Post-fledging dispersal of Northern Goshawks *Accipiter gentilis* in an urban environment

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Hamburg is one of the few cities with an urban population of Northern Goshawks. Breeding pairs use public parks, cemeteries, hospital grounds and private gardens for nesting. In 1997, both surviving juveniles (female, male) of one urban breeding pair were trapped during the post-fledging period, fitted with radio-transmitters and tracked on their post-fledging dispersal. Both hawks dispersed around the 25 July independently and in different directions. Neither of them was found at the natal nest site again during the monitoring period which lasted 8 and 5 months, respectively. For roosting and hunting, they used forests and parks at the periphery of the city as well as built-up areas with high levels of human activity in the city centre. Both individuals repeatedly returned to sites, which they had discovered at the very beginning of their dispersal, but continued exploring new urban and suburban areas of the city. From fledging age onward, both hawks showed a remarkable tolerance of human disturbance. Their behaviour was more secretive in forested suburban areas than in the city centre. They perched on electricity pylons and TV aerials, used buildings for cover while hunting and plucked kills on roofs and chimneys. Roost sites were located in suburban woods and urban back-yards. Night activity was recorded on five occasions. The male was found with a broken wing in a private garden in December 1997, and signal contact with the female was lost in March 1998. This is the first study investigating the dispersal of city-fledged Northern Goshawks. It demonstrates the behavioural flexibility of this species and gives some examples of how Goshawks adjust their behaviour in response to novel features of an urban environment.

Key words: Northern Goshawk; *Accipiter gentilis*; radio telemetry; natal dispersal; habitat use; urban environment; night activity.

1. Introduction

Recently, the Northern Goshawk started colonising suburban environments (BEDNAREK 1975; DIETRICH 1982; FISCHER 1995; ZIJLMANS 1995; MARCUS 1996) and, in some cases, even large cities (Cologne, WÜRFELS 1994, 1999; Hamburg, RUTZ 2001a; Berlin, ALTENKAMP 2002; Moscow, APAROVA 2003). Urban Goshawks use public parks, cemeteries, hospital grounds and private gardens as nesting habitat. Compared with their rural counterparts, they are remarkably tolerant of human disturbance (WÜRFELS 1994, 1999; RUTZ 2001a; ALTENKAMP 2002).

Radio-tagged breeding males in the city of Hamburg spent most of the time resting in forested patches and made short, but regular, hunting excursions into the surrounding built-up habitat (RUTZ 2001a, b). Their hunting behaviour differed from that of rural individuals, and they enjoyed a significantly higher hunting success (RUTZ 2001a, b; C. RUTZ in prep.). Feral Pigeon *Columba livia f. domestica*, Blackbird *Turdus merula* and Magpie *Pica pica* are the principal prey species of urban Goshawks, accounting numerically for about 50% of the breeding season diet (WÜRFELS 1994, 1999; ALTENKAMP & HEROLD 2001; RUTZ 2001a, 2003, in press; see also DEPPE 1976; JACOB & WITT 1986).

So far, nothing is known about dispersal movements and behaviour of Northern Goshawks that fledge in an urban environment. In 1979/80, DIETRICH (1982) tracked a female of unknown origin during its first winter in suburban habitat surrounding the city of Saarbrücken, Germany (see also DIETRICH & ELLENBERG 1980). The bird occasionally used the city centre for hunting. However, given that highly urbanised areas are nowadays inhabited by Goshawks in the cities of Berlin, Cologne and Hamburg, this individual can hardly be regarded as a representative example of a 'city Goshawk'.

In the present study, two Goshawk siblings were trapped during the post-fledging period, fitted with radio-transmitters and tracked on their post-fledging dispersal in metropolitan Hamburg. The aim was to collect qualitative information as a baseline for more quantitative research in the future. Besides detailed documentation of spatio-temporal aspects of individual dispersal movements, an important part of the study

was the collection of behavioural data through direct observation of the tagged hawks. Of special interest were their ability to tolerate human disturbance and their hunting behaviour in built-up areas.

2. Methods

In 1997, the two offspring of a Goshawk pair nesting in an extensively used public park in the city centre of Hamburg (53°34' N, 9°59' E), Germany, were chosen for a radio-tracking pilot-study. The park was completely surrounded by a built-up area and located some 7.5 km away from rural habitat. The Goshawk pair had three young, but only two reached fledging age. One male with aberrant plumage colouration and a severe disorder of the central nervous system fell out of the nest at 28 days old and died later in captivity. Symptoms were probably caused by a genetic defect due to close inbreeding (RUTZ 2001c; RUTZ *et al.* in press). The tagged birds had a normal phenotype and did not show any signs of abnormal behaviour. For a detailed description of the nest site and the spatio-temporal habitat use of the breeding male, see RUTZ (2001a).

