris</i>	6.5	5.5	6.2	4.05
Blue Tit <i>Parus caeruleus</i>	6.1	3.4	5.1	1.20
Chaffinch <i>Fringilla coelebs</i>	5.3	8.3	6.4	3.65
Nuthatch <i>Sitta europaea</i>	3.3	1.5	2.6	1.35
Song Thrush <i>Turdus philomelos</i>	1.7	1.6	1.7	2.67
Blackcap <i>Sylvia atricapilla</i>	1.6	1.3	1.5	0.67
Woodpigeon <i>Columba palumbus</i>	1.4	2.6	1.9	19.41
Starling <i>Sturnus vulgaris</i>	1.3	1.9	1.5	2.79
Linnet <i>Carduelis cannabina</i>	1.3	5.4	2.8	1.14
Robin <i>Erithacus rubecula</i>	0.9	1.3	1.1	0.45
Pied Wagtail <i>Motacilla alba</i>	0.8	2.3	1.3	0.55
Bullfinch <i>Pyrrhula pyrrhula</i>	0.8	0.7	0.7	0.55
Pied Flycatcher <i>Ficedula hypoleuca</i>	0.6	0.2	0.4	0.14
Redwing <i>Turdus iliacus</i>	0.6	0.7	0.6	1.00
Brambling <i>Fringilla montifringilla</i>	0.6	1.0	0.7	0.46
Great Spotted Woodpecker				
<i>Dendrocopos major</i>	0.5	0.9	0.6	1.28
Swallow <i>Hirundo rustica</i>	0.5	3.6	1.7	0.76
Willow Warbler <i>Phylloscopus trochilus</i>	0.4	0.6	0.5	0.10
Fieldfare <i>Turdus pilaris</i>	0.4	1.9	1.0	2.39
House/Tree Sparrow				
<i>Passer domesticus/montanus</i>	0.4	0.7	0.5	0.28
Jay <i>Garrulus glandarius</i>	0.3	1.0	0.6	2.26
Lesser Whitethroat <i>Sylvia curruca</i>	0.3	0.7	0.5	0.13
Goldcrest <i>Regulus regulus</i>	0.3	1.0	0.6	0.08
Dunnock <i>Prunella modularis</i>	0.3	0.7	0.4	0.21
Siskin <i>Carduelis spinus</i>	0.3	0.7	0.4	0.13
Crossbill <i>Loxia curvirostra</i>	0.3	0.2	0.2	0.20
Unidentified birds <i>Ubestemte fugle</i>	0.3	0.3	0.3	0.13
Feral pigeon <i>Columba livia</i>	0.2	0.2	0.2	0.99
House Martin <i>Delichon urbica</i>	0.2		0.1	0.04
Magpie <i>Pica pica</i>	0.2		0.1	0.56
Wren <i>Troglodytes troglodytes</i>	0.2	0.2	0.2	0.04
Chiffchaff <i>Phylloscopus collybita</i>	0.2	0.3	0.2	0.04
Willow Warbler/Chiffchaff				
<i>Phylloscopus trochilus/collybita</i>	0.2		0.1	0.02
Wood Warbler <i>Phylloscopus sibilatrix</i>	0.2	0.6	0.3	0.08
Spotted Flycatcher <i>Muscicapa striata</i>	0.2	0.2	0.2	0.06
Mistle Thrush <i>Turdus viscivorus</i>	0.2	0.7	0.4	1.00
Yellowhammer <i>Emberiza citrinella</i>	0.2	0.9	0.4	0.32
Sparrowhawk <i>Accipiter nisus</i>	0.1	0.2	0.1	0.38
Pheasant <i>Phasianus colchicus</i>	0.1	0.2	0.1	1.79
Woodcock <i>Scolopax rusticola</i>	0.1	0.3	0.2	1.18
Meadow Pipit <i>Anthus pratensis</i>	0.1		0.1	0.02
Garden Warbler <i>Sylvia borin</i>	0.1		0.1	0.03
Marsh Tit <i>Parus palustris</i>	0.1		0.1	0.01
Treecreeper <i>Certhia familiaris</i>	0.1		0.1	0.01
Hawfinch <i>Coccothraustes coccothraustes</i>	0.1		0.1	0.07
Skylark <i>Alauda arvensis</i>		1.9	0.7	0.63
Sand Martin <i>Riparia riparia</i>		0.2	0.1	0.02

