Do Barn Owls *Tyto alba* in northern Germany migrate?

manuscript unpublished

By Ernst Kniprath

Content

1 Introduction

In his study on the ringing data (419 recoveries of the schemes Rossiten and Helgoland) SCHNEIDER (1937) has stated that barn owls indeed undertake displacements. Nevertheless he found no indication for anything like migration. All later authors, including SAUTER (1956), KNEIS (1981), and BAIRLEIN (1985), confirmed this interpretation. None of the numerous studies in different European countries as well came to a differing result (see review by KNIPRATH 2010). Why again occupy with the subject?

Since the authors cited the recovery data extraordinarily have multiplied. Especially the number of adult birds recorded alive has grown enormously. So it seemed possible to know more about the displacements of barn owls. These displacements could include to and fro movements of a smaller scale, which hitherto had escaped notice.

In contrast to older authors single recoveries here don’t play any role. The numbers have augmented in such an extent that it is hardly necessary to mention them.

2 Material and methods

We studied all recoveries of the Vogelwarte Helgoland from its total domain: Schleswig-Holstein, Hamburg, Bremen, Niedersachsen, Nordrhein-Westfalen, and Hessen (after excluding uncertain data: 10.183 ring-numbers with 11.732 recoveries). For that purpose the data were transferred into a MS-ACCESS-database. Each selection of data especially wanted was done with the selection-functions integrated in ACCESS. Integrated into these selection-functions were two search- and calculation programmes. First that is a routine to order temporarily the sequences of the recoveries of the individual ring-birds (RALF MALISKA). The calculation programme (BERND WEDEMEYER) is used to find dispersal directions and distances from the coordinates. The resulting data were transferred to MS-EXCEL for functions integrated and to produce the graphs.

To recognize the eventual influence of some extreme values in all tests for dispersal distances always means and medians were examined in parallel.

To name ringing and recovery values the codes of the „EURING exchange-code 2000“ were used (see www.euring.org).

3 Results

3.1 Displacements by all recoveries of barn owls ringed as nestlings

Among these 10.183 ring-birds (after exclusion of those recovered at the ringing site) 7.542 had been ringed as nestlings (with 8.521 recoveries) and 1.391 of unknown age (with 2.412 recoveries). More than 92% of the birds ringed as nestlings were recovered only once, the others at least twice (see tables 1 and 2). Table 1 additionally shows the respective numbers of birds found dead. In total the portion of these was 74,91%. The numbers for the birds ringed at unknown age are: 66,93% one recovery, found dead 34,8%. The decrease in the amount of birds found dead only in part reflects the known decrease of mortality with increasing age (see later). Much more it shows the efforts of several ringers to control adult birds at their breeding sites. By this the portion of birds controlled alive increases.

Table 1: The frequencies of multiple recoveries for birds ringed as nestlings (A: maximum of recoveries per bird, B: Number (of cases), C: portion of the total (8277)

A	B	C	dead	Portion dead %
1	6.926	91,83	5.478	79.09
2	425	5,64	144	16,94
3	108	1,43	18	5,56
4	38	0,50	7	4,61
5	21	0,28	1	0,95
6	13	0,17	2	2,56
7	4	0,05	0	0,00
8	5	0,07	0	0,00
9	2	0,02	0	0,00
sum	7.542		5.650	74,91

Table 2: The frequencies of multiple recoveries for birds ringed with unknown age (A: maximum of recoveries per bird, B: Number (of cases), C: portion of the total (1.391)

A	B	C	dead	Portion dead %
1	931	66,93	401	43,07
2	225	16,18	42	9,33
3	108	7,76	24	7,41
4	47	3,38	9	4,79
5	33	2,37	5	3,03
6	17	1,22	1	0,98
7	13	0,39	0	0
8	7	0,50	1	1,79
9	5	0,36	1	2,22
10-16	5	0,36	0	0
sum	1.391		484	34,8

Distances of multiple recoveries by recovery number

When regarding only superficially, the discrimination for the distances of the recoveries (only owls ringed as nestlings) by their recovery frequencies lead to a confusing result: With the number of recoveries (up to 3) the mean distances as well as the medians decreased (fig. 1) and then remained at the same level. It could be assumed, the dispersing owls after a greater distance in the beginning would narrow their birth site from recovery to recovery.