Both juveniles were trapped in the late post-fledging period near the nest, using spring-net traps baited with meat and feathers of white domestic pigeons (KARLBOM 1981). They were fitted with 16-g tail-mounted radio-transmitters (model: TW-3 ½ AA, 150 MHz-band; Biotrack Ltd., Dorset, UK; Tab. 1). The two central rectrices, which were used for tag attachment following the method described by KENWARD (1978), were fully grown in both individuals. Tags were equipped with tilt-switches that indicated the birds' activity by altering the pulse rate of the radio-signal (KENWARD 1987). The age of the birds at capture was calculated by backdating, using their nestling wing lengths measured during banding on 1 June 1997 (for method, see KENWARD *et al.* 1993; tabulated values from BIJLSMA 1997).

Tab. 1: Summary of radio-tracking information for two immature Northern Goshawks monitored on their post-fledging dispersal in the city of Hamburg (1997/98). The birds were siblings and hatched in a nest in a public park in the city centre. – *Radiotelemetrische Daten für zwei Junghabichte während ihres Dispersals in Hamburg (1997/98). Die Vögel waren Nestgeschwister, die in einem innerstädtischen Park geschlüpft sind.*

	female	male
basic information		
capture date	16.07.97	17.07.97
age at capture (days)	ca. 69	ca. 69
frequency of tag (MHz)	150.058	150.069
monitoring period	18.07.97 -26.03.98	18.07.97 -15.12.97
number of fixes	53	38
with direct observation	21	14
by cross-triangulation	32	24
during daylight	34	25
at night	19	13
roosts in built-up area	11	3
roosts in parks or woods	6	7
night activity	2	3

Fixes were made with a portable M-57 receiver (Mariner Radar Ltd., Suffolk, UK) and a three-element hand-held Yagi antenna. At the beginning of each tracking session, a first crude bearing was taken from the 13th floor of a University building in the city centre. The distance to the bird was estimated by subjective interpretation of signal strength at standard receiver settings. Depending on this estimate, hawks were then searched for either by car, bicycle or on foot. Locations were obtained by opportunistically homing-in on the tagged animal (WHITE & GARROTT 1990). When birds could not be seen directly (see Tab. 1), locations were estimated by cross-triangulation from within 100 m and with a minimum of three bearings for a perched hawk (KENWARD 1987; WHITE & GARROTT 1990). All distances were measured to the nearest 50 m.

It was assumed that a bird had started its dispersal, when it travelled farther than 1 km from the nest and did not subsequently return (WYLLIE 1985). Each hawk was monitored for at least 30 min every day until the onset of dispersal. During dispersal, a single radio-fix per individual was obtained on average every three days from 18 July to 12 October, and once a week afterwards. About a third of all locations were recorded at night in order to find roost sites and to check for possible nocturnal activity (Tab. 1). Distances are reported as arithmetic means ± 1 s. e.

3. Results

3.1. Spatial and temporal aspects of dispersal

Both Goshawks made short excursions into the built-up area surrounding the nest site from 20 July onwards. At first, they always returned to the nest stand after a few minutes, giving loud begging calls. No hunting attempts were observed while they were still associated with their parents. Explorative trips became longer every day until the birds started their dispersal around the 25 July independently and in different directions at an age of about 78 days. Their movements are shown in Figure 1.

During the first months of their dispersal, both individuals gradually drifted away from the natal nest site. In mid-October, they settled at comparatively constant distances (Fig. 2a). In the following months, average distance from the nest was 4.5 km ± 2.1 for the female (n = 24 fixes, excursion not included; 19 October 1997 to 26 March 1998) and 9.6 km ± 2.2 for the male (n = 16; 19 October to 15 December). Distances between consecutive fixes increased slightly during the first two months (Fig. 2b). Both hawks were found in a total of 29 1-km^2 grid-cells (Fig. 3). The majority of cells were visited only once.

