The movements of northern German barn owls ringed as nestlings as found in the recovery material of the Vogelwarte Helgoland – part 2

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Content
(Part 1 see: http://dw.kniprath-schleiereule.de/lib/exe/fetch.php?media=en:movements_1-2.pdf)

1 Preface

In part 1 of this paper (KNIPRATH 2012b) the data from the northern German Lowlands – as far as the ringing is organized by the Vogelwarte Helgoland – has been studied either as an entity or divided into the three areas west, centre, and north. Therein the selection of data always followed the birth-sites of the owls. This part here is the immediate continuation of part 1. The facts concerning material and methods as communicated there still are current, so are not repeated. As an obvious indication of this continuation the numbering of chapters (omitting the preliminary summary) as well as that of the figures here runs ahead. Likewise the discussion here now includes the results of both parts. So the discussion in part 1 is no more valid.
Here now is the opportunity to point to an error in part 1: In fig. 3 the two sub-figures “west” and “north” have been interchanged.

3.6 Distances and directions of multiple recoveries

Until now each single recovery has been counted as the end of a finished movement, even if it had been only one of several recoveries of an individual. Following the proceeding of SAUTER (1956) in the following the multiple recoveries are discriminated and analysed separately. 91.8% of the 8.251 recoveries (with a recovery distance >0) of the 7.542 owls ringed as nestlings were those which had been recovered only once, all others had at least two recoveries (table 5). This table in addition shows the respective numbers of dead recoveries and the portion of these of the total recoveries.

Table 5: Numbers of multiple recoveries (A: number of recovery, B: number of the owls controlled A-fold, C: number of the owls controlled only A-fold, D: part of the total of individuals (7.542)) of owls ringed as nestlings

A	B	C	D	dead	part dead %
1	7.542	6.926	91,83	5.478	79,09
2	616	425	5,64	144	33,88
3	191	108	1,43	18	16,67
4	83	38	0,50	7	18,42
5	45	21	0,28	1	4,76
6	24	13	0,17	2	15,38
7	11	4	0,05	0	0,00
8	7	5	0,07	0	0,00
9	2	2	0,03	0	0,00
	8.521	7.542	100,00	5.650	74,91

Moving distance of multiple recoveries following their recovery position

The recoveries of the individual ringed birds were given a “recovery number” (column A in tab. 5) ordered by the recovery date. As in each case time had passed from one recovery number to the next one, it could be assumed that site-changes would become visible when comparing the distance values. The result is astonishing (fig. 23): The owls from recovery to recovery (at least for the first recoveries) seemingly again should have approached the ringing site.

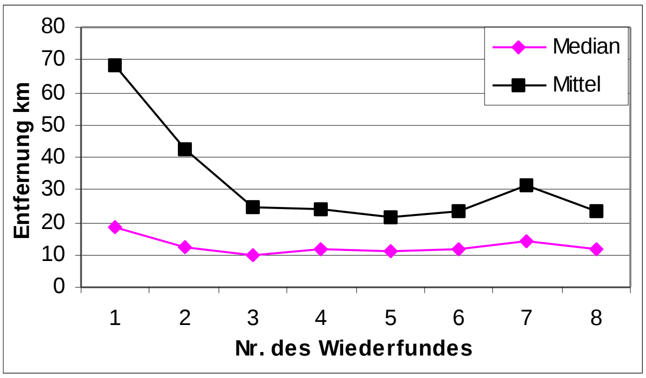


Figure 23: Alterations of means and medians of the recovery distances from ringing site of barn owls ringed as nestlings from recovery to recovery (n=8.251)

This type of comparison indeed contains a dangerous non-logic. Not the recoveries of all owls (numbers in column B table 5) might be compared for this issue but only those of the individual owls. So we now compare the stages of the same individuals. The procedure: All birds having a second recovery (616 following table 5, column C) are discriminated by their recovery-values at their second recovery from the table of recoveries. Then for these owls their distances at their first recovery are calculated. This new data-plot then of course has the same size as the first quantity. Now we have the distance values at start and at the arrival of the second stage (recovery-numbers E1 and E2 in fig. 24). The number of value-pairs per stage is found in tab. 5, column B. For stage 9 we only find two. Now there is no alteration neither for the medians nor for between these: The distance of the owls from the ringing-site has become neither smaller nor bigger. The comparison of the means of the distances between start and end of the individual stages by ANOVA (EXCEL) gave a ns (P>0.1). The deviant mean values of the stages 2 and 7 in figure 24 only indicate that in these samples there had been some owls, which had been recovered twice far away from their ringing-site. The medians do not exhibit these deviations.

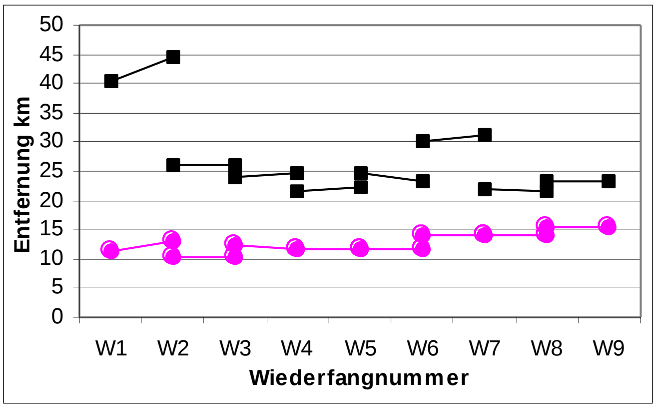


Figure 24: Alterations of means (black) and medians of the recovery distances from ringing site of barn owls ringed as nestlings from recovery to recovery. The coupled data are those of the same individuals. (The n of the couples are those of column B in table 5)

Again nearer to the biology of the owls is the comparison of the distance-values between breeding season and winter. It already exists (KNIPRATH & STIER-KNIPRATH 2009). There as well no site changing of importance was found.

Direction of movements

SAUTER (1956) as well as KNEIS (1981) had studied the multiple recoveries of the material they had at hand with respect to direction changing from stage to stage. This will be done for the present material: To do that, first value-couples for the second stage were produced (n=616) in the same way as in the preceding sub-chapter. All value-couples with distance-values <2 km between start and end (n = 436; 70.1%), as the owls were still in the narrower nest area. Among the values excluded there was only one couple with opposite moving direction between stage 1 and stage 2 (with 7.9 resp. 9.8, together 17.7 km). Among the remaining ones in stage 2 89 (14.4%) start and end as seen from the ringing site pointed to the same direction (directions reduced to 8 sectors). For 27 of them the difference between start and end was >10 km (fig. 25). They indeed had moved not only in the nearer surroundings of the first recovery-site. In figure 25 positive values of difference indicate that the owls on their second recovery were farer from the ringing-site than on their first one. Even if these latter ones slightly outweigh, considering the only small numbers (27) we cannot deduce a continuation of the movement away from the ringing-site.

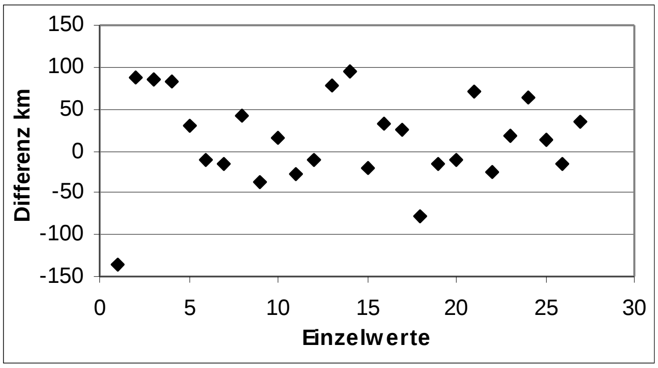


Figure 25: The distance difference from ringing-site of start and end of stage 2 (only difference > 10 km; n=27)

In addition there were nine more couples of data, in which the owls had switched exactly (2) or nearly exactly (7) to the opposite direction. For two of them the distance-values at starting were so small (<10 km) that we could assume that dispersal not yet had started. For the resting 7 couples the distance between start and end was from 28 to 470 km (mean 158 km, median 50 km). The then remaining 91 (14,6%) had deviated at any angle from the original direction.

The same procedure used for stage 3 at a total 191 lead to the exclusion of 160 (83.8%) value-couples (difference >2 km). Here we found no couple with opposite direction. Among the remaining ones 15 (7.9%) were found with same direction, whereof only 2 (1%) with a difference >10 km, here <30 km. The examination showed that only two of the 15 owls were still in their youth-year (until end of Febraury), not indeed the two with barely 30 km.

3.7 Far-wanderers

In the material studied here the part of far-wanderers (>10 km) amounts to 25.7% (area west), 14.2% (area centre), and 15.7% (area north). For the total of the Helgoland recoveries the value for the youth-year (to end February) is 21.3%, for the later years 16.5%.

Extreme wanderers

Among the far-wanderers we found 39 distances >1.000 km. Their direction-distribution is seen in figure 26. The general slight preference of the direction SW as already mentioned in chapter 3.1 in this distance-zone becomes the absolutely dominant one. It seems astonishing that the two extreme values of >2.000 km in the recoveries are direction E. Nothing is known about the nearer circumstances of these recoveries, for example whether there is a suspicion in direction of freighting. For the owls wandered direction SW the mean of distance is at 1.800 km, for all other directions at least 500 km less.

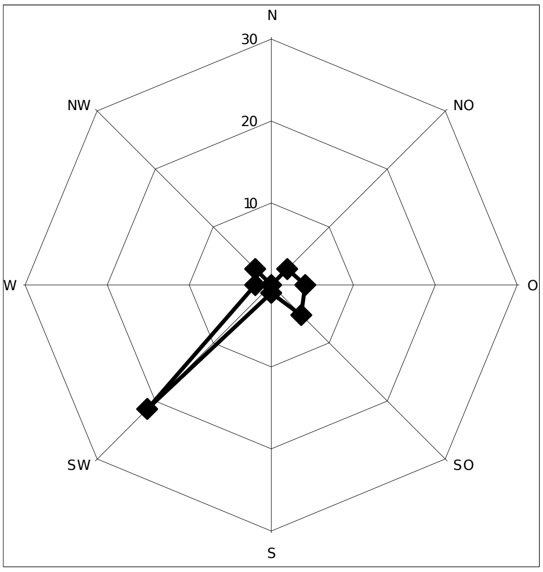


Figure 26: The distribution of the extreme-wanderers (>1.000 km) following their directions (n=39; direction N: no data)

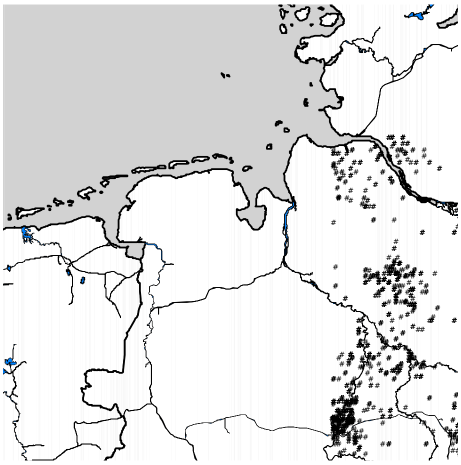
4 The movement for smaller regions of origin

As we could assume that the summing up to these three indeed large areas (as in chapter 3) eventually could hide regional properties, we here adopted the method of BAIRLEIN (1985): The analysis only uses recoveries belonging to birds ringed in narrower areas. The size of the respective region mostly freely results from the fact that the actions of intensely working Barn Owl ringers of course are narrowly limited geographically.