continued

Waxwing <i>Bombycilla garrulus</i>		0.2	0.1	0.08
Redstart <i>Phoenicurus phoenicurus</i>		0.2	0.1	0.02
<i>Turdus</i> sp.		0.2	0.1	0.13
<i>Parus</i> sp.		0.2	0.1	0.02
Chaffinch/Brambling				
<i>Fringilla coelebs/montifringilla</i>		0.4	0.2	0.10
Goldfinch <i>Carduelis carduelis</i>		0.2	0.1	0.02
Bank vole <i>Clethrionomys glareolus</i>	0.8	0.3	0.6	0.46
Yellow-necked/Wood mouse				
<i>Apodemus flavicollis/sylvaticus</i>		0.2	0.1	0.04
Total items <i>Bytte ialt</i>	1195	686	1881	79.0 kg

a: Weights of fledglings in the sample are assumed to be two-thirds of the weight of an adult.  
*Vægten af unger med ikke-færdigudviklet fjerdragt er sat til 2/3 af voksen vægt.*

Tab. 2. Prey species that differed significantly in the diet of Sparrowhawks living in the urban and the rural zone.  $\chi^2$ -values and corresponding significance levels (p) are given.

*Byttearter der udviste signifikant forskel i føden hos Spurvehøge i by-zonen og land-zonen.  $\chi^2$ -værdier og tilhørende signifikans-niveauer (p) er angivet.*

Species	$\chi^2_1$	p
Predominantly urban:		
House Sparrow	73.7	< 0.001
Blue Tit	5.5	< 0.025
Nuthatch	5.2	< 0.05
Predominantly rural:		
Linnet	26.5	< 0.001
Swallow	25.7	< 0.001
Skylark	20.5	< 0.001
Fieldfare	8.7	< 0.005
Pied Wagtail	7.4	< 0.01
Chaffinch	7.2	< 0.01

coastal forest is shown in relation to the distance from nest to the city center. Following the coastline, this forest extends along an ecological gradient from the city center towards the rural habitats (Fig. 1).

Female Sparrowhawks on the average take larger prey than males (Opdam 1975, Newton & Marquiss 1982) and do less hunting in the breeding season. Therefore, only data from successful Sparrowhawk pairs were included, so to avoid differences in prey sizes (and compositions) caused by failed females that started hunting at an early stage. These hawks nested at distances from 2 km to more than 10 km from the city center, but no nests were more than 700 m (mean 425 m) from the nearest human settlement. Variation in diet is therefore, to some extent, an

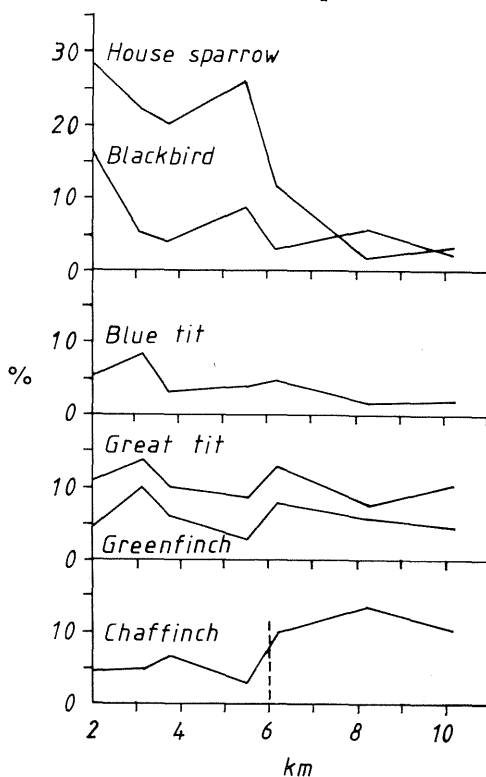


Fig. 2. Proportions (%) of various prey species in the diet of Sparrowhawks in relation to distance from nest to city center, 1984-1987. (----) city boundary.  
*Nogle byttearters gennemsnitlige andel (%) af Spurvehøgens føde i relation til redens afstand til bycentrum, 1984-87. (----) bygrænse.*