These observations as well as their interpretations are valid as well for the medians as for the means (Fig. 1). But in the medians the influence of the greater distances and especially that of the (mostly few) extreme values considerably is diminished. In general – as in the following comparisons as well – the mean values are about twice as high as the medians.

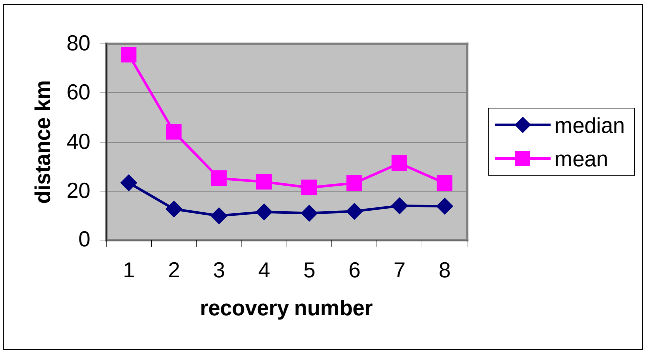

Figure 1: Alterations of mean and median of the distance of recovery sites from the ringing sites of barn owls ringed as nestlings, from recovery to recovery (N= 8.275)

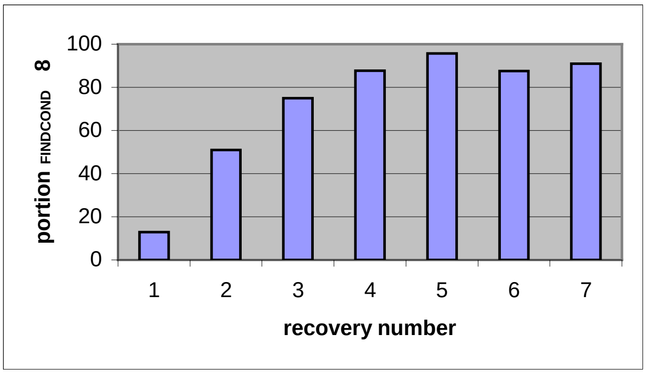

Figure 2: The portion (%) of the recoveries made by ringers in the multiple recoveries (selection for FINDCOND code 8) (N=1.084)

To judge the influence of recoveries made by ringers, these were excluded. The N now is 6.837. Figure 3 nevertheless still shows the reduction of the recovery distances (like in fig. 1), at least from recovery 1 to recovery 3. (The N of the two additional values being 21 and 7 resp. are to small for usable results.) Looking at the recoveries only by ringers (fig. 4) at one hand we find clearly more recoveries per bird and on the other hand the recovery distances are considerably higher. But then we again see that at least for the means the reduction of the recovery distances is present.

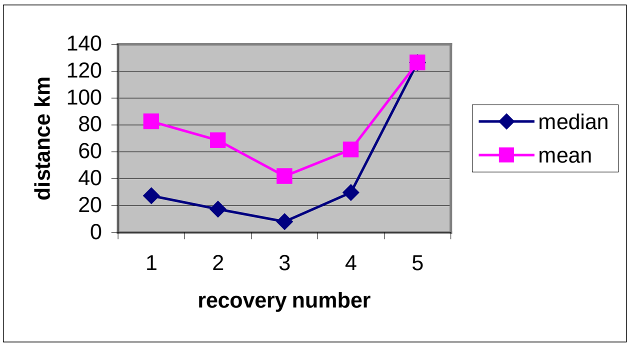

Figure 3: Distances as in fig. 1 but without recoveries of ringers (N= 6.837)