The siblings roosted together on 31 August in a suburban wood (distance < 50 m) and were located only 700 m apart from each other on 7 September near the River Elbe. The female made an excursion northwards on 23 February 1998 (see Figs. 1a and 2). Several attempts to locate its exact position failed, but the bird must have travelled at least some 30 km; two days later it had returned to the city centre again. Nei-

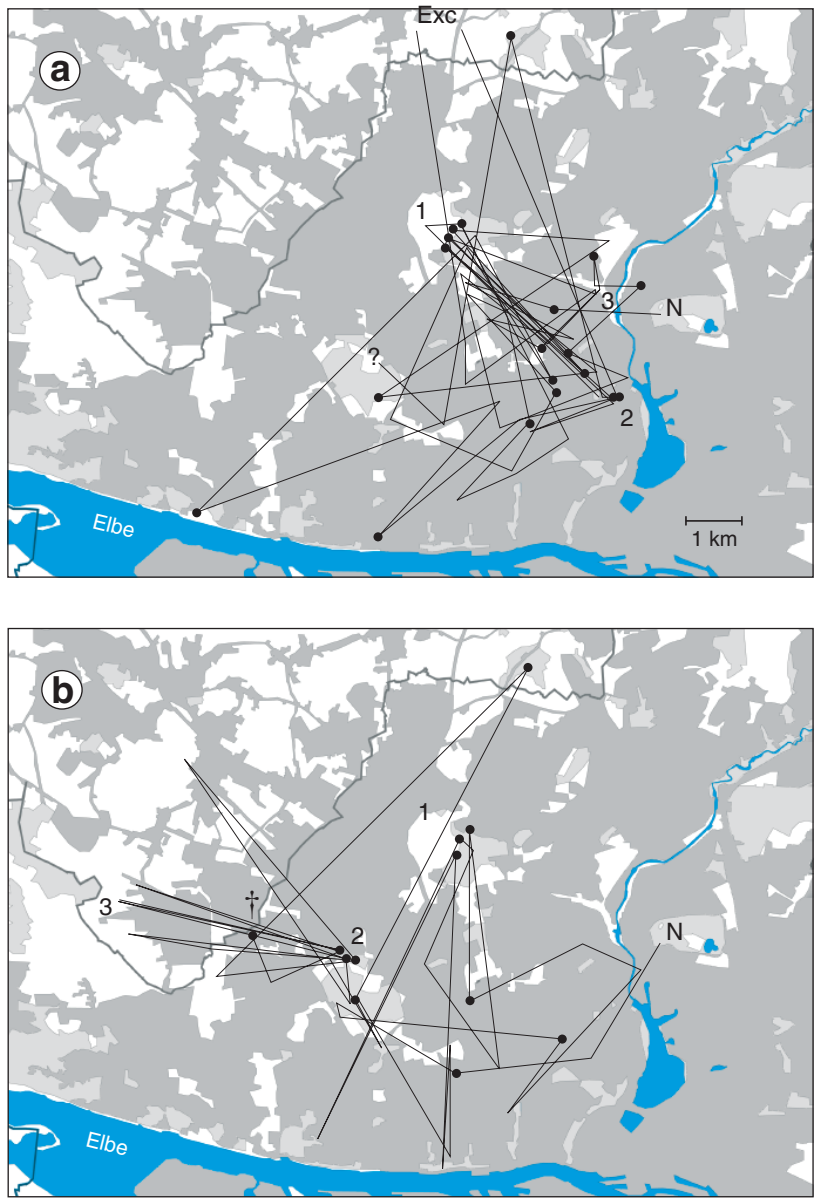

Fig. 1: Movements of two radio-tagged immature Northern Goshawks during their post-fledging dispersal in the city of Hamburg (1997/98). **a:** female (tracking period: 18.07.97–26.03.98); **b:** male (18.07.97–15.12.97). The birds were siblings and hatched in a nest in a public park in the city centre (nest site marked with 'N'). Successive fixes are connected with straight lines, and night locations are marked with dots. Frequently used areas were assigned numbers, which correspond to site descriptions in Table 2. – *Bewegungen von zwei besenderten Junghabichten während ihres Dispersals in Hamburg (1997/98). a: Weibchen (Telemetriezeitraum: 18.07.97–26.03.98); b: Männchen (18.07.97–15.12.97). Die Vögel waren Nestgeschwister, die in einem innerstädtischen Park geschlüpft sind (Horst durch 'N' markiert). Aufeinanderfolgende Ortungen wurden durch gerade Linien miteinander verbunden und Nachtortungen durch fette Punkte hervorgehoben. Häufig aufgesuchte Orte wurden mit Nummern versehen, die mit denen der Habitatbeschreibungen in Tab. 2 übereinstimmen.*

dark grey = built-up habitat
light grey = forested habitat (woods, parks, cemeteries)
white = open habitat (mainly rural)
blue = water
EXC = excursion on 23 February 1998
? = last radio-fix before loss of contact
† = location of fatal accident

ther of the hawks was found at the natal nest site after dispersal. However, on 14 August the female roosted in a back-yard that was known to be used frequently by its father for prey preparation.