Tab. 3. Number and fresh weight estimates of items collected at a Sparrowhawk nest during the breeding season. *Antal og estimeret frisk-vægt af bytte indsamlet ved en Spurvehøge-rede i yngletiden.*

	Period <i>Periode</i>	Number of days <i>Antal dage</i>	Number of items <i>Antal pluk</i>	Weight (g) <i>Vægt (g)</i>
Mating and nestbuilding period <i>Parrings- og redebygningstiden</i>	12/3 - 18/4	38	10	789
Egg laying and incubation period <i>Æglægnings- og rugetiden</i>	19/4 - 28/5	40	43	982
Nestling period <i>Redeunge-tiden</i>	29/5 - 29/6	32	184	4999
Post-fledging period (young stay close to nest) <i>Flyveperioden (ungerne bliver nær reden)</i>	30/6 - 22/7	23	61	1878
Total breeding period <i>Hele yngleperioden</i>	12/3 - 22/7	133	298	8648

expression of to what degree the hunting area is covered with human habitation.

The proportion of House Sparrows in the diet increased with decreasing distance to the city center (Fig. 2). Inside the city limits, this species comprised more than 20% of the food at all distances.

Blackbirds occurred in significantly higher proportions (mean 17%) in the diet of the hawks nesting 2 km from the city center, when compared with the other nesting sites, where Blackbirds comprised less than 10% of the food ( $\chi^2 = 28.3$ ,  $P < 0.001$ ,  $df = 1$ ).

Blue Tits, and to a lesser extent Great Tits and Greenfinches, showed a slight increase with decreasing distance to the city center. The proportion of Chaffinches outside the city boundary was twice the proportion within the urban zone.

### Changes in prey delivery in a Sparrowhawk family

The proportion of prey items plucked near the nest during the breeding season varies greatly in Sparrowhawks. In 1985 a breeding pair in the urban zone, that plucked a comparatively high proportion in the nesting area, was visited almost daily.

On 12 March when this area was scanned for the first time, the female Sparrowhawk was present, and plucks of larger items indicated that she had been so for some days. On 27 March, both male and female were present. Egg laying began on 19 April (backdated from age of young). The pair raised three young that reached independence around 22 July.

Altogether, 298 items with a calculated fresh weight of 8.6 kg were found during the period of 133 days (Tab. 3). By number and by weight these items made up 65-75% of the total consumption of a Sparrowhawk family during the breeding season, as estimated by Uttendörfer (1939), Tinbergen (1946), Holstein (1950) and Hurrell (1973). The highest proportion was collected in the nestling period 29 May - 29 June. Newton (1978) found that the consumption was 5.9 kg in this period for broods of 3 - 4 young (including the adult female), although great variations have been observed (see Newton 1986). In the present sample, 184 items weighing a calculated 5.0 kg were found in the nestling period.

In Fig. 3, prey deliveries (plucks found) during the nestling period are shown. Assuming that trends in the number or weight of plucks represent trends in the consumption, the overall consumption of this brood increased from the beginning of the nestling period, reached its highest level around the middle of the period, and then decreased towards the time of fledging. The few items found on days 15-16 were caused by heavy rainfall, which tends to reduce the delivery rate.

The increasing food demand during the nestling period was to a high degree met by the appearance of fledgling prey in the diet. Fledglings, not fully grown young which have just left the nest, could be distinguished from full-grown prey birds (including adults and full-grown young) by their feathers.