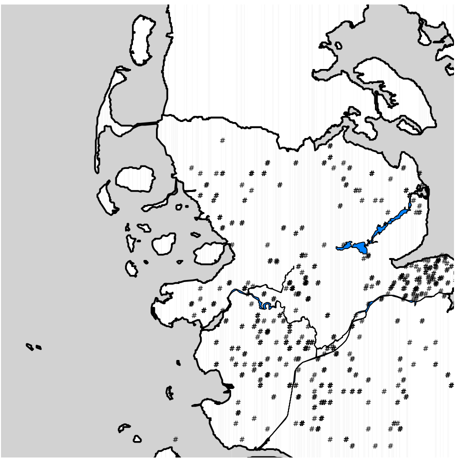
4.1 Material and methods

This latter fact very clearly is visible in the maps (fig. 27). There we as well see that the areas studied are of quite different extents. The extent of ringing is very different from area to area. The necessary consequence of that is that repeatedly the theoretically possible analysis only in part could be performed.

West



Center



North

Figure 27: The ringing areas belonging to the recoveries of Barn Owls ringed as nestling in the Lowland. The sub-maps are not to scale.

The number of the areas so distinguished in the Northern German Lowland amounts to 21, whereby a greater concentration is visible at the southern border of the lowland. There as well we find the greater numbers. Independently we here proceed from West to East and from North to South: from the coastal regions to the inland and then following the southern areas along the border of the mountains of lower altitude.

For all these areas we first ascertain to which directions the dispersing young owls had moved. The amount of data only once permitted to answer this question by discriminating the sexes. Sometimes the material was sufficient to answer the question whether the tendency of direction was different depending on the distance from the ringing site. It seemed possible that a firstly uniform distribution beginning at a certain distance from the ringing site would narrow to only a few directions.

The data of the respective areas were discriminated by co-ordinates as an ACCESS-query. Then followed the discovery of the numbers of recoveries per direction by a next, grouped-query. These directions were renamed into the order needed here of the compass. The figures were produced with the diagram-type “net”. For each region analyzed the co-ordinates of the centre and the approximate altitude.

4.2 The dispersal by regions

4.2.1 Coast

Region Wangerland (7.78 east, 53.57 North) (1 in fig. 27)
Of course we self evidently expected for the recoveries in this coastal region west of Wilhelmshaven (Lower Saxony) that the northern directions (towards the coast) would be discriminated against. Figure 28 impressively proves this assumption despite of the indeed low numbers.

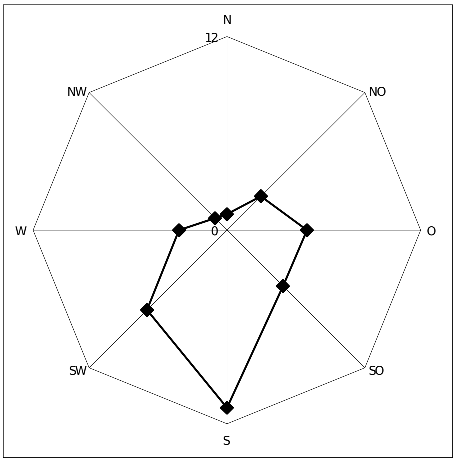


Figure 28: Recovery numbers of Barn Owls ringed as nestlings in the region Wangerland by directions (n=36)

Region Jade-Oste (8.8 east, 53.4 north, 3 m)(2 in fig. 27)
Immediately adjoining the preceding region eastwards this one indeed shows a quite different distribution of the recovery-directions (fig. 29). Here merely a slight preference of the direction southeast may be recognized.

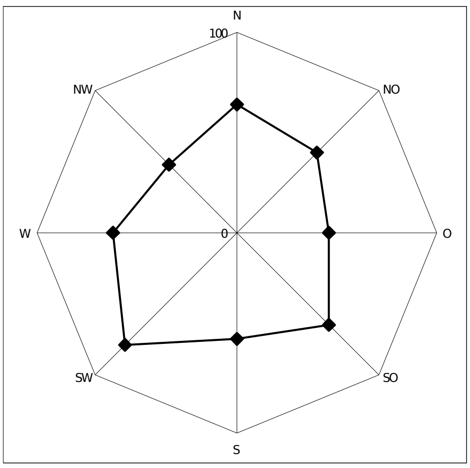


Figure 29: Recovery numbers of Barn Owls ringed as nestlings in the region Jade-Oste by directions (n=474)

Then followed the discrimination of the data by recovery-distances. It seemed possible that the preference of a certain direction would become remarkable only for the recoveries at farer distances. Indeed, for the greater distances we have a quite different picture (fig. 30). Here the recoveries direction SW are strongly and those direction N still as well are accentuated. In addition direction N is lacking totally. Direction N means shoals and open water. Obviously it is avoided. There is likewise no recovery of an owl washed ashore. Direction N means Schleswig and Denmark. Here of course some owls would have to cross the greater water-surface of the Elbe estuary (between 2.5 and 6 km). All southern directions from SW to SE would be similarly favourable by their geography. Indeed SW is preferred. This selection of direction (fig. 31) as well is prominent for those owls found only after the February of the year following their birth, thus being settled with some certainty. After exclusion of the recoveries made by ringers (code FINDCIRCUMSTANCES = 8) the picture does not change. An influence by controls of ringers is not recognizable (no fig.).

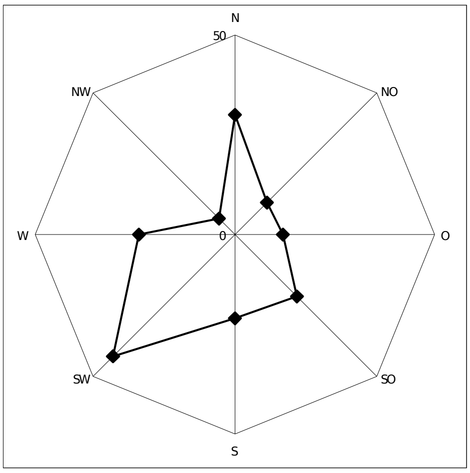


Figure 30: Recovery numbers of Barn Owls ringed as nestlings in the region Jade-Oste at distances >50 km by directions (n=169)

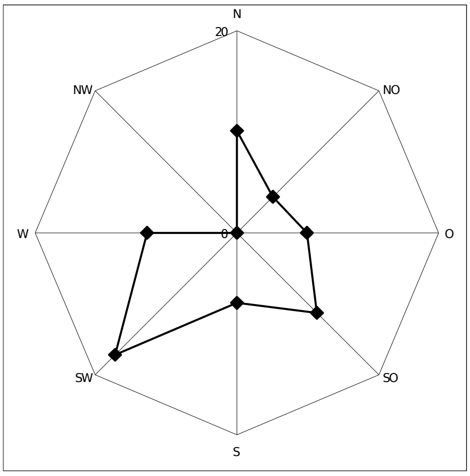


Figure 31: Recovery numbers of Barn Owls ringed as nestlings in the region Jade-Oste after February of the year following ringing by directions (n=66)

Region Kehdingen (9.2 East, 53.5 North, 15 m) (3 in fig. 27)
This region is that immediately adjoining the preceding on eastwards. Despite a quite smaller number of recoveries it shows a distinct preference of the direction SW (fig. 32). Recoveries by ringers don't play any role.

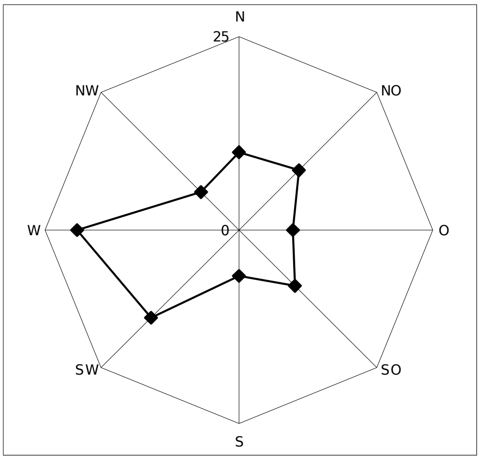


Figure 32: Recovery numbers of Barn Owls ringed as nestlings in the region Kehdingen by directions (n=88)

Region Elmshorn (9.55 East, 53.8 North, 4 m) (4 in fig. 27)
This region follows the preceding one east of the Elbe estuary. Despite the small numbers we here find the same preference as there (fig. 33). NE as additionally avoided direction here means direction Baltic Sea. Indeed, the small numbers make all conclusions quite speculative.

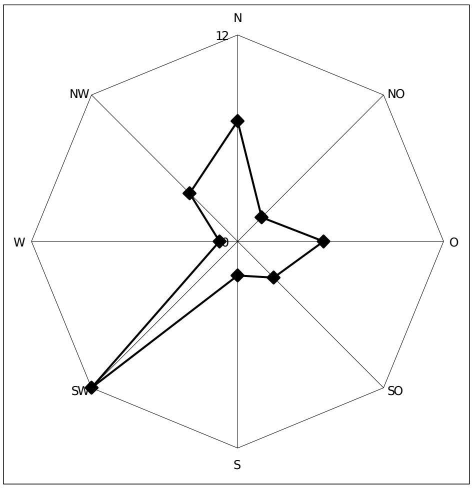


Figure 33: Recovery numbers of Barn Owls ringed as nestlings in the region Elmshorn by directions (n=36)

Region Oldesloe (10.3 East, 53.8 North, 20 m)(5 in fig. 27)
Although this region is situated not to far eastwards of the preceding one, the picture again is different (fig. 34). The directions N and NW (Schleswig and Denmark) are accentuated clearly. The influence by the controlling activities of ringers is clear: After exclusion of their recoveries the accentuation of the direction N (and exclusively this one) is reduced very strongly. Only there (especially in Danish Wohld) adult birds are controlled (MARTENS in litt.). The under-representation of the direction SE points to the

non attraction of greater woods. There we find the mostly wooded natural park “Lauenburgische Seen”.