The male was found with a broken humerus in a small private garden on 15 December 1997 and died three days later in captivity. Signal contact with the female was lost between 26 March and 2 April 1998. The bird could not be located during a search-flight covering an area of approximately 8000 km^2 on 22 June (range of transmitter for bearings from the air about 30 km according to the manufacturer's product information).

3.2. Habitat use

The female used a wide range of different habitat types for hunting and roosting. It was found in built-up areas (residential and industrial) as well as in forested habitat types (urban woods, public parks, cemeteries). Visited sites had various levels of disturbance (as measured by degree of human activity) ranging from 'very low' to 'very high' (Tab. 2). Movements of this bird centred on

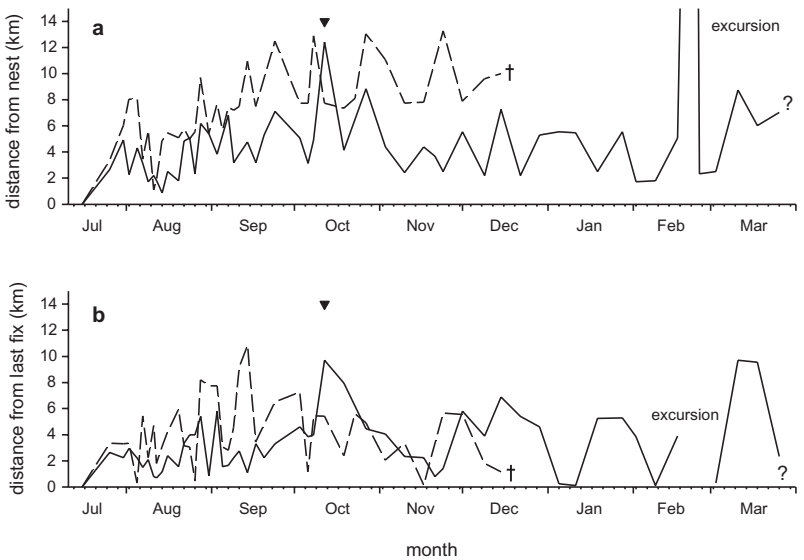

Fig. 2: a) Distance of two radio-tagged immature Northern Goshawks from the natal nest site during their post-fledging dispersal in the city of Hamburg (1997/98). **b)** distance between two consecutive locations. Signal contact with the female (solid lines) was lost in March 1998 (marked with '?'), and the male bird (broken lines) had a fatal accident in mid-December 1997 (†). The triangle marks a change in the monitoring frequency (see methods section for details). – *a) Entfernung von zwei besenderten Junghabichten vom elterlichen Horst während ihres Dispersals in Hamburg (1997/98). b) Entfernung zwischen zwei aufeinanderfolgenden Ortungen. Der Signalkontakt zum Weibchen (durchgezogene Linien) brach im März 1998 ab (gekennzeichnet durch '?'), und das Männchen (gestrichelte Linien) hatte Mitte Dezember 1997 einen Unfall mit tödlichen Folgen (†). Das Dreieck markiert eine Änderung der Ortungshäufigkeit (siehe Methodenteil für Details).*