The first fledglings appeared in the diet in the last week of May, at the time when they became available in the environment (Fig. 4). Their number increased to reach a peak in mid June

and then declined through late June to mid July when the Sparrowhawk young reached independence and left the territory. The peak number of fledglings coincided almost exactly with the time of highest prey delivery shown in Fig. 3.

In mid June, fledglings comprised about half of the prey eaten. Since many of the full-grown birds killed in June and July may also have been recently fledged offspring, predation on young individuals was even more marked than Fig. 4 suggests.

First occurrence of fledglings in late May was also found at the sites of other breeding pairs in the area. Only a few fledgling Woodpigeons appeared at some nests in April and early May.

**Discussion**

In the complete list of prey items found in the study area, eight species comprised more than 5% of the food by number or by weight. Together they made up 74% of all items and 72% of all food by weight.

The House Sparrow was the most frequent prey species, which is typical of Sparrowhawks in Denmark (Storgård et al. 1983) and central Europe (Newton 1986). Other main prey species were Tree Sparrow, Great Tit, Blackbird, Chaffinch, Greenfinch, Blue Tit and Woodpigeon.

The Woodpigeon comprised only approx. 2% of all items but is so much heavier (500 g) than the other main species that it formed about 19% of the food by weight. Actually, however, full-grown Woodpigeons are likely to comprise somewhat less of the diet, because Sparrowhawks can eat only part of these birds at one sitting, and often leave the rest to scavengers (Newton & Marquiss 1982). Full-grown Woodpigeons were mainly killed in the periods when both male and female hunted, suggesting that the females took most of these birds.

Rodents, which were the only mammalian prey recorded, comprised less than 1% of all items. Most of these animals, almost entirely Bank Voles, were killed after a year with rich crops of mast. Large crops of mast may result in high proportions of rodents in the diet of Sparrowhawks. In a previous Danish study, Bomholt (1983) found that mice comprised up to 25% of the food (in spring) after a year with very large crops of mast. Locally voles have been recorded as important prey. In Finland, Sulkava (1964)

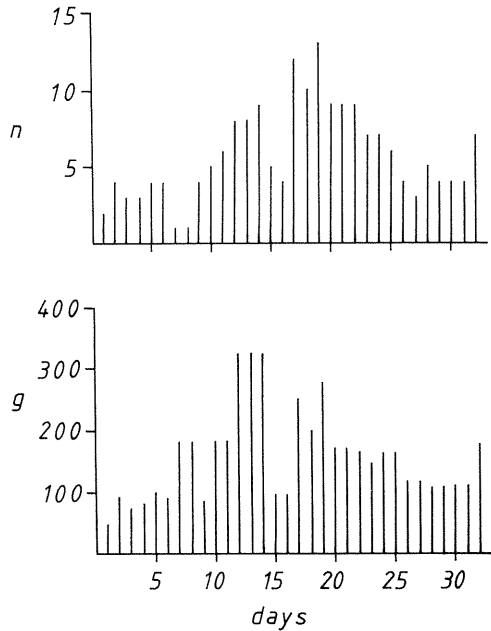
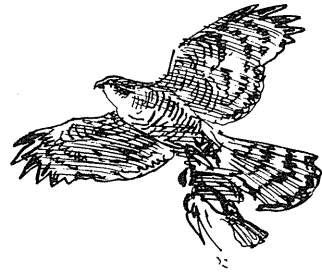


Fig. 3. Prey deliveries by number (n) and by weight (g) at a Sparrowhawk nest during the nestling period (32 days).  
 Antal (n) og vægt (g) af bytteleveringer ved en Spurvehøge-rede i de første 32 dage af ungetiden.