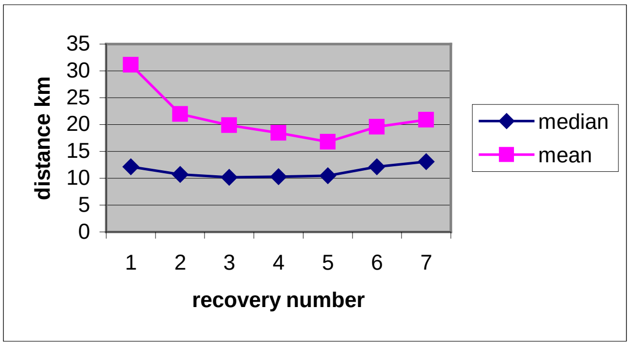

Figure 4: Distances as in fig. 1 but only recoveries by ringers (N=1.684)

Distances of multiple recoveries by time intervals

Above the time intervals between the recoveries not have been considered. With more biological content we should ask: How do the barn owls move between two breeding periods or as well between a breeding period and the winter stay (if it really exists) and back? For the selection of the values “breeding period” and “winter” were defined strictly: Breeding period: April to July ; winter: September to February. Additionally for the winter data owls called breeders (FINDCIRCUMSTANCES = N) were excluded.

First the mean and median values of the distances (from the ringing site) summarized by breeding periods of owls ringed as nestlings were studied (N=2.438). In the graph (fig. 5) we see oscillations of the mean values (ANOVA: ns). In contrast to that the medians oscillate in narrow limits (14,7 – 18,4 km), nevertheless showing a slight increase from the first to the third breeding period. If we exclude also here the recoveries by ringers (which indeed mount to 56%), the general picture is not altered (fig. 6): The oscillations in the mean values in figure 5 persisted as well as the slight increase (ANOVA: ns). The very distinct increase of the mean level of the medians as well as the means to almost more than the double doesn’t astonish: Ringers communicate recoveries from their closer range (which in fig. 6 are lacking). This again is visible if we include only recoveries of ringers (fig. 7). The very distinct gap between the median and the mean values also here merely indicates that in the different sub-domains of the area of the Vogelwarte Helgoland, which in part are distinctly apart from each other, there are ringers which control adult birds. So there does result the greater number of closer recoveries of each ringer and those of the colleagues working at some distances. The more central part is lacking.

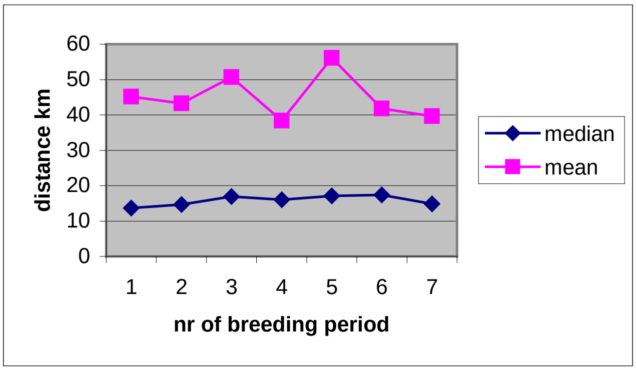

Figure 5: Median and mean distance values of recoveries from the ringing location in the nth breeding period (April – July) after ringing (all recoveries N= 2.438)

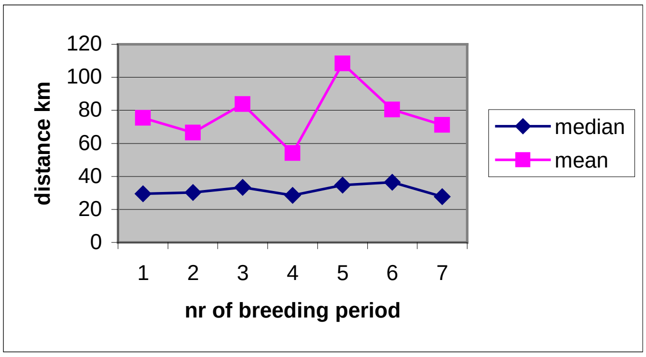

Figure 6: Median and mean distance values from the ringing location of recoveries in the nth breeding period (April – July) after ringing (recoveries of ringers excluded; N= 1.073)

