Owls ringed as nestlings, from the data of the Vogelwarte Helgoland – part 2

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Content

Preface

In part 1 of this study (KNIPRATH 2012b) the material from the Northern German Lowlands – as far as ringing here is organized by the Vogelwarte Helgoland – has been analyzed either as a unity or subdivided into the areas west, centre, and north. Thereby the selection of the data always was done following the site of birth of the owls. This part now is the direct continuation of the first part. The facts on material and methods communicated there are still valid and will not be repeated. As an evident expression of this continuation the enumeration of the chapters (omitting the preliminary summary) as well as that of the figures is continued. Indeed the discussion now comprehends the content of both parts. The (preliminary) summary at the end of part 1 thus is invalid.

3.6 Distances and directions of multiple recoveries

Hitherto each single recovery has been counted as the end of a completed movement, even if it is only one of a series of recoveries of an individual. Following the method of SAUTER (1956) in the following the multiple records are filtered out of the material and analysed separately.

Among the 8.251 recoveries (with recovery distance >0) of 7.542 owls ringed as nestlings 91,8% were those of owls recovered only once. The residual ones at least had two recoveries (table 5). This table additionally shows the respective number of dead-recoveries and the part of these in the numbers of recoveries.

[1] Translation of the original publication: Kniprath E 2012: Die Wanderung nestjung beringter norddeutscher Schleiereulen *Tyto alba* nach dem Material der Vogelwarte Helgoland – Teil 2. Eulen-Rundblick 63: 101-110

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

A	B	C	D	part 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

Dispersal distances of multiple recoveries by recovery number

Following their dates the individual recoveries of the ring birds were given a “recovery number” (column A in table 5). As from recovery number to recovery number in each case time had passed, we may assume to find locomotion by comparing the distance values following the recovery numbers. The result is astonishing (fig. 23): Seemingly the owls (at least in the first recoveries) from recovery to recovery again had approached the ringing locality.

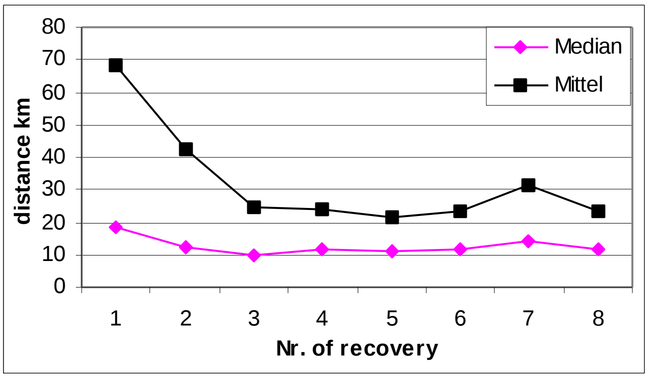


Figure 23: Changes of mean and median distances between recovery and ringing site from recovery to recovery of barn owls ringed as nestlings (n = 8.251).

This kind of comparison indeed contains a dangerous illogic. Not the recoveries of all owls (numbers in column B, table 5) may be compared for the purpose intended, but only the recoveries of the same individuals. So now we compare the stages of the individual birds. The procedure: All bird having a second recovery (616 after table 5, column C) are selected from the table of recoveries together with their distance values at their 2nd recovery. Then for these owls the distances at their 1st recoveries are selected. This new data set of course has the same volume as the 1st one. Now for each of the 616 birds we have the distance values from the ringing site at the start and that at the arrival in the 2nd stage (recovery numbers E1 and E2 in fig. 24). The numbers of the paired values per stage may be found in table 5, column B. For stage 9 there are no more than two. Now the medians do not show any differences, neither within nor between the stages: The distances of the owls from the ringing site neither have augmented nor diminished. The comparison of the means of all distances for the starts as well as for the arrivals by ANOVA (EXCEL) gave a ns (P>0,1). The deviating values of the means of the stages 2 and 7 in figure 24 only means that in these samples there were owls, which far from the ringing site had been recovered twice. The medians do not show these deviations.

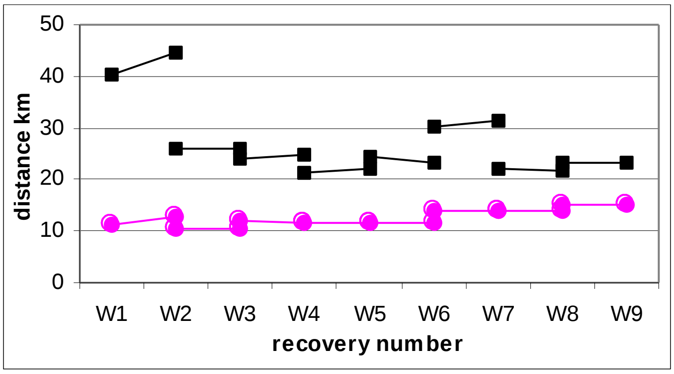


Figure 24: The alterations of means (black) and medians of the distances of the recovery sites from the ringing sites from recovery to recovery for barn owls ringed as nestlings. The paired data each represent the values of the same individuals. (The n of the pairs are found in tab. 5, column B.)

Again nearer to the biology of the owls is the comparison of the distance values between breeding season and winter. It is already existing (KNIPRATH & STIER-KNIPRATH 2009). There too no important spatial alteration had been found.

Directions of the movements

SAUTER (1956) as well as KNEIS (1981) had studied the multiple recoveries in the material they had from stage to stage to find alterations in the direction of the movements. So we will do for the data studied here: For this purpose the paired values (n = 616) were selected for the second stages as described in the preceding chapter. All pairs with a difference in distance of <2 km between start and arrival (n = 436; 70,1%) were eliminated, as these owls still were in the narrower nesting site. Among these values there was only one pair with opposite moving direction between stage 1 and stage 2 (with distances of 7,9 resp. 9,8, altogether 17,7 km). For the rest of stage 2 in 89 (14,4%) start and arrival, as seen from the ringing site, pointed into the same direction (when reduced to 8 sectors). For 27 of these the difference between start and arrival was >10 km (fig. 25). That means, they had moved not exclusively within the nearer surroundings of the first recovery site. In fig. 25 positive difference-values indicate that at their second recovery the owls were farer from the ringing site than at their first one. Even if these moderately predominate, on account of the few resulting values (27) we certainly cannot deduce a continuation of the dispersal away from the ringing site.

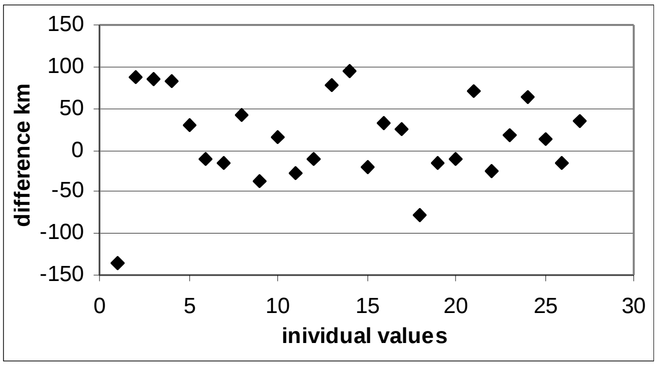


Figure 25: The difference in distance from ringing site at start and arrival site at stage 2 (only difference >10 km) (n = 27)

In addition we found nine more value pairs, for which the owls exactly (2) or almost exactly (7) had turned to the opposite direction. For two of these the starting values were as low that we might assume that the dispersal not yet had started. For the rest the distances between start and arrival were