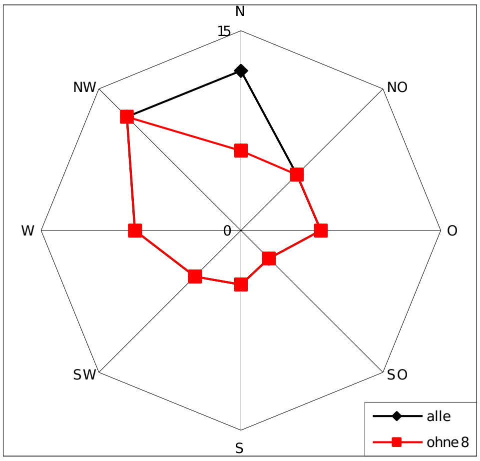


Figure 34: Recovery numbers of Barn Owls ringed as nestlings in the region Oldesloe by directions (all: n=56; without recoveries by ringers: n=50)

Region Dithmarschen (9.29 East, 54.19 North, 5 m) (6 in fig. 27)
As was expected, in the southern part of the Schleswig-Holstein North-Sea coast the direction W is strongly discriminated against. Interestingly the direction NE-E as well evidently is avoided (fig. 35).

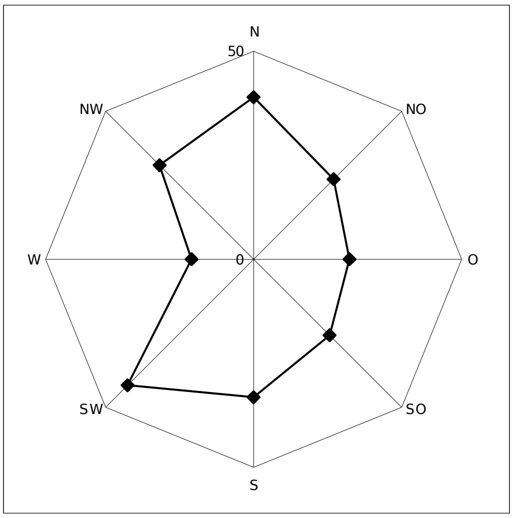


Figure 35: Recovery numbers of Barn Owls ringed as nestlings in the region Dithmarchen by directions (n=238)

Region northern Schleswig-Holstein (9.12 East, 54.19 N, 10 m)(7 in fig. 27)
Generally there should have been expected that both directions toward the sea (direction W the North-Sea, E the Baltic) should be avoided to a similar extent (Fig. 36). The supposition that the majority of ringing would have been done in the western part of the region, by which the direction E would more likely, is not confirmed (n=345 of 832).

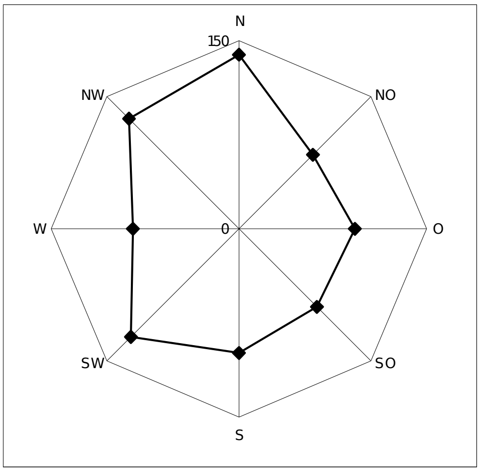


Figure 36: Recovery numbers of Barn Owls ringed as nestlings in the region North Schleswig-Holstein by directions (n=832)

Region Danish Wohld (10.0 East, 54.4 North, 25 m) (8 in fig. 27)
As this region borders to the Baltic Sea, the discrimination of the direction W doesn’t surprise (fig. 37). Also concerning the distances wandered the values in this direction as well as mean as also as median (fig. 38) are distinctly smaller. An influence by ringers can be excluded. The part of these in the recoveries only amounts to 10 (2.6%). An explanation is missing.

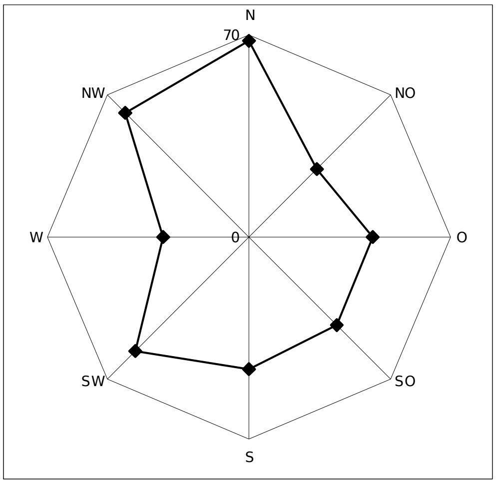


Figure 37: Recovery numbers of Barn Owls ringed as nestlings in the region Danish Wohld by directions (n=380)

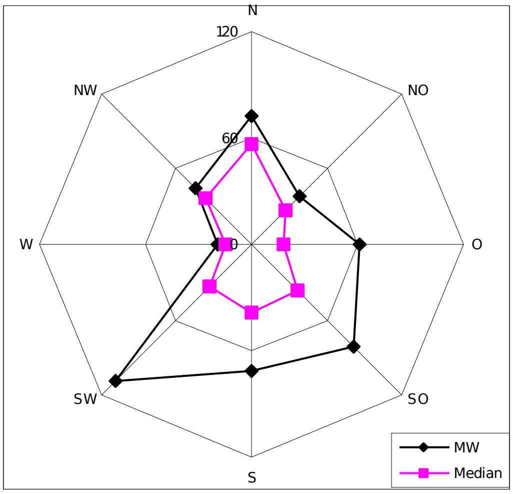


Figure 38: The recovery distances belonging to the values of fig. 37 (mean and median) in km

<u>4.2.2 Inland</u>

Region Lower Rhine (6.5 EAst, 51.6 North, 10 m) (9 in fig. 27)
All ringing took place in the left-Rhine-lowland. There could be found no geographic peculiarities for the slightly preferred directions North and South (fig. 39). Indeed the rather small numbers give great opportunities to hazard.

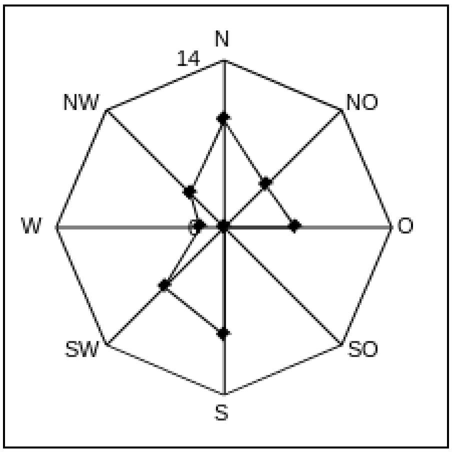


Figure 39: Recovery numbers of Barn Owls ringed as nestlings in the region Lower Rhine by directions (n=42)

Region Rur – Erft (6.3 East, 51 North, 100 m) (10 in fig. 27)
This region is situated in the transition zone from the left-Rhine lowland to the Eifel. The graph (fig. 40) shows a preference of eastern directions by omitting the direction East itself. Here we find the wooded area of the governmental forest “Ville”. Die directions NE SE respectively mean their by-passing. The general preference of the direction E could be deception: The three values from NE to SE have a mean of three and so scarcely more than all other directions. For the number of recoveries is very small, hazard may play a great role. In this data set there are no recoveries by ringers.

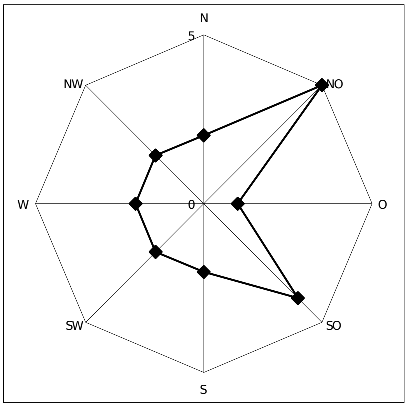


Figure 40: Recovery numbers of Barn Owls ringed as nestlings in the region Rur-Erft by directions (n=20)

Region Coesfeld (7.0 East, 51.8 North, 69 m) (11 in fig. 27)
This region is far from the sea and still about 50 km from the border of the medium high mountains (direction South). The total avoidance of this latter direction (fig. 41) might be caused that there is the continuous wooded area of the “Nature Park Hohemark”. The wandering Barn Owls prefer to evade in western direction, generally prefer indeed southern to northern directions. Due to the small numbers explanations would be speculative.

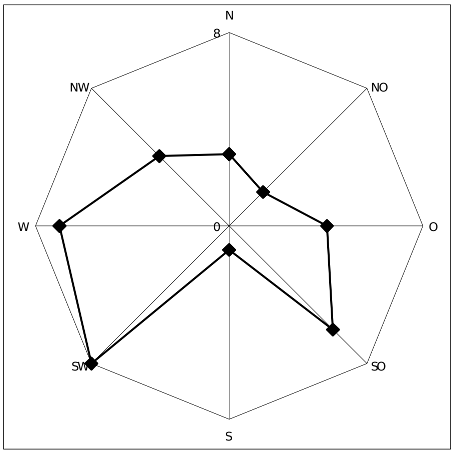


Figure 41: Recovery numbers of Barn Owls ringed as nestlings in the region Coesfeld by directions (n=35)

Region Rotenburg Wümme (9.4 East, 53.1 North, 22 m) (12 in fig. 27)
In the West we find the large town of Bremen at a distance of about 30 km and in the East a greater wooded area of the Lüneburger Heide. Only this latte one seems to repell (Fig. 42). The direction towards the large town is preferred still at recovery directions >50 km (thus farer than Bremen itself) (no fig.). The preference of SW is evident. An influence of ringer-activities was not found.