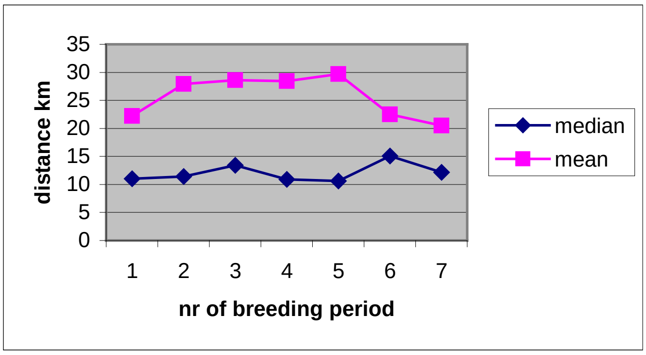

Figure 7: Median and mean distance values from the ringing location of recoveries in the nth breeding period (April – July) after ringing (recoveries by ringers only; N= 1.365)

In a next step we analysed, whether the distances outside breeding periods alter depending on the age of the birds. For this the months September – February were selected. In addition those owls were excluded which had been named breeders (FINDCIRCUMSTANCES = N). Surprisingly figure 8 shows the same heavily oscillating values for means and medians. Here indeed the comparison (ANOVA) gave a significant (P<0,05). These deflections have the same rhythm as in the breeding period values (figs. 5-7). It is evident that medians and means do have values of twice the values during the breeding periods (see fig. 5). We should realize that we always analysed the distances from the ringing location.

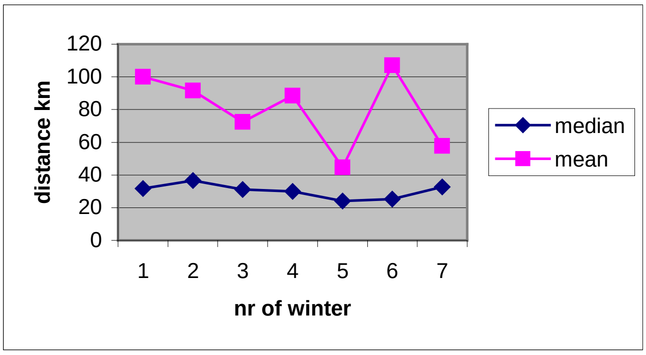

Figure 8: Means and medians of recovery distances in the n^th^ "winter " (September – February) after ringing as nestlings (all recoveries; N=4.236)

3.2 Displacements of individuals

The extensive material allowed to trace individuals. Here we analyse the moving of single barn owls within a breeding period and also that one after a first breeding period. As a basis for this analysis we united all data sets of birds ringed as adults or of those of unknown age (ringings and recoveries) with the recoveries of owls ringed as nestlings beginning with their first breeding period (13.142 data sets).

6.014 of these are data of certain records within the breeding period (here again we cautiously only use the months April – July). Therein there might be more than one record of an individual within a single breeding period as well as records belonging to several breeding periods. To simplify description here the term "individual breeding year" is introduced. It means the record of a single individual within a single breeding period (no matter how often). So, for an individual controlled in two different years as breeder or at least within the breeding season, we count two individual breeding years, even if it has been controlled five times in these two years. Following this definition the material included sets of 5.324 individual breeding years, which belonged to 3.959 individuals. Of these latter ones a total of 3.054 only once had been controlled in one of the breeding periods as strictly defined above, all others either several times within one breeding period and / or within several breeding periods.

Moving of individuals within a breeding period

For 480 individuals there were data sets of 521 individual breeding years with 1.112 controls during the breeding periods altogether (2-4 each). For 446 (67,4%) of the total of 662 movements within a single breeding period the distance recorded was 0 (zero). The owls had been controlled at the site of the first capture. Additional 192 (29,0%) were controlled at a distance of <10 km, hence in the vicinity. Only 24 (3,6%) were found farther (10 – 305 km, mean 43,3 km, median 24,4 km). For the total these values are: mean 2,1 km, median 0 km. For about 500 of the owls included here the sex has been stated: ca. 90% were ♀.