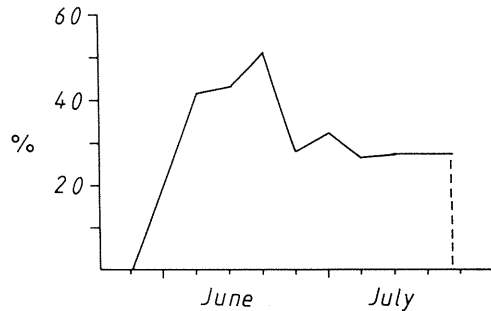


Fig. 4. Proportion of fledglings (not fully grown) in the diet of a Sparrowhawk family throughout the breeding period.  
 Andelen af unger med ikke-færdigudviklet fjerdragt i en Spurvehøge-families føde gennem yngleperioden.



*Spurvehøgen lever godt op til sit navn. En trediedel af dens byttedyr er Gråspurve og Skovspurve. Foto: Erik Thomsen, Biofoto.*

found that voles comprised 10% of all food items through the breeding season.

Food data from this study area are largely in agreement with data from a similar study carried out in a heavily cultivated landscape in Holland (Opdam 1978). The rank order of the five most frequent species was the same as here found.

Six species occurred among the seven most frequent prey birds (>5%) in both urban and rural habitats: House Sparrow, Tree Sparrow, Great Tit, Blackbird, Greenfinch and Chaffinch. The House Sparrow dominated in the urban zone, the Tree Sparrow in the rural zone. However, in the urban zone, the main prey species (>5%) formed a higher proportion of the food than in the rural zone, which may express the avian species diversity in the respective areas. In urban areas, the most common bird species in general show higher numerical dominance than in rural areas (Bezzel 1985, Plath 1985).

The same species that constituted the main prey birds in the urban zone of this study have been recorded by Schnurre (1937) at Sparrowhawk nests in urban parks of Berlin. Schnurre also found that House Sparrows dominated the prey lists, followed by Tree Sparrows, while the

rank order of the other species was somewhat different.

Comparing the individual food items in the two zones, birds typical of open farmland (Linnet, Swallow, Skylark) appeared more frequently in the rural zone, while in the urban zone the higher proportion of House Sparrows was highly significant. In general, House Sparrows form more than 20% of all items in prey lists of Sparrowhawks living in woodland adjacent to urban residential areas or in heavily cultivated landscapes in central Europe (Schnurre 1937, Klaas 1943, Tinbergen 1946, Kramer 1954, Opdam 1978). However, in the present study, House Sparrows formed only 9% of the food in the rural zone.

The prey lists from the two zones suggest that Sparrowhawks nesting outside the city boundary mainly hunted in the farmland, in the rural forests and along the forest edges, while the hawks nesting inside the city boundary hunted in the city parks and in the urban wood, as well as around human dwellings.

Sparrowhawks are territorial birds, defending their home range during the breeding season. Although home ranges may overlap in the late part



of the breeding cycle (Marquiss & Newton 1981), hawks living in the rural zone seem, to some extent, to be prevented from hunting in the bird-rich urban parks and gardens, probably because these areas form part of occupied territories of other pairs. Furthermore, there is some evidence that Sparrowhawks breeding in mixed-forest areas less often visit House Sparrow habitats than do hawks nesting in bird-poor pine-forest (Opdam 1978). This has been confirmed by Friemann (1979), who found that Sparrowhawks nesting in mixed deciduous forests in the suburbs of Darmstadt (West Germany) mainly hunted in the forests, as reflected by a high proportion of tits, Nuthatches and woodpeckers in their diet.

When plotting the proportion of various prey species in the diet of Sparrowhawks against the distance from nest to the city center, the proportion of House Sparrows increased with decreasing distance to the city center, from less than 5% at a distance of 10 km to about 28% at 2 km. In Holland, Tinbergen (1946) and Opdam (1978) have shown similar trends when plotting the diet against mean nearest distance from nest to human settlements.

Blackbirds and Blue Tits also showed some increase with decreasing distance to the city center, while Chaffinches occurred in higher proportions outside the city boundary.

The trends in the species proportions partly confirm data on density trends of various birds in intensively man-used environments (Mulsow 1980, Bezzel 1985, Plath 1985) and in rural woods (Zande et al. 1984).