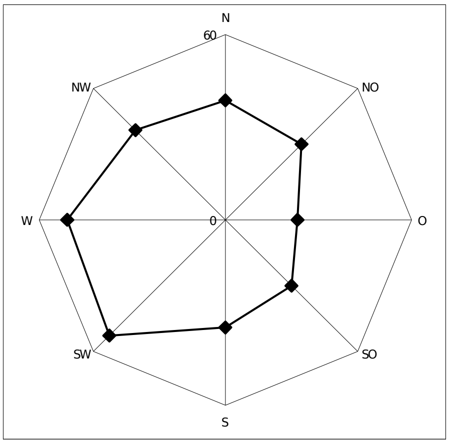


Figure 42: Recovery numbers of Barn Owls ringed as nestlings in the region Rotenburg Wümme by directions (n=307)

Region Uelzen (10.5 East, 52.9 North, 41 m) (13 in fig. 27)
The figure (43) makes evident that the wandering directions E (wood area Göhrde) and – less – W (Lüneburg Heide and Southern Heide) are distinctly less attractive by their high part of wood than N and S. There is no influence of ringers.

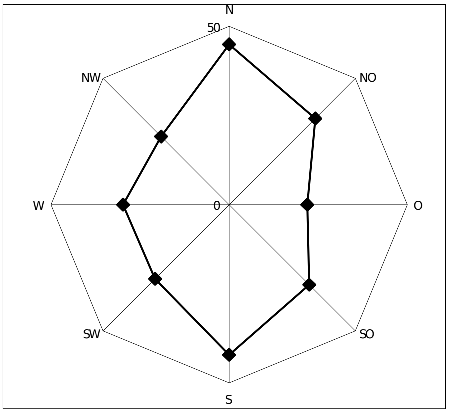


Figure 43: Recovery numbers of Barn Owls ringed as nestlings in the region Uelzen by directions (n=262)

Region Nienburg (9.2 East, 52.6 North, 26 m) (14 in fig. 27)
This region, situated at the river Weser SW from the previous one, doesn’t show in its surroundings any conspicuous geomorphologic structure. The preferred directions NW and S are not explained (fig. 44). There is no influence by ringers in these directions.

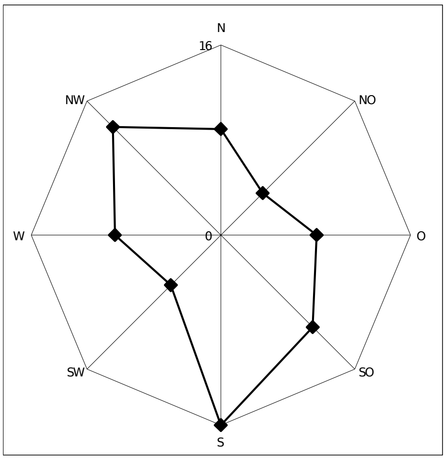


Figure 44: Recovery numbers of Barn Owls ringed as nestlings in the region Nienburg by directions (n=77)

Region Celle (10.1 East, 52.6 North, 46 m) (15 in fig. 27)
There is no explanation for the eventual preference of the directions W and NE-E (fig. 45). Though 146 of the recoveries had been made by ringers, no influence of these on the recovery direction is recognizable (no fig.). These recoveries originate in lower distances, thus from inside the region.

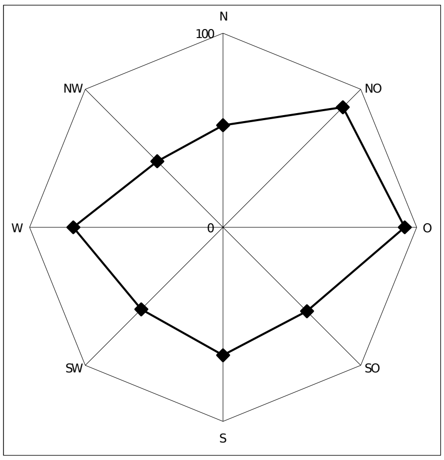


Figure 45: Recovery numbers of Barn Owls ringed as nestlings in the region Celle by directions (n=548)

Region Peine (10.2 East, 52.3 North, 64 m) (16 in fig. 27)
The general suspicion that large towns have a repelling effect here again (see region Rotheburg Wümme) is refuted: direction W there is Hannover and direction E Brunswick, both less than 40 km apart (fig. 46: violet). It seemed possible that their influence would become obvious only beyond a border of 40 km. Figure 47 (green) proves the contrary: both directions clearly are preferred. West even beyond 60 km, thus farer than Hannover, is preferred (fig. 46: brown). Already from 40 km on (fig. 47: green) a certain influence of the border of the medium altitude mountains direction South may be supposed.
If we then indeed look at the distribution of the recoveries made from the first breeding season on the image is quite different (fig. 48: violet): The accentuation of the direction W is totally missing. Instead there again is the accentuation already visible in fig. 46 of the directions NE and E. This one indeed exclusively results in the action of ringers in

these directions: If we eliminate recoveries by ringers (FINDCOND=8), this accentuation disappears (fig. 48: black).
Simultaneously it becomes evident that the accentuation of the directions W and A is not such an effect.

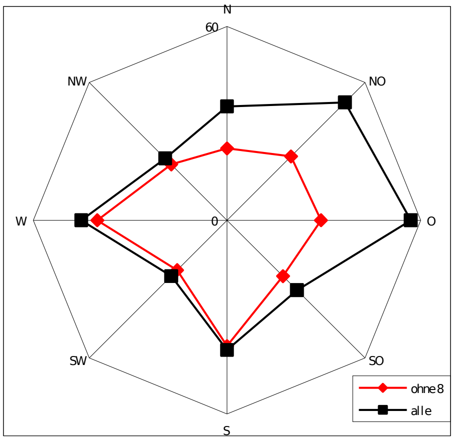


Figure 46: Recovery numbers of Barn Owls ringed as nestlings in the region Peine by directions (black: all; n=311; red: without recoveries of ringers; n=229)

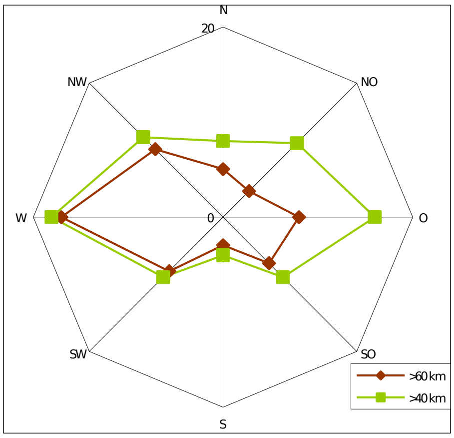


Figure 47: Recovery numbers of Barn Owls ringed as nestlings in the region Peine by directions (green: only recoveries >40 km; n=87; brown: only recoveries >60 km; n=62)

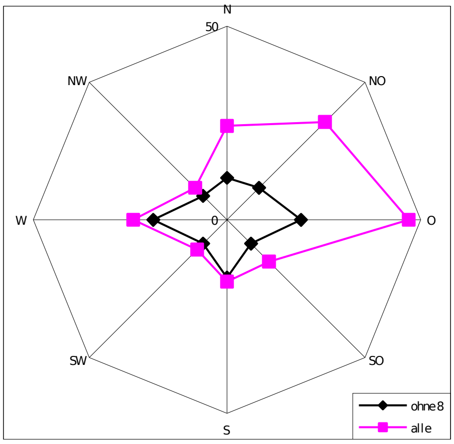


Figure 48: Recovery numbers of Barn Owls ringed as nestlings in the region Peine by directions (violet: only recoveries after February of the year after ringing; n=185; black: likewise but without the recoveries by ringers; n=103)

Region Wolfsburg (10.7 East, 52.4 North, 56 m) (17 in fig. 27)
The recoveries were made to an amount of >50% by ringers, which had controlled the birds alive and freed them afterwards. Nevertheless, the recoveries of these people do not influence the picture (fig. 49) remarkably. This region, the working area of the ornithological group of Wolfsburg, so at one hand itself is a region of intense controls and in addition evidently surrounded by areas, in which ringers control the adult birds. The median of distance of the data produced by ringers is at 9.7 km and thus proves that the majority of the recoveries originate in the region itself. The slight discrimination against the directions demonstrates that in this direction there is a barrier, the Harz Mountains. Both curves in addition show a weak preference of the direction W. These two influences become more prominent in recoveries of >50 km, the approximate distance of the Harz Mountains from this region (fig. 50).
For 93.45% of the owls controlled by ringers, the sex is known (257 ♂, 228 ♀) (of the remaining ones only for 5.35%). The recovery directions indeed don't exhibit any interpretable differences between the sexes (fig. 51).

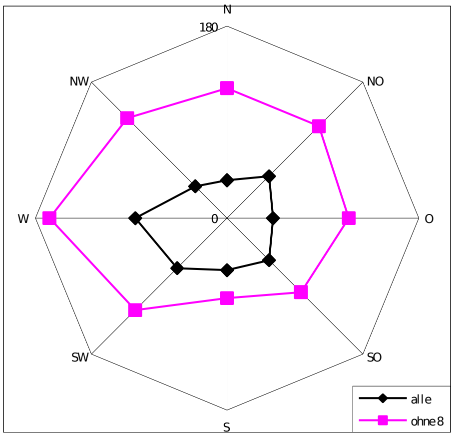


Figure 49: Recovery numbers of Barn Owls ringed as nestlings in the region Wolfsburg by directions (violet: all; n=952; black: without recoveries of ringers; n=433)

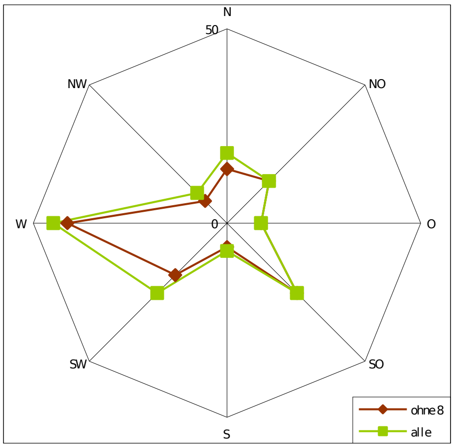


Figure 50: Recovery numbers of Barn Owls ringed as nestlings in the region Wolfsburg by directions, recovery distance >50 km (green: all; n=155; brown: without recoveries by ringers; n=137)

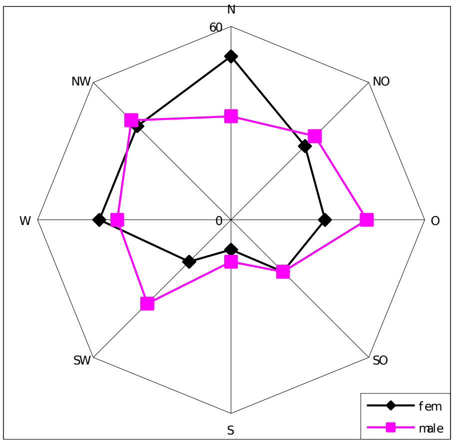


Figure 51: Recovery numbers of Barn Owls ringed as nestlings in the region Wolfsburg by directions and sexes (violet: ♂, n=263; black: ♀, n=244)

4.2.3 Border of the mountains of medium altitude

Region Niederbergisches Land (6.9 East, 51.2 North, 142 m) (18 in fig. 27)
This is a fairly small region northeast of Düsseldorf, which mostly is surrounded by urban areas. In addition, direction S and SE the valleys of the “Bergisches Land” nearly entirely are occupied by the town of Wuppertal. Moreover here the areas of higher altitude mostly are wooded. The figure 52 makes guess that a greater part of the owls has dismigrated passing over Düsseldorf ore by surrounding this town direction W. Despite of the indeed small numbers of recoveries the westward tendency is shown not only for the total but in the same extent for the distances until 10 km, until 20 km, and still beyond 50 km, and as well for the bird already settled (no fig.).