Moving of individuals after the breeding season

Following each breeding season the owls earlier or later have the opportunity to leave the breeding site. BRANDT & SEEBAß (1994) found that they enlarge their home range until autumn. So for the further study we use the total of 6.014 records at any breeding period. There included are the multiple controls (about 600) within a certain breeding period. These are neglected here.

Moving from breeding season to breeding season

Out of the 3.959 owls engaged in the total of 5.419 individual breeding years 2.753 were controlled only during one breeding period (April – July). The remaining 1.206 owls additionally were recorded in two to eight further breeding periods (fig. 9). This indeed doesn't always mean a gapless series of breeding period records. For 2.467 (75,7%) of the 3.261 owls recorded again already in the first breeding period breeding had been stated (STATUSBROODSIZE: „N"). 1.105 of them had been sexed: 314 ♂ and 791 ♀.

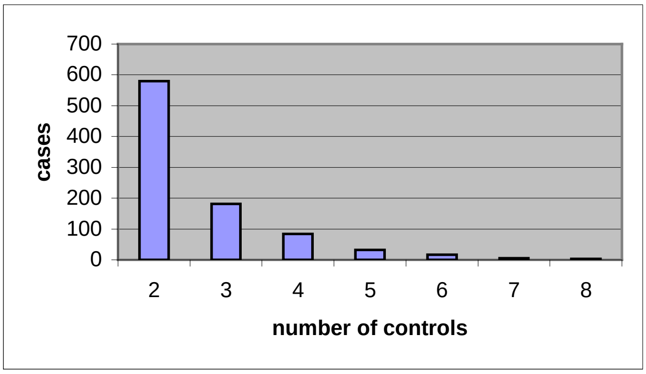

Figure 9: Total number of records of the same individuals in later breeding periods (N=3.261)

Among the 1.641 new controls 708 (43,1%) were at the site of the preceding one (0 km), 745 (45,4%) more within a distance of 5 km, and only 78 (4,8%) at a distance of >10 km. For 674 of the 682 owls controlled as breeders the consecutive year the sex is indicated (200 ♂, 474 ♀). Among the owls which had moved > 10 km from one to the next breeding season there were 13 ♂ but 49 ♀.

Moving from breeding season to next winter

For 395 of the owls recorded during a breeding season (N=6.014) there was at least one record during the following months September – March. After exclusion of the early ore late breeders (STATUSBROODSIZE: „N") 201 recoveries remained. Among these the find for 137 that the distance is less than 10 km and only for 18 >100 km. How these recoveries disperse over the moths is shown in figure 10. Among the 38 owls which had moved for >10 km from the respective breeding seasons record, 32 were known to be ♀, only 6 to be ♂.

Neither the moving direction for displacements of >50 km (fig. 11) nor that for >100 km (fig. 12) gave any indication of a preference.

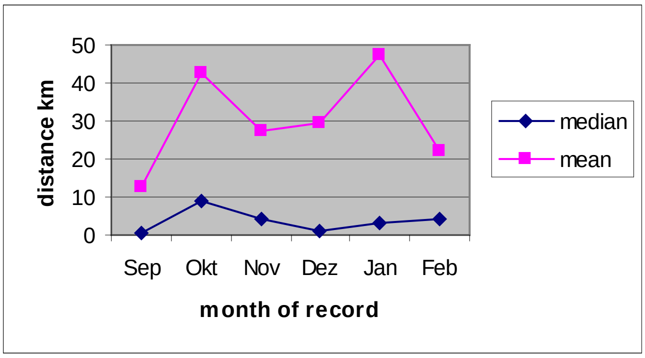

Figure 10: Recovery distances of owls controlled in the months September – February after a breeding season