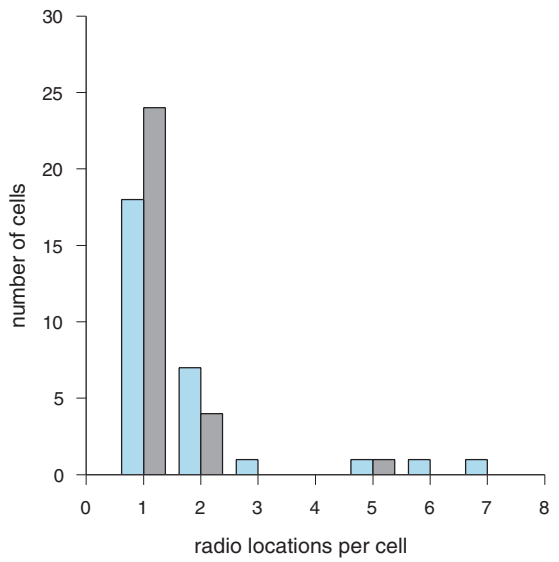

Fig. 3: Visitation frequency of 1-km² grid-cells by two radio-tagged immature Northern Goshawks (female: blue, male: grey bars) during their post-fledging dispersal in the city of Hamburg (1997/98). Only a few cells were visited more than once (see Tab. 2). – *Gitterfeldfrequenz (Zellengröße 1 km²) für Ortungen von zwei besenderten Junghabichten (Weibchen: blaue, Männchen: graue Balken) während ihres Dispersals in Hamburg (1997/98). Wenige Zellen wurden mehrmals aufgesucht (vgl. Tab. 2).*

a complex of suburban woods at the north-west periphery of the city (number 1 in Fig. 1a and Tab. 2) and two urban areas with high human activity in the city centre (2, 3). The female discovered these sites at the very beginning of its dispersal. Although it continued exploring the habitat during the entire monitoring period, it always returned to these areas after a few days. The bird roosted in small gardens and single trees in built-up areas until the beginning of October (Fig. 1a; Tab. 1). One roost site was located 10 m from a five-storey building. From October onwards, the female seemed to prefer larger woods and parks as roost sites and used built-up areas exclusively for hunting.

The male was located in the same habitat types as the female. After some 'undirected' movements at the beginning of its dispersal it roosted in the northern suburban wood three times in the last week of August (number 1 in Fig. 1b and Tab. 2). It then switched to a large urban park in the south-west (2). The male used this park mainly for roosting at night and made hunting excursions during daylight hours into the suburban areas beyond the western city boundary (3). It roosted twice in the city centre (back-yard; single tree beside road) and four times near the nest of a resident Goshawk breeding pair in an urban park (number 2 in Fig. 1b).

3.3. Tolerance of human disturbance and hunting behaviour

Both individuals showed a remarkable tolerance of human disturbance. They seemed to be indifferent towards noise and did not avoid areas with high levels of human activity (Tab. 2). They allowed humans to approach them to within 10 m, as long as the observer did not look directly at them. They demonstrated this degree of tameness from fledging onward. They appeared to be more secretive in their general behaviour and less tolerant of humans in suburban wooded habitats than in the city.

On some occasions, they perched in single trees beside busy streets in the rush-hour. Electricity pylons and TV aerials on large buildings were used several times for perching. In the city, they flew low between

Tab. 2: Habitat use of two radio-tagged Northern Goshawks during their post-fledging dispersal in the city of Hamburg (1997/98). Sites are described, which were visited at least four times. Numbers in the second column correspond to the numbers used in Figures 1a, 1b and in the text. – *Habitatnutzung von zwei besenderten Junghabichten während ihres Dispersals in Hamburg (1997/98). Es wurden Orte beschrieben, die mindestens viermal aufgesucht wurden. Die Nummern in der zweiten Spalte entsprechen den Beschriftungen in den Abbildungen 1a und 1b und den Angaben im Text.*

ind	visited habitat site			disturbance*		fixes	
	no	name	description	weekdays	weekend	day	night
♀	1	Niendorfer Gehege	*suburban wood*: mature forest; about 180 ha in size; dense network of footpaths; one Goshawk breeding pair at the southern border of the wood	low	high	3**	4
	2	Winterhude	*urban district*: residential area in the city centre; old villas with mature trees in back-yards; shops and restaurants; lots of traffic	very high	very high	3	2
	3	Eppendorfer Mühlenteich	*small lake in the city centre*: some old trees; high abundance of waterbirds that are fed by the public; bird sanctuary with dovecote	high	high	4	0
♂	1	Niendorfer Gehege	*suburban wood*: see description above	low	high	1	3
	2	Altonaer Volkspark/ Friedhof	*large urban park/cemetery complex*: patches of mature forest; about 210 ha in size; dense network of footpaths; one Goshawk breeding pair at the northern border of the park	high	very high	6	5
	3	Halstenbek/ Schenefeld	*suburban residential area*: suburban area with semi-detached housing; open rural space on the west side of the city border	intermediate	intermediate	6	0

Notes:
* level of disturbance due to human activity was ranked on a subjective scale with five categories ('very low', 'low', 'intermediate', 'high' and 'very high')
** another 5 daytime locations were recorded in the surrounding area

buildings, using anthropogenic elements of the habitat like parked cars or fences for cover. After a few months, both birds showed some tendency to prefer urban parks and woods with more cover for roosting.