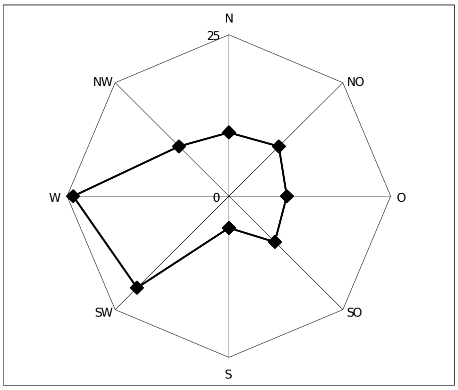


Figure 52: Recovery numbers of Barn Owls ringed as nestlings in the region Niederbergisches Land by directions (n=100)

Region Soest (8.1 East, 51.5 North, 97 m) (19 in fig. 27)
The influence of the mountains southward on the recovery direction is well seen in figure 53. The region South is evidently discriminated against and the directions W and E are preferred. No influence of the recoveries by ringers (n=12) is visible. The relatively few recoveries of the northern direction remain unexplained.

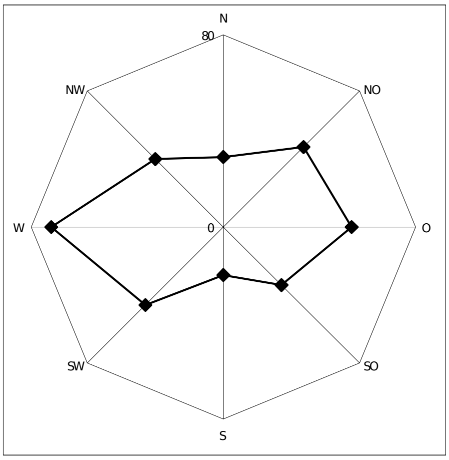


Figure 53: Recovery numbers of Barn Owls ringed as nestlings in the region Soest by directions (n=341)

Region Delbrück near Paderborn (8.5 East, 51.7 North, 92 m) (20 in fig. 27)
Like the region Soest the region Delbrück is situated near the border of the mountains. In addition this region in eastern direction ends at the Eggegebirge with altitudes >400 m. The direction north as well is closed by the Teutoburger Wald (a little less high but wooded). The effect of this position in a funnel is well visible (fig. 54) in the distribution of these few recoveries. Here again there is no influence of the recoveries made by ringers.

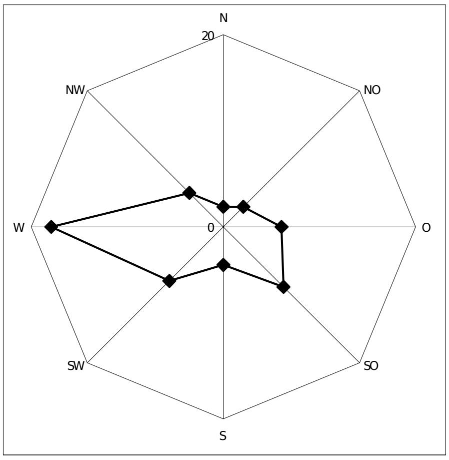


Figure 54: Recovery numbers of Barn Owls ringed as nestlings in the region Delbrück by directions (n=55)

Region Bielefeld (8.5 East, 52.0 North, 100 m) (21 in fig. 27)
Only 25 km apart from the previous region this one is situated immediately north-east at the Teutoburger Wald and thus outsider the funnel described. So it is restricted direction S by the Teutoburger Wald and direction N by the Wiehengebirge with altitudes of about 300 m. The direction of the recoveries accentuated in figure 55 is the direction well reachable by valleys to the Porta Westphalika, the breaking through of the river Weser between Teutoburger Wald and Wiehengebirge. Of the 11 recoveries direction S four are >50 km away, thus ulterior to the Teutoburger Wald. This may indicate that this mountain chain is not unconquerable. There is no influence of ringers (no fig.).

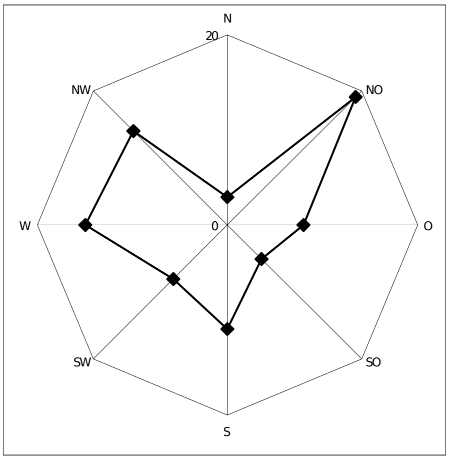


Figure 55: Recovery numbers of Barn Owls ringed as nestlings in the region Bielefeld by directions (n=83)

Region Minden (8.9 East, 52.4 North, 48 m) (22 in fig. 27)
In the two preferred dispersal directions W and E the course of the Wiehen- and Weser-mountains laying south is recognizable (fig. 56). Though 148 (20.4%) of the recoveries originate from ringers, the elimination of these doesn't influence the picture. This may indicate that these recoveries mostly originate in the region itself. The median of the distances of 10.9 km proves this supposition.

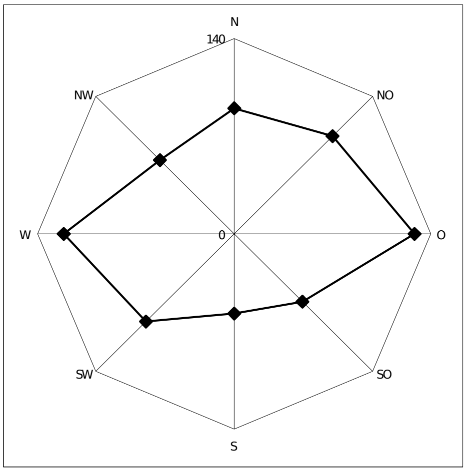


Figure 56: Recovery numbers of Barn Owls ringed as nestlings in the region Minden by directions (n=726)

5 Discussion
If in the following sometimes we point to a review appeared earlier (KNIPRATH 2010) it is not intended to disregard those many authors but the sizes of the text and also of the bibliography here shall be kept smaller.
Three of the earlier papers on the dispersal of young Barn Owls are very prominent: SAUTER (1956) because of the thorough of the questions and of the analyses, KNEIS (1981; due to its fundamental discussion), and BAIRLEIN (1985; for the principal to focus the analysis of larger quantities of data on narrower regions). They all together hardly omitted any aspect. The study presented here presents only a few corrections to the results of the authors mentioned. Instead many statements could be confirmed and several formulated more precisely. Due to the possibilities now at our disposition

(electronic data bases, functions for analyses and graphic programmes such as furnished by Microsoft-EXCEL) considerably greater data-quantities can be analysed with much lesser expense. Likewise therefore it was possible, to focus on some questions going farer. The generally just analyses of the older authors are the more admirable as they sometimes base on less than 10% of the data which now are at our disposition concerning the Barn Owl. Different than for some of the older authors individual recoveries here play no role. The numbers have augmented in such a manner that this information has become superfluous. But before we focus on contents, it first is necessary to define some terms and to discuss different human influences. GLUTZ VON BLOTZHEIM & SCHWARZENBACH (1974), KNEIS (1981), BAIRLEIN (1985: 83), DE BRUIJN (1994), und MÁRTINEZ & LÓPEZ (1995) when comparing young birds with older ones have used a "1rst year of life" which often not has been defined. Amplifying the argumentation of KNEIS (1981), who had introduced a theoretical breeding period beginning on April 1, we here use the term "youth-year". As border between being young and adult we fix the start of the month March in the second calendar year. Latest then the young owls are mature (KNIPRATH 1999) and begin displaying and breeding. Due to the very different dates of hatching of the owls this youth-year comprises a very different number of months, but always less than 12. This definition indeed makes the comparison with the results of older authors more difficult but is nearer to the biology of the owls than a "first year of life".

Each wandering passes in space and time. It may be straight ore twisted ore even with abrupt direction changes (until return). Likewise this wandering may have a more continuous course ore one with pauses of different number and duration. Also different velocities from bird to bird and/or from stage to stage may occur.

All hitherto analyses of ring-recoveries had the aim at least to distillate some of these peculiarities of the dispersal from these few dates: site and date of ringing and site and date of recovery. Here the site of ringing (if no freighting had happened) in narrow borders also is the starting site of the wandering. Instead the recovery site only indicates that the owl on its recovery or death had been about there. It tells us, at least up to the end of the youth-year, nothing about the question, whether the wandering of this owl when surviving there and then would have or already had ended. A recovery site of owls found later than at the time mentioned instead fairly exactly marks the end of the dispersal. Later no greater wandering is to be expected (KNEIS 1981, TAYLOR 1994, MÁTICS & HORVÁTH 2000, KNIPRATH & STIER-KNIPRATH 2009). The dispersal had the aim to find a suitable site for the first brood. As Barn Owls already as yearlings are mature (KNIPRATH 1999), they end their youth-dispersal if possible just before their first breeding season or just earlier (GLUTZ VON BLOTZHEIM & SCHWARZENBACH 1979, KNEIS 1981, HILLERS 1998). Start and end in the time for greater recovery indications may be deduced indirectly. The dispersal has begun, when in a certain interval mean and median of the recovery distance distinctly (about 10 km) differ from zero. If these values don't alter systematically any more, we might conclude that the end of the dispersion has been reached.