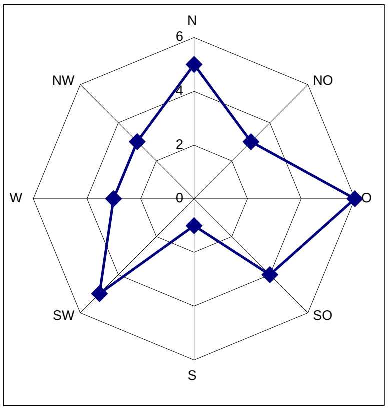

Figure 11: The moving directions for distances >50 km (N=30)

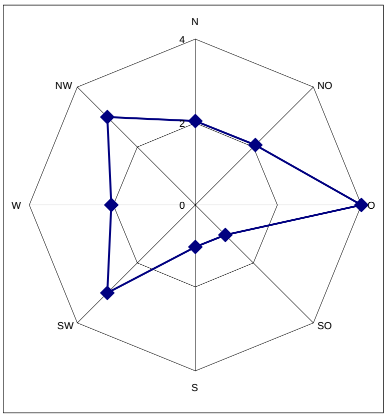

Figure 12: The moving directions for distances >100 km (N=18)

Moving within a winter
The 5.032 records within any winter (September – February; early and late breeders again excluded) belong to 4.880 individuals. Only 148 of these were controlled more often than once, again 119 of these twice to three times during the same winter. The respective distances of the second records from the first ones were <10 km (N= 69; 58,0%), >50 km (N=13; 10,9%). Because data are insufficient a discrimination for sexes was not possible.

Moving from winter to the following breeding season
Among the 4.880 individuals mentioned above with 5.032 records during any winter (September – February; again early and late breeders excluded) there were 72 individuals with 90 records during the following breeding season (April – July). For 69 (76,7%) of these double records the distance between the two controls was <10 km, for 15 (6,7%) >20 km. Here too discrimination for sexes is not possible.

Moving from a breeding period to the next winter and again to the next breeding season
Basis for the query for individuals for which there was a record in any breeding season, then a second one during the following winter, and again a third one during the next breeding season, are the 201 records above (see chapter breeding season – winter). Among these there were 12 data sets with records for all three periods belonging to eight individuals (7 ♀, 1 ♂; 4 ♀ had been controlled twice each). All individuals concerned indeed had bread as well in the first as in the second breeding season. None

of the ♀ had moved >4 km to the winter record, the ♂ had flown 16,4 km. The breeding records in the following year for all ♀ was within less than 6 km apart from the record during the first breeding season, for four of them exactly at the same breeding site. For the ♂ the distance between the two sites was 2,5 km. They all stayed within their familiar home range.

4 Discussion

From the earlier studies on dispersion of young barn owls three emerge considerably: SAUTER (1956) because of its thoroughness of questioning and analysis not exceeded since, KNEIS (1981; because of the principle discussion), and BAIRLEIN (1985; because of the method to focus the analysis on a narrower region). They all together omitted almost no aspect. To their results the present study gives only minor corrections. Due to the now available possibilities (electronic data bases, functions for analysis, and graphic programmes as those of Microsoft-EXCEL) enormously larger data quantities could be studied with lesser expense. For the same reasons it was possible to occupy with some farer going questions. The generally right analyses of the older authors are the more admirable as they are based on less than 10% of the data which we now have for the barn owl.

Nevertheless we should not omit to mention that automation by all means has its risks. In this study repeatedly several queries were combined and then the results combined again. In this it often is considerably difficult not to loose the logic thread especially as the logic of electronic programs not always is recognizable from the beginning.

The number of values actually used in an analysis sometimes was slightly lesser than there should have been after simple addition or subtraction. Because of the mostly very large basis numbers and the very small losses in relation to them we disclaimed to clarify these obviously methodical losses.

In the tables 1 & 2 the part of owls fond dead had diminished following the increasing number of recoveries of an individual. This reduction only partly reflects the decrease in mortality with the increase in age (as already found by SCHIFFERLI in 1957). It additionally shows the increasing efforts of some ringers to control adult birds at their breeding sites. So the partition of birds controlled alive increases.