The number of food items found in the area visited daily in 1985 was sufficiently large to give data on prey delivery of this Sparrowhawk pair. Food consumption, represented by number of items and by weight, reached a maximum around the middle of the nestling period, which fits the growth patterns of Sparrowhawk nestlings (Newton 1978, Moss 1979). Similar prey delivery patterns have been found by Tinbergen (1946) and Holstein (1950), while prey deliveries stayed at a high level throughout the nestling period at the nests watched by Newton (1978).

Fledglings began to appear in the diet in late May, around the time of hatching. In mid June, at the time of peak food demand, they formed about half of the prey eaten; hereafter the proportion of fledglings declined. This simultaneous growing-up of the young of Sparrowhawks and their prey

has been studied in southern Scotland by Newton & Marquiss (1982), who found that "a supply of highly vulnerable fledglings may have been crucial to Sparrowhawk breeding", and also that the female hawks in Scotland may largely depend on fledgling food supply in April-May to produce their eggs. However, in the present study, fledglings did not appear in the diet of Sparrowhawks until late May, shortly before hatching. The prey bird stock of the area was sufficiently rich for the female Sparrowhawks to put on weight before laying, but the increased food demand during the nestling period was, to a high degree, met by the appearance of fledglings in the diet.

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### Resumé

#### **Bynære Spurvehøges *Accipiter nisus* føde og prædation i yngletiden**

I de senere år, især efter 1980, er Spurvehøgen indvandret til byområder. Flere europæiske byer har således Spurvehøge ynglende inden for bygrænserne i parker, store haver, kirkegårde m.m. I relation til denne indvandring kunne spørgsmålet stilles om hvorvidt fødeudbudet i de ekspanderende byområder er tilstrækkeligt til, at arten kan klare sig i denne habitat.

Formålet med denne artikel er at beskrive Spurvehøgens byttesammensætning i et bynært område ved Århus (Fig. 1), at sammenligne føden for Spurvehøge, der yngler inden for bygrænsen (by-zonen), med føden for høge, der yngler uden for bygrænsen (land-zonen), samt at beskrive ændringer i byttelevering ved en Spurvehøge-rede i tiden med redeunger.

Bytterester blev indsamlet omkring redeerne i perioden marts til august.

Af det samlede antal bytterester udgjorde fugle 99% og mus de resterende 1% (Tab. 1). Otte byttearter udgjorde hver mere end 5% af føden, efter antal eller efter vægt.

Spurvehøge, der yngede i by-zonen, tog forholdsvis flere individer af færre arter end høgene i land-zonen, hvilket sandsynligvis er et udtryk for artsdiversiteten i de respektive områder.

Ved sammenligning af de enkelte byttearters hyppigheder i fødelisterne for de 2 habitater optrådte arter typiske for åbne landområder signifikant hyppigere i land-zonen, medens især Gråspurv *Passer domesticus* optrådte hyppigere i by-zonen (Tab. 2). Nogle alminde-

lige byttearters hyppigheder i Spurvehøgens føde angivet i relation til redens afstand til bycentrum (Fig. 2) støtter tidligere undersøgelser af disse arters tæthed i bynære områder. Spurvehøgene synes således hovedsageligt at have jaget i redens nærmeste omegn.

Ved et Spurvehøge-par, der opfostrede 3 unger i byzonen, blev bytterester indsamlet næsten dagligt (Tab. 3). I redeunge-tidens 32 dage udviste ændringer i bytteleveringen et forløb, der synes at være tilpasset Spurvehøge-ungers sigmoide vækstkurve, med det maksimale antal leveringer i midten af perioden (Fig. 3). I tiden med størst fødebehov udgjorde ikke fuldt færdigudviklede unger op mod halvdelen af byttemængden (Fig. 4).

Fødebudgetet i området er åbenbart tilstrækkeligt til, at Spurvehøgene kan opretholde territorium og reproducere.

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