5.1 Human influences

Before estimating the parameters of the dispersal me must clarify, whether such influences on the basic data do exist and which they are. Then the operation of each one has to be established and to be considered.

It is certain that not before 1998 the "own recoveries" i.e. those by the ringers themselves, meaning young birds having died mostly shortly after ringing had been introduced in a greater extent to the data basis of the Vogelwarte Helgoland (fig. 57).

This fact indeed has no greater importance for the analyses here: The recoveries in the nest (find distance = 0 km) were always, those in the nearest surroundings (find distance < 2 km) when relevant have been excluded. Such exclusion is mentioned in the text.

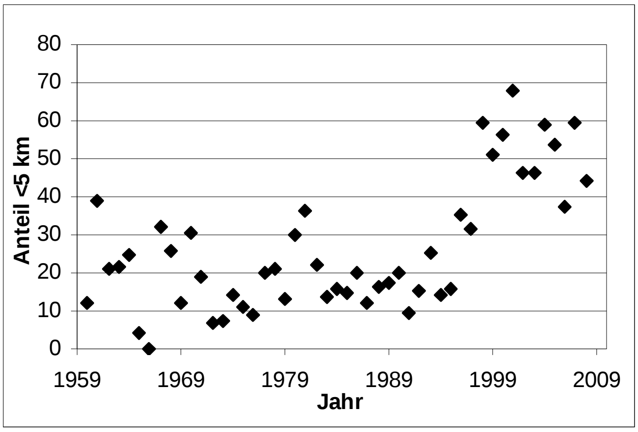


Figure 57: The parts of the recoveries nearer than 5 km to the ringing site in the total recovery material of the Vogelwarte Helgoland

The lack of the own recoveries in a greater amount in the data of the Vogelwarte makes expect that means of the values of distance calculated for the close range (also in the analysis presented!) generally are to high. For all comparisons (like in fig. 6, part 1) this is of lesser importance, as the mistake in the data compared probably is the same. This is quite different for deductions like this: “50% of the .... were recovered up to a radius of xx km.” These distances always are to high. The part of the far-wanderers by the same reasons is estimated (unimportantly?) to high.
In table 5, considering the part of the dead-recoveries, a decline with the number of recoveries has become evident. This only in part may reflect an eventual decline in mortality with growing age of the owls. Instead it may indicate the increasing efforts of some ringers to control adult birds at the breeding sites. Thus the part of life-recoveries is augmented. It as well inclines logically by the fact that only birds being alive more often than once may be recovered.
The analysis of the recovery distances in the sub-areas and also in some regions has shown that there in part are prominent differences between these. Some influences have been found as for some regions splitting of the data because of their amount had been possible. Already KNEIS (1981) had stated that the recoveries made by ringers (“gezielte” = intended recoveries) gave differing, minor means of the recovery distances than those by the public. The multiple examinations here, whether such an influence does exist as well on the recovery direction, made it very clear. If in the vicinity of a region there is one more, in which breeding birds are controlled, this may result in a clear accentuation of exactly that direction. Due to the fact that for recoveries in the data basis of the Vogelwarte the recoveries made by ringers (code: findconditions = 8) are discriminated for, this influence easily is to be established and might be considered or excluded at all (s. figs. 34, 46, 48, 49). There is, indeed, the possibility that a great amount of controls made by ringers is not expressed in the direction-distribution of the recoveries (region 15: Celle, see fig. 45; region 17: Wolfsburg, see figs. 49, 50; region 22: Minden, see. fig. 56). This means, we found control catches within the analysed region itself ore as well that we are analysing the rare case of a region (region 17:

Wolfsburg, see fig. 49) which nearly totally is surrounded by other regions, in which as well adult birds were controlled.

So it proves forcibly necessary for such studies to consider mathematically and logically the activities of ringers.

Just earlier (KNIPRATH 2012a) it has been discussed that owl protectors do have an influence on the settling distance of young Barn Owls. Here it was shown for all three areas that in the course of time the settling distances almost steadily had become always smaller (fig. 5, part 1). In accordance with TAYLOR (1994) we here accept that in the course of time the increasing posting of nest boxes has facilitated the young owls a settlement nearer to their birth-site. Considering this, we may deduce from figure 12 (part 1) that in the central area the number of nest boxes must be clearly higher than in the two other ones.

5.2 Course and interval of the dispersal

The heading “3.3 speed of dispersion” (part 1) had been chosen unhappily as we here much more spoke on the interval of the dispersal. To calculate the velocity of wandering the time of starting and ending would be necessary. Both we do know only very inaccurately.

Two phenomena here will be looked at separately: the far wandering (>100 km) and the “normal” dispersal. Already HILLERS (1998) had recognized that the first proofs of far wandering began with August/September (following KNEIS 1981 not before October/November), what means very early. Also in the material analysed here far wanderers were found beginning with August (identified by the increase of the distance-mean-values, but not of the medians). That indicates that the phenomenon far wandering becomes visible just immediately after the young become independent. Later (chapter 5.4 wandering distances) we intensely will focus onto that.

Several authors (see the review by KNIPRATH 2010: 60) have written about the “normal” dispersal. Following them it begins during September. That means: for the great majority of a cohort nearly at the same time. The data presented here confirm this opinion, here visible in the increase of the distance-median-values (figs. 14-17, part 1). This “nearly at the same time” only became evident as when calculating the distances, the two influences: ringing months and recovery months had been considered.

In TAYLOR (1994: 190) we find that the dispersal (of the English owls) ends after about three months.

Nearly all authors agree that the juvenile dispersal ends during November. On the other hand HILLERS (1998: 60 & 64) found for Schleswig-Holstein (Germany) that the recovery sites of the owls with the end of their first winter (January-March) again approach their birth site. Indeed the means and the medians of the recovery distance in this analysis for all three areas (figs. 14-17, part 1) decrease after December. Indeed, I would not use these data to deduce a re-wandering. It seems to me to be more obvious that the greater winter losses already hit the birds that had wandered farer already in the months of November and December. This winter weather reached the birds, which were in lowlands influenced by the Atlantic, only later. Thus in the material studied, the distance values decrease. It seems to be in discordance to that that in this study the means as well as medians of repeatedly controlled owls, at least up to the third record, clearly decrease (fig. 23). Here, indeed, it was shown that the wrong data had been compared: Only after the data of the same birds had been compared, such an effect no more appeared (fig. 24). Young stay where they are during the first winter of their lives.

BAIRLEIN (1985) indicates for southern Germany that the recovery distances in later years of life (of birds ringed as nestlings) exceed those of the first year. So the owls

should have wandered still after their first breeding season farer away from their birth site. This counts for all sub-areas studied by BAIRLEIN. MÁTICS & HORVÁTH (2000) indeed accentuate that the Hungarian birds don't cover greater distances after their juvenile dispersal. The present study comes to exactly the same result (tabs. 3+4, part 1). In addition the analysis of the wandering distances of birds ringed not as nestlings in the material of the Vogelwarte Helgoland until the year 2008 (n=2.412) gave a median of 1.2 km. That means, the far greatest number of young owls during the first breeding seasons of their lives are in the region, in which they stay forever. This statement again is supported by eight triple controls (breeding perod 1 – winter – breeding period 2) from the study area of the author, in which the maximum distance between the recovery sites was 16.4 km, mostly indeed less than 4 km (KNIPRATH & STIER-KNIPRATH 2009). This proves the faithfulness of the owls to the breeding site once chosen, this the more as seven of the eight individuals were ♀, which after KNIPRATH (2007) also in their adult life have a clearly greater tendency to wander than the ♂. The former ones after loss of their partner mostly move in the nearer surrounding, the latter ones preferably stay.
The thorough examination of the text of BAIRLEIN (1985) gave an indication on the he possible reason for so different results. In the time in question BAIRLEIN found a greater part of far wanderers. This one has been taken as proof for a prolonged juvenile dispersal. For the young owls, as presented above, after the turn of the year in their youth-year don't wander any more in an amount worth mentioning, the greater number of recovered far wanderers must have other reasons. Here the numbers of far wanderers recovered is valued as an impropriate measure for the wandering.
For all owls found dead in the months until February of their youth-year we never can be sure, whether the recovery site in fact is the site, at which they would have ended their wandering. This indeed certainly is, if we deny a prolongation of the juvenile dispersal, the case in the owls found beginning with Mach 1rst, very certainly for the then recovered breeders. Concerning this, BAIRLEIN (1985: 99) wrote: „ … almost half of the settlings for breeding at the end of the first year of life in more than 50 km from the birth site….". The distance values here (tab. 2 & 3, part 1) for all ringing months and breeding years clearly are beyond this value (almost half). This difference in part could be originated in the study of BAIRLEIN in the possibly mostly lacking "own recoveries", lacking for the reasons mentioned above. Certainly we here see also that the settling distance has declined clearly due to the many nesting boxes posted since (TAYLOR 1994).
Let's have a nearer look to settling. Already the summation of all distance values (fig. 8, part 1) had demonstrated that the recoveries beginning with the first breeding season in all three areas are nearer to the ringing site than those in the first autumn of life and also in the first winter. We may deduce there from that a settlement near to the birth site increases survival expectance. On the other hand, figure 21 (part 1:) demonstrates that the mean distance of the settled birds from the birth place increases with the birth month, and figure 22 (part 1) that an early birth date in general positively influences the settling probability (what then as well means: the probability of survival): Those born earlier in the year more often find a site for settlement, settle nearer to their birth place, and then do have a higher survival probability.

5.3 Direction of dispersal
The generally disordered direction of dismigration as described by the authors (review in KNIPRATH 1910: 61) here is ascertained as well as the slight preference of the direction SW. This latte one – like in the analysis of the regions – often is hidden by

other influences, but mostly becomes visible, if data from greater areas are analysed (as here for the areas West and Centre, fig. 4, part 1).
The influence of the ringers, especially of those who systematically control adult birds, here becomes visible: In some of the regions analysed nearer in the wandering directions peaks become visible, not explainable by the geography (figs. 30-54). These indeed disappeared, when the recoveries by ringers were eliminated. The explanation given here is that in the direction preferred there is an enthusiastic ringer, who also rings the adult birds. So the number of recoveries in this direction increases. Such an influence has disappeared in the analysis of the three areas of the lowland as a whole (fig. 4, part 1) or should we say: has been neutralized?