The figures 1, 3, and 4 with increasing number of the recovery had shown a decrease of the mean distances from the ringing site (and thus that of the site of birth). More than a real decrease of distance we here could see that in the recoveries the numbers of hazardous ones decreased in favour of the “intended” ones (so called by KNEIS 1981) (fig. 2). We only can expect more than two recoveries of an individual if intentionally adult birds are caught. As these controls by ringers preferably are made in smaller areas the nearer recoveries should gain a greater weight. Nevertheless the exclusion of the recoveries made by ringers doesn’t alter anything concerning the general distribution of the values (fig. 3). It seems possible that farer wandering is more dangerous and that these owls earlier come to death than those which move to a lesser extent. MÁRTINEZ & LÓPEZ (1995) already uttered in this sense.

These results contradict the results of BAIRLEIN (1985) for barn owls in southern Germany and of HILLERS (1998) for the Schleswig-Holstein population. Here the barn owls ringed as nestlings from their first breeding season to the next one should move farer from their respective birth sites.

In all figures with values for the distance from the ringing site (1, 3-8, 10) we first recognize that the means are more than twice as high as the medians. From that we may deduce with certainty that the original values have a very unsymmetrical distribution: There always are some ore more owls, which wander considerably or very considerably farer than the main body.

The jumps of the means of the distances from the places of birth as appearing in the figures 5-6 and 8 might be the result of dismigration distances being very different from year to year and simultaneously of very differing recovery numbers. The study of the numbers as well as the mean distances of all recoveries of >50 km and of those of >100 km as well of course gave some peak values but no coincidence in certain years. Additionally in both categories there were never peak values in the distance of two years. The interpretation as “Wanderjahre” (SAUTER 1956) cannot be allowed as the values are the sums of the owls years of life and not of calendar years. The jumps remain unexplained. No biological meaning offers even as supposition.

If then the recoveries were summarized following the segments of life (breeding periods, not-breeding periods) for the medians of the distance values (figs. 5, 6) we found a slight increase of 3-4 km from the first to the third breeding period and from the first post-breeding-winter to the next one. This increase indeed seems to be considerably to small to be a support for the supposition of BAIRLEIN (1985) and HILLERS (1998) (see above).

It astonishes that the winter recoveries (figs. 8,10; as means and as medians) are twice as far from the ringing site as the breeding time recoveries (figs. 3-7). Certainly, as BRANDT & SEEBAß (1994) found, outside the breeding periods the owls stroll about evidently farer than inside these ones. If this strolling about is undirected, as we indeed should expect, there should result neither in the mean nor in the median values a greater distance. Here of course it seems as if the owls regularly after each breeding period should elongate from their ringing place and afterwards should come back. Finally, as the figures 3-7 demonstrate, in the following breeding season they are again nearer to their ringing site. So these data as well cannot support the statements of BAIRLEIN (1985) und HILLERS (1998).

When studying exclusively the multiple records of individuals we found as expected that moving inside a breeding period is very low. The few owls which left the original locality of control, might have been those ♀, which had moved for a divorce-second-brood or of individuals or pairs for replacement broods, as has been shown for a population in southern Lower-Saxony (KNIPRATH & STIER 2008).

Among 1.641 owls, which had been controlled for two consecutive breeding periods, only 4,8% moved more than 10 km. This again confirms the great breeding-site fidelity of barn owls. Of course, here we cannot make any statement whether this breeding-site fidelity is correlated with mate-fidelity. As almost ¾ of the owls, which had moved, were ♀, again ascertains the slightly greater moving tendency of this sex.

The behaviour of single owls after the breeding period should give information about an eventual migration. Indeed, those only 18 individuals (from 395), which had moved more than 100 km from their preceding breeding site, showed that nothing of that kind exists. The wandering directions (figs. 11+12) additionally prove that this wandering has no preference. The apparent difference between the sexes in this distance (32 ♀ versus 6 ♂) once more proves the greater mobility of the ♀ (TAYLOR 1994, SHAWYER 1998).