Nocturnal activity was recorded on five occasions (Tab. 1). The male was active twice in urban woods (7 August, 02:50 h; 31 August, 23:37 h) and once in a residential area in the middle of the city (11 September, 20:30 h). The female was found moving between back-yards in the city centre twice (26 August, 21:35 h; 6 October, 22:14 h). In all cases, the activity sensing switch of the tag indicated that the birds flew short distances in rapid succession.

Hunting was observed only once: on 3 September the male engaged in an unsuccessful tail chase with an adult male Blackbird in a private garden. In eight cases, hawks showed movements that could be interpreted as 'short-stay-perch'-hunting (female: 2, male: 6; all in built-up areas). The female killed a Feral Pigeon in the dovecote of a local bird sanctuary on 9 August (number 3 in Fig. 1a and Tab. 2) and became trapped in the same loft during another attack three days later. It was released immediately unharmed.

The female bird was located on freshly killed prey six times (3 Feral Pigeons; 3 unidentified birds) and the male four times (2 Feral Pigeons; 1 Song Thrush *Turdus philomelos*; 1 unidentified bird). Prey killed in built-up areas were plucked in back-yards and on roofs or chimneys.

4. Discussion

4.1. Spatial and temporal aspects of dispersal

Both Goshawks started exploring residential areas surrounding the nesting park at the end of the post-fledging period. Similar excursions away from the inner nesting area have been reported for fledglings of Goshawks (KENWARD *et al.* 1993; KENNEDY *et al.* 1994) and other raptor species in rural habitats (*Buteo jamaicensis*, JOHNSON 1986; *Falco sparverius*, KELLNER 1990; *Buteo buteo*, TYACK *et al.* 1998). Nest stands of urban-breeding Goshawks are areas of high human activity and considerable disturbance, but they are still much safer places than the surrounding built-up habitat. Therefore, explorative behaviour may be particularly important for inexperienced fledglings in urban environments: it not only offers the chance to become familiar with suitable hunting habitat (see KENNEDY *et al.* 1994), but may also help birds to learn about potential hazards inherent in metropolitan settings (e.g. buildings and cars).

Birds left the natal area simultaneously at about 78 days old. This was about two weeks after their primary feathers and rectrices had finished growth (see also KENWARD *et al.* 1993). Dispersal age was within the range of average values reported for rural individuals (70 days, CRAMP & SIMMONS 1980; 70-80 days, BRÜLL 1984; 61-110 days, depending on sex and food availability, KENWARD *et al.* 1993). KENWARD *et al.* (1993) showed in controlled field experiments

that supplemental feeding in the post-fledging period significantly delayed dispersal in juvenile Goshawks. It has often been hypothesised that high local abundances of potential prey might ultimately cause the synurbanisation of certain raptor species (WÜRFELS 1994, 1999; GEHLBACH 1996; LOVE & BIRD 2000; RUTZ 2001a). This hypothesis cannot be tested directly, but an indirect approach using a prediction derived from KENWARD *et al.*'s results may be employed: if food conditions are better in cities than in rural environments, urban fledglings are expected to disperse later than their rural counterparts (RUTZ 2001a). Quantitative radio-tracking of juvenile cohorts in urban and non-urban study areas could be a first step towards an understanding of the interrelationship between local prey availability in cities and synurbanisation tendencies in raptors.

According to the four different dispersal types distinguished by WALLS & KENWARD (1995), both hawks in the present study could be classified as 'dispersers'. They gradually drifted away from the natal nest site and settled at comparatively constant distances in mid-October (Fig. 2a). They stayed within the city limits until the end of the study, the only exception being one excursion of the female at the end of February. This is the time when Goshawks start courtship and nest building (GLUTZ VON BLOTZHEIM *et al.* 1971; FISCHER 1995). Immatures seem to be attracted by displaying breeding pairs (FISCHER 1995; pers. obs.), and on several occasions – including within this study – they have been observed to stay in the nesting territories of resident pairs (KOLLINGER 1964; LOOFT & BUSCHE 1981). DIETRICH (1982) found that his tagged female Goshawk spent more time near occupied nests in the pre-breeding and breeding time than during winter. It is therefore very likely that the female in the present study was searching for a first breeding opportunity (see KENWARD 1977; for documentation of a 'second dispersal' in spring time in Common Buzzards *Buteo buteo*, see WALLS & KENWARD 1998). If it eventually succeeded in finding a partner a considerable distance away from the city, this would explain its sudden disappearance in March. Colour-ringed individuals from the same urban population have been identified as breeding birds in first-year plumage in urban as well as rural habitats. Likewise, cases of immigration into the city have been documented (C. RUTZ unpubl. data). Thus, at least for Hamburg's Goshawk population there is evidence for gene flow between urban and nearby rural areas.

4.2. Habitat use

Given the secretive behaviour of most forest-dwelling raptor species, one might expect that these birds avoid built-up areas with high levels of human activity in urban environments. However, like other urban *Accipiter* (*A. nisus*, MCGRADY 1991; *A. cooperii*, MANNAN & BOAL 2000), Goshawks in metropolitan Hamburg use built-up areas as well as forested patches for hunting and roosting. This is true for immatures (this study) and adult breeding males (RUTZ 2001a, b). A radio-tagged immature female Goshawk in another study also visited various types of urban habitat on its natal dispersal (DIETRICH 1982; see also DIETRICH & ELLENBERG 1980). During a bad-weather period in winter it shifted its activity centre from rural landscape into the city of Saarbrücken. DIETRICH (1982) believed that the hawk opportunistically followed prey availability. Numerous non-systematic observations of immature Goshawks in built-up areas of Hamburg further confirm that the use of urban habitat by the tagged individuals was typical behaviour. Breeding males in Hamburg used built-up areas less than expected from its availability, but made 48 % of all recorded kills in this habitat type, indicating that it offered important hunting opportunities (RUTZ 2001a, b; C. RUTZ in prep.).

4.3. Tolerance of human disturbance and hunting behaviour

Raptors appear to learn that humans are no threat in urban environments (WÜRFELS 1994). Both investigated Goshawks were as tame as adult individuals of the same study population (e. g. their father; see RUTZ 2001a). Tolerance of human disturbance was present since fledging and was therefore not acquired by positive experience in the course of dispersal. A similar degree of tolerance is known from Goshawks nesting in the cities of Cologne and Berlin (WÜRFELS 1994; ALTENKAMP 2002) and from other urban-breeding raptors (e.g. *Falco columbarius*, WARKENTIN & OLIPHANT 1990; *Accipiter nisus*, MCGRADY 1991; *Buteo lineatus*, BLOOM & MCCRARY 1996; *Milvus milvus*, HELLMANN 1999; *Accipiter cooperii*, MANNAN & BOAL 2000). About 25 years ago, BERNDT (1975) first recognised behavioural changes towards an increased tolerance of human disturbance in German raptors, and he foresaw the tendency of some species to colonise urban areas. In Germany, the Goshawk has been legally protected from hunting since 1977, and in large parts of the country persecution ceased as early as in 1970 (PEGEL 1981). A rapid decrease in hunting pressure may have triggered behavioural adaptations, which promoted the synurbanisation of this species (RUTZ 2001a).

Hawks perched on electricity pylons and TV aerials, used buildings for cover during low-quartering flights and plucked kills on roofs and chimneys. Other individuals of the study population are known to use man-made structures for Peregrine-like perched hunting (RUTZ 2001a, in press). Perching and plucking on buildings have been photographed (quoted in WÜRFELS 1994; LESSOW 2001) and described for this species before (TAUCHNITZ 1991). WITTENBERG (1985) observed an immature Goshawk in the city of Gar-

misch-Partenkirchen landing on the roof of a parked car after a hunting manoeuvre with a Blackbird. These observations illustrate the behavioural flexibility of this species, which until recently had a reputation for being a particularly 'shy' and secretive inhabitant of large, undisturbed forests (e.g. RODRIGUEZ DE LA FUENTE 1971; FISCHER 1995). Hunting under artificial light conditions is perhaps one of the most remarkable adaptations of urban-living raptors. Both Goshawks in the present study as well as DIETRICH'S (1982) individual were active at night. Successful night-hunting has been reported for breeding Goshawks in Hamburg (RUTZ 2001a; see also TAUCHNITZ 1991), Peregrine Falcons (*Falco peregrinus*, WENDT *et al.* 1991) and Lesser Kestrels (*F. naumanni*, NEGRO *et al.* 2000). Goshawks have found ways of coping with the properties of the novel urban environment within a couple of generations after the first pioneering breeding attempts in urban green space. By adjusting to human activity and developing new hunting techniques, they gained access to hitherto unexploited resources, like nest sites and food.

Although favourable in some respects (high prey abundance, low predation pressure etc.; see GEHLBACH 1996), urban sites are also potentially dangerous for raptors, which often fall victim to windows, motor vehicles and other anthropogenic structures during their hunting flights (KLEM 1981; BAIRLEIN & HARMS 1994; photo in HAVELKA & SABO 1995; LOVE & BIRD 2000). The tagged male in the present study hit a fence in a suburban garden and broke its wing. It is very likely that the accident happened during prey-searching or attacking a fleeing prey. SWEENEY *et al.* (1997) found that the majority of Peregrine Falcons with traumatic injuries, which were recovered in urban settings, were first-year birds, indicating an increased risk for inexperienced individuals in cities. However, a preliminary analysis of recovery data from ringed Goshawks banded in Hamburg during 1996–2000 neither provides evidence for increased population mortality compared with rural control plots (LOOFT & BUSCHE 1981) nor for any age-effects (C. RUTZ unpubl. data).

4.4. Future work

Dispersal affects the demography and genetic composition of animal populations in a fundamental way (ARCESE 1989; JOHNSON & GAINES 1990). In stable populations, natal dispersal reduces intraspecific competition for resources (breeding places, partners, food) and minimises the risk of inbreeding (GREENWOOD 1980; JOHNSON & GAINES 1990; LAMBIN *et al.* 2001; PERRIN & GOUDET 2001). In a newly-founded population, however, breeding places and food are not limiting factors. The strength of competition for partners and the risk of inbreeding depends on the degree of isolation from the source population. Expanding urban animal populations constitute natural experiments offering unique opportunities to test predictions of theoretical population biology about the ultimate causes of natal dispersal (RUTZ 2001a). During the next years, dispersal of city-fledged Goshawks will be investigated quantitatively in the Hamburg study area. The behavioural data gathered during the pilot study presented in this paper will form the basis for the interpretation of the results of this follow up-project.

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5. Zusammenfassung

Rutz, C. 2003: Dispersal von Habichten *Accipiter gentilis* in einem urbanen Lebensraum. Vogelwelt 124: 93–101.

Hamburg ist eine der wenigen Städte mit einer innerstädtischen Population des Habichts *Accipiter gentilis*. Brutpaare nutzen öffentliche Parkanlagen, Friedhöfe, Krankenhausgelände und Privatgärten als Niststandorte. Im Jahr 1997 wurden die beiden überlebenden Jungvögel (Weibchen, Männchen) eines innerstädtischen Paares während des Bettelfluges gefangen, mit Telemetriesendern ausgestattet und anschließend auf ihrem Dispersal durch den urbanen Habitat verfolgt. Beide Habichte verließen das elterliche Brutrevier unabhängig voneinander und in unterschiedliche Himmelsrichtungen um den 25 Juli. Sie wurden im Verlauf der Untersuchung (8 bzw. 5 Monate) nicht mehr am Nest angetroffen. Sie nutzten Wälder und Parks der Stadtperipherie gleichermaßen wie stark versiegelte innerstädtische Bereiche mit hohem Störungsdruck. Beide Individuen kehrten regelmäßig zu Orten zurück, die sie zu Beginn ihres Dispersals entdeckt hatten, erkundeten aber bis zuletzt neue urbane und suburbane Bereiche Hamburgs. Die

beiden Habichte zeigten bereits im Bettelflugalter eine außergewöhnliche Störungstoleranz. Sie wirkten in waldigen, suburbanen Habitaten heimlicher und scheuer als in ausgesprochen urbanen Bereichen des Stadtzentrums. In der Stadt saßen sie ungedeckt auf Hochspannungsmasten und Antennen, nutzten Gebäude bei bodennahen Flügen als Deckung und rupften Beute auf Häuserdächern und Schornsteinen. Schlafplätze befanden sich in Stadtrandwäldern und innerstädtischen Hinterhöfen. Nachtaktivität wurde fünfmal festgestellt. Das Männchen wurde im Dezember 1997 mit einem gebrochenen Oberarmknochen in einem Garten des westlichen Stadtrandes gefunden. Der Signalkontakt zum Weibchen riss im März 1998 ab. Dies ist die weltweit erste Studie, die das Dispersal städtischer Habichte untersuchte. Sie demonstrierte die verhaltensbiologische Flexibilität dieser Art und lieferte Beispiele, in welcher Form sich Habichte an die besonderen Bedingungen eines urbanen Lebensraumes anpassen.

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