Influence of the topography on the dismigration direction
Scarcely in the great areas but only in the regions the influence of topographic peculiarities is visible. A nearby coast (region 1: Wangerland, fig. 28; region 4: Elmshorn, fig. 33; region 6: Dithmarschen, fig. 35) becomes recognizable by the under-representation of this direction. This indeed sometimes only becomes visible for greater recovery distances (region 2: Jade Oste, fig. 30). For two more regions this influence obviously is superimposed by other influences (region 7: northern Schleswig-Holstein, fig. 36; region 8: Danish Wohld, fig. 37 & 38).
In the material studied there were no ringed owls, which had been washed ashore by the sea, but owls not ringed had already been found on the shore. These findings as well as other proofs for passing greater distances over sea have been reviewed by KNIPRATH (2010: 61). These cases must be accomplished with the description of YOUNG (1954): A Barn Owl west of the Strait of Gibraltar in the open sea came aboard of a ship and disappeared again in the evening. Also broader waters obviously are crossed occasionally. From region 2 (Jade-Weser, fig. 29) owls more probably reach Schleswig and Denmark directly by crossing the Lower Elbe (2.5-6 km broad) than by flying around it.
The effect as a barrier of higher mountain regions repeatedly is discussed in the literature (review: KNIPRATH 2010: 61). In the present analysis such an influence of the Harz (all mountains in the regions analysed here at least are of medium altitude) is clear (region 17: Wolfsburg, figs 49-61). That corresponds to a statement of ZANG et al. (1994). MÖNIG & REGULSKI (1999) name the Bergisches Land less attractive for the Barn Owls dismigrating from their territory. KNEIS (1981) writes of a “guide line effect” of mountains (term belonging to the bird migration study!). GÜNTHER (1985) writes for Thüringen that surrounding mountains like the Thüringer and the Frankenwald inside of Thüringen do have a repellent operation.
As indeed in the study area there are no non-wooded mountain regions it cannot be decided, whether it isn’t first the wood to be repellent. In several figures it becomes visible (regions 5: Oldesloe, fig. 34; 10: Rur-Erft, fig. 40; 11: Coesfeld, fig. 41; 12: Rothenburg Wümme, fig. 42; 13: Uelzen, fig. 43) that wood outside mountain regions is a clear barrier.
Four great towns are situated in such a manner in the surrounding of several regions that their influence can be estimated. Neither Bremen (region 12: Rothenburg Wümme, fig. 42) nor Hannover and Braunschweig (region 16: Peine, fig. 46), nor Düsseldorf (region 18: Niederbergisches Land, fig. 52) had a recognizable influence on the dispersal direction.
The graphs indeed have shown more preferences and also rejections of distinct directions, which could not be explained.

Already SAUTER (1956) had established the idea and KNEIS (1981) had found further evidence that the owls certainly and also manifold can alter their wandering direction. The present study has corroborated these statements (chapt. 3.6): Certainly the majority of the dispersing young owls keep to a certain degree their original direction, but alterations of the direction up to a return are not extraordinary rare. These alterations may be caused by topographic elements.

How do barriers act?
Generally two different mechanisms are thinkable: either the owls realize the disadvantage of a structure of the terrain (great water, wood, (wooded) mountain) as they actually reach it, and terminate their wandering, return, or deviate laterally. Or they realize the disadvantage only when overflying the structure, and overfly it (accelerated?), or return. There are some indications, which could help at our decision: Overflying such a structure would have no effect on the recovery values: The owls in fact remain in their original direction and would not be missed in total numbers. By all means we could postulate that they overfly indeed and here have increased losses. But these are not detected, as dead Barn Owls rarely are found in woods ore at sea. On the beaches of the North-Sea and the Baltic hitherto really no ring-birds have been found but not ringed ones. And flight over sea as well has been proved (see above).
Would the owls terminate their wandering in front of such a barrier or even return, so as well there would be no influence on the general find numbers in that direction. Indeed it would be possible to detect such behaviour, if in such a situation the find numbers in the short distances would be detectably augmented. For a decision the numbers in the fitting regions of this study mostly are to small. On the other hand in the case of an accentuation of exactly the opposite direction we could not decide whether it is an original preference or whether the returners had wandered into the opposite direction beyond the ringing site (as in fig. 42). The “repelling” of the wandering owls by the Harz is very good recognizable in fig. 3 in ZANG et al. (1994).
If the owls turn aside to a barrier, i.e. fly around it, the deficit of the find numbers in the original direction should level out the values in the two neighbour directions, as it became obvious for the regions 10 Rur-Erft (fig. 40) and 11 Coesfeld (fig. 41). Flying around an ocean is not possible because of its extent, lateral evading certainly.

5.4 Dispersal distances
Already KNEIS (1981) had stated that the dispersal distance found is influenced by ringers. He wrote of “gezielte” (=intended) finds. Ringers, who in their area occasionally or systematically control adult birds, bring about that the minor distances become more prominent. They do so also indirectly by practically and propagandistically caring for a more frequent report to the ringing scheme of ring birds found in their area. This too leads to a stronger accentuation of the lower distance values, as these records more often are those of locally ringed owls. The influence stated by KNEIS is much more than confirmed by the present data: Analyses without its consideration easily lead to false interpretations.
Already for the very general question, how far young owls did move away from their birth place, we obtained different results for the three areas studied: western, central, and northern lowlands. In the western lowland for 50% of the birds the dismigration ended within a circuit of 32 km, for those of the central lowland of 21.5 km, and for those of the northern one at 28 km (fig 6, part 1). Even if this difference is not to obvious in the graph, it indeed is of importance for the owls. If we start at that the numbers of nest boxes installed within the areas compared over time augmented with about the same

velocity, by this reason there might be no difference. Indeed there is a different possibility: The main part of the recoveries used here could originate from respective different time intervals. The examination indeed gave a difference. The mean year of the ringing in the western area is 1985 (median 1989), in the central area 1991 (1993). The values of the western area thus originate from obviously earlier years thus with presumably fewer nest boxes. Merely by that we obtain greater distances for the records.

Following the idea that an eventual difference in the number of nest boxes would have equalized sometime, we only analyzed the recovers distances only for the time after 1989. The figure 58 demonstrates that surprisingly the difference now is considerably greater. Perhaps the numbers of nest boxes in the compared areas West and Centre indeed are very different, what must indicate that in the central area today in the surrounding of the ringers there are much more Barn Owl boxes. The owls can settle nearer to their birth places. A different interpretation as well is possible: In the central area during the time studied there was ringed and controlled mostly in regions with distinctly more boxes installed, in the western area not (no more). Numbers for that do not exist.

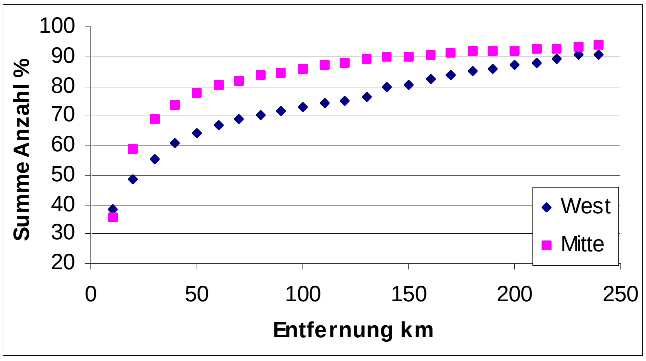


Figure 58: Comparison of the summed up records by distances

Comparisons with the results of earlier studies and between areas with different numbers of nest boxes so are very uncertain, if this influence is not considered.

Figure 5 (part 1) demonstrates for all three areas identically that the find distances of Barn Owls ringed as nestlings during the study interval steadily decreased. This here is explained by the fact that the posting of always more boxes allowed the owls a steadily nearer settlement. Already TAYLOR (1994) had pointed to this influence.

The decrease as well of the means as of the medians from control to control of the find distances of multiple controlled owls as seen in fig. 23, only demonstrates that in the recoveries the part of recoveries by the public permanently decreased and that of the “gezielten” (=intended; term of KNEIS 1981) recoveries strongly increases (fig. 59). More than two recoveries of an individual only may be expected, if adult birds are controlled systematically. As control catches by ringers normally happen on smaller areas, the recoveries of the former ones steadily get a greater weight.

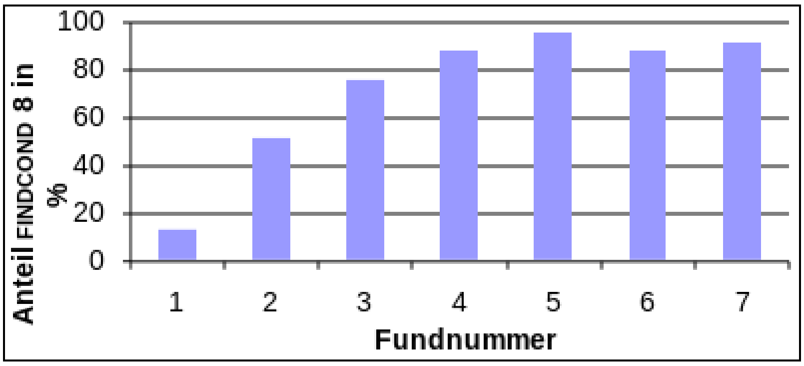


Figure 59: The part of recoveries communicated by ringers ("gezielte" = intended recoveries; term introduced by KNEIS 1981) among the multiple recoveries (discrimination: FINDCOND code 8)

The great extent, which is occupied by the far wanderers in nearly all papers concerning the wandering movements of the species, might be due to the search for migrators. An importance of the far wanderers for the original population cannot be recognized. Of course dispersal over greater distances promotes gen-exchange between far distant (sub-) populations (KNEIS 1981, MÁTICS 2003) and also has an importance in the refilling of locally collapsed populations and as well in the colonization of hitherto not inhabited areas. Probably the part of far wanderers is regionally different: BAIRLEIN (1985: 83) for southern Germany found a mean part of 24.5%. In the material studied here this value is at 25.7% (area West), 14.2% (area centre), and 15.7% (North) (see fig. 11, part 1).
It was also BAIRLEIN (1985: 84 Tab. 1), who found different parts of far wanderers for owls in their first year of life (22.1%) and for those of later years (30.2%). The continuation of the dispersal, which had been deduced from these values, already above (chapt. 5.2) has been rejected. This higher part of far wanderers in older owls also could indicate that far wandering would produce an advantage in survival. In contrast to this is the communication of MÁRTINEZ & LÓPEZ (1995), a far dispersal already in the first year would bring death to Spanish young owls. In the present material (all Helgoland recoveries together) The value for the later years is 16.5%, instead for the youth year (until end of February) 21.3%. This lower value of far wanderers for older ages better fits to the conclusion above that nearer settlement would bring an advantage in survival. DE BRUIJN (1994) in a population in The Netherlands had found a part of 18% among the recoveries of the first year. For later years there is given no value.
That there is an influence of the month, in which the owls had been ringed, on the recovery distance, already has been elaborated by GLUTZ VON BLOTZHEIM & BAUER (1980) (different than in GLUTZ VON BLOTZHEIM & SCHWARZENBACH 1979), GIRAUDOUX (1985), HILLERS (1998), and KNEIS (1981: Abb. 3a): The owls hatched earlier were found nearer to the ringing site. In the present study this statement indeed not has been confirmed in that overall manner. Nevertheless it was shown that the owls hatched earlier at least in the areas West and Centre had an advantage when settling (fig. 21, part 1). This advantage of an earlier birth also became evident in the fact that the part of those, which at all reached the first breeding period, from May to July steadily and then heavily decreased (fig. 22). Who arrives first, of course naturally first finds the possibilities for settlement still being free and that as well in the proximity as far off. This advantage of an early birth indeed doesn't exist for Spanish Barn Owls (MARTÍNEZ & LÓPEZ 1995).

By sex
In earlier papers (juvenile dispersal: TAYLOR 1994: 193; later age: Kniprath 2007, KNIPRATH & STIER 2008) we find the statement that when wandering, the ♀ pass greater distances than the ♂.
Originally we didn't succeed to prove a general influence of the sexes onto the dismigration distances in the present material (fig. 7, part 1), this exclusively as the values for the ♀ in the area West were lower. Already the fourfold higher number of ♀ in fig. 7 (part 1) should have made arise the suspicion that in this area a clearly higher number of breeding females had been controlled. Following this idea we additionally controlled the influence of ringers (fig. 60; for the area North we altogether had only 11 values). Now also in the area West we see that the ♀ have passed longer distances until their recovery: For them the part per distance-class generally is below that of the ♂.

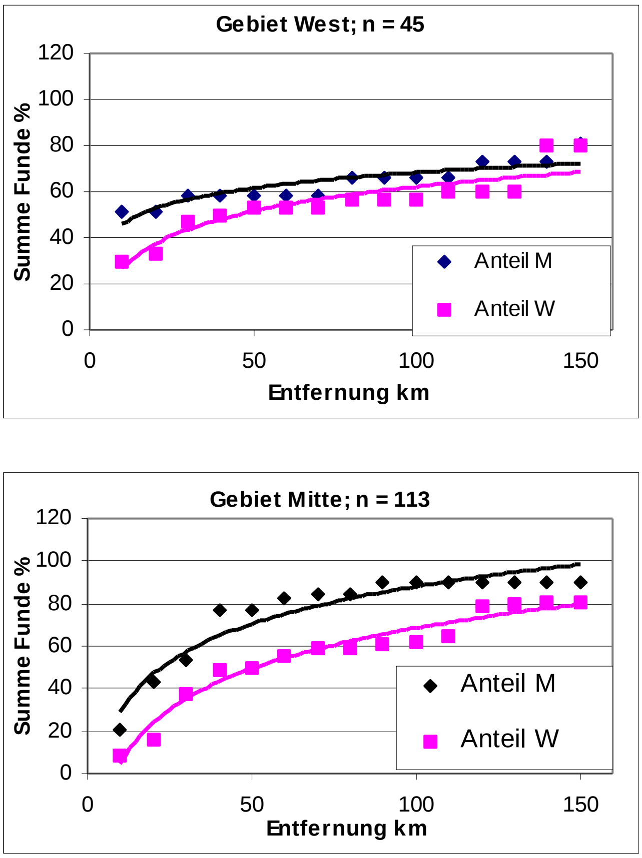


Figure 60: Cumulated part of recoveries (%) in dependence of the find-distance by the sexes; without recoveries by ringers

Causes of different dispersal distances
As a not insignificant cause for differences in the distances of the dispersal the number of nest boxes installed, generally: the number of possible nesting sites already several times has been accentuated. Indeed it seems hard to imagine that the requisite nesting site for young owls not yet mature is of a primary meaning. At first security, what means the presence of undisturbed resting sites over day, seems to be of more importance. Generally the authors (GLUTZ VON BLOTZHEIM & BAUER 1980; BRANDT & SEEBASS 1994, TAYLOR 1994) accentuate the importance of such sites for the owls. The real influence of the requisite resting site indeed cannot be estimated from the ring recoveries. This seems to be better for a further claim of the owls on their surrounding, i.e. the sufficient

presence of prey. We can judge the importance from the finding that in worse rodent years the wandering distances, especially the settling distances passed are greater than in good prey-years (SCHÖNFELD 1974, KNEIS 1981). Also the higher part of settlings around the birth-place in good prey-years illustrates this interpretation (KNEIS 1981). A farer dismigration from areas less densely inhabited (by Barn Owls) likewise enforces this opinion: Those areas indeed mostly are inhabited less densely, as there the prey-stock is poorer. As for the present study no data on the rodent densities were available, we tried to seize this influence by replacement values (number of recoveries per cohort: figs. 9, 10 (part 1), Variation of brood numbers from year to year). But we didn't succeed.
The recoveries don't give information about the moment at which a prospective breeding site becomes important for the dispersing young owls. ROULIN (1998) however had stated from his controls of nest boxes that pairs find already during February. As such a pair-finding is preceded by courtship, nesting possibilities latest at the end of January could be of importance for the young owls.

Causes of far wandering
BAIRLEIN (1985) imagined that far wandering would be caused (additionally) by lack of prey. Simultaneously he assumed that the mortality rate would be increased by that lack of prey. These two assumptions indeed lead to a dilemma: Just the regions in his study area with the more favourable surviving rates had the greater part of far wanderers. KAUS (1977: 29) mentions the years 1967 and 1972 as years with extended wandering, but then writes: "A correlation of extreme lack of prey and wandering therefore for these two cases has to be excluded." Probably the dilemma may be solved by the following assumptions:

1. Only a part of the European population has a disposition for far wandering. This one could be a heritage from the times when Barn Owls immigrated into moderate zones, coming from southern regions.
2. This disposition only then becomes active, if the prey density during the growing phase and still during the first weeks of independence is extraordinary good. The owls in analogy to the migrating species can accumulate greater energy reserves. Just this good prey situation and not perhaps the contemporaneous high density of young birds (density dependence) would be causal, as SAUTER (1956), KAUS (1977), and also KNEIS (1981) suppose.

Dismigration direction and distance
Above we had stated a – even if not important – preference of the direction SW. The figures 12 (part 1) in addition have shown that in this direction the on average greater distances were reached. For the far wanderers this preference still is visible, but hereby we see (fig. 13, part 1) that generally in southern directions greater distances are reached than in northern ones. This is no more astonishing as in this latter direction on one side there is the North Sea and on the other side direction Scandinavia the distribution border of the species is near.
Extreme distances (>1.000 km) are reached by dispersing young Barn Owls as well in south western direction (southern France, Spain) as also in north-eastern direction up to the vicinity of the distribution border or even beyond it (authors in KNIPRATH 2010: 62). The two first directions are those into very favourable climates for Barn Owls, the latter ones into rather unfavourable ones. Also in these distances in the present material the direction SW predominates very clearly (fig. 26; the most far distances indeed were reached by two owls direction East.).

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Olaf Geiter/Wilhelmshaven has produced the maps and Ralf Maliska the calculation routines for the wandering distances and directions. The colleagues Dr. Karel Poprach (Cz) and Dr. Beatrix Wuntke (D) critically read the paper and gave valuable suppositions, Christopher Husband corrected the summary, and my wife tolerated over years with great patience my long computer sessions and my mental absence in the real life with great patience. I am very grateful to them all.

5 Summary

At the end of 2008, the data base of the Vogelwarte Helgoland contained 6.558 recoveries of Barn Owls ringed as nestlings in the north German Lowland. These data were studied after subdivision into the three regions: western, central, and northern lowland and then a further subdivision into 21 areas with a greater density of ringed individuals. As these two subdivisions provided results for different aspects and also complemented each other, they both proved necessary.
There is hardly any aspect, which had not shown the influences by owl protection (the installation of nest boxes), by the ringers themselves (controls of breeding birds), and, to a smaller extent, also by the ringing scheme (intermittent rejection of ringers "own" recoveries). These influences must be taken into consideration in all analyses.
The earlier in the year the owls hatch, the more time they take before dispersal. By September dispersal has fully commenced and in October or November most young owls already reach the maximum distance from their hatching sites. They mostly have reached the site where they (want to) stay.
The earlier in the year the owls hatch, the greater is the part of those that reaches the first breeding period alive and the nearer to their hatching site they may settle. Results show no continuation of dispersal after owls settle and no indication of a return movement.
Young owls generally disperse in all directions. There is an indication of a weak preference for the SW direction and it is in this direction that the greatest distances are reached. However, extreme distances (>1.000 km) are also found in the directions E and SE, but these involve only a small number of individuals. Larger expanses of water and forest, especially forested mountain regions, are crossed only rarely, generally the owls fly around them. Large towns evidently do not have a repelling effect. Data from the activities of other ringers at some distance from the ringing sites can falsely suggest a preference for dispersal in their direction. It is evidently possible for owls to alter their direction of dispersal more than once, and in extreme cases this may lead them back to the site of their birth. When comparing the distances of multiple recoveries, only the values of the same birds should be compared with each other.
The distances of dispersal depend to a great extent on the presence of breeding sites. If many nesting sites are available, the owls do not need to disperse over longer distances. The occurrence of long-distance dispersal (>100 km) does not seem to be caused by food shortage and/or population pressure. We adopt the following view: A certain proportion of the owls has the inherited disposition for long-distance dispersal. However, this can only become operative if the food situation is very advantageous during the rearing phase and also subsequently. Only then can the young owls deposit the reserves necessary for long-distance dispersal. The proportion of owls undertaking long-distance dispersal might vary from region to region.

No indications of special “eruption years” could be found. Females disperse further than males.
Owls hatched earlier in the year more often find a settlement site, settle nearer to their birthplace and then have a greater probability of survival.

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