Also the moving during the winter with 10,9% >50 km was unimportant and gave no reason to suppose any migrating behaviour.

At least there were 90 records for a wandering from en eventual winter site to the consecutive breeding site. But also among these there were only six with a distance of >50 km. Then the 12 records of eight owls moving from their breeding site to that in winter and back again brought the convincing details: Only one moved 16 km, all others <4 km.

There can be only one conclusion: Barn owls in northern Germany only rarely leave their breeding site during winter. There is no migration.

The influence of ringers

In all analysis of the moving it became visible that it is absolutely necessary to discriminate for these studies the data collected by ringers from those made by the public. Recoveries made by ringers, especially those made at the breeding sites, lead to distinctly lower distances than those made by hazard. We absolutely agree with the concerning demand of KNEIS (1981).

Acknowledgements

I wish to thank the Vogelwarte Helgoland (Wilhelmshaven) for leaving the data, RALF MALISKA (Northeim) for the sorting program, and BERND WEDEMEYER (Wolfsburg) for the program for calculating distances and directions.

5. Summary

Judging from the multiple recoveries in the responsibility area of the Vogelwarte Helgoland barn owls extensively are faithful to their breeding site once chosen. Between the breeding periods they mostly move within a smaller, rarely greater radius around this breeding site. Indeed, all owls which had been recorded in two consecutive breeding periods and additionally during the winter in between, scarcely had moved or not at all. So there is no migration. From that we deduce also that die dispersion of young barn owls ends with the settlement for their first brood. The next deduction is that the partners (may) keep contact over winter, hence very seemingly live in full time partnership (see ENS et al. 1996).

Literature

BAIRLEIN F 1985: Dismigration und Sterblichkeit in Süddeutschland beringter Schleiereulen (*Tyto alba*). Vogelwarte 33: 81-108

Brandt T & Seebaß C 1994: Die Schleiereule. Aula Wiesbaden

ENS BJ, CHOUDHURY S & BLACK JM 1996: Mate fidelity and divorce in monogamous birds: 344-401 in Black JM: Partnerships in birds. Oxford Univ. Press

HILLERS D 1998: Untersuchung der Dismigration und Sterblichkeit von Schleiereulen (*Tyto alba*) in Schleswig-Holstein auf der Grundlage von Ringwiederfunden. Thesis Univ. Kiel, 71 pp

KNEIS P 1981: Zur Dismigration der Schleiereule (*Tyto alba*) nach den Ringfunden der DDR. Ber. Vogelwarte Hiddensee 1: 31-59

KNIPRATH E 2007: Schleiereule *Tyto alba*: Dynamik und Bruterfolg einer niedersächsischen Population. Eulen-Rundblick 57: 17-39 (the papers of KNIPRATH as English translations may be found for download at www.kniprath.barn-owl.de)

KNIPRATH E 2010: Die Wanderungen der jungen Schleiereulen Tyto alba in Europa, eine Literaturübersicht. Eulen-Rundblick 61: 54-65

KNIPRATH E & STIER S 2008: Mehrfachbruten bei der Schleiereule *Tyto alba*. Eulen-Rundblick 58: 41-54

MÁRTINEZ JA & LÓPEZ G 1995: Dispersal and causes of mortality of the Barn owl (*Tyto alba*) in Spain. Ardeola 42: 29-37

SAUTER U 1956: Beiträge zur Ökologie der Schleiereule (*Tyto alba*) nach Ringfunden. Vogelwarte 18: 109-151

Schifferli A 1957: Alter und Sterblichkeit beim Waldkauz (*Strix aluco*) und der Schleiereule (*Tyto alba*) in der Schweiz. Orn. Beob. 54: 50-56

SCHNEIDER W 1937: Beringungs-Ergebnisse an der mitteleuropäischen Schleiereule (*Tyto alba guttata* Brehm). Vogelzug 8: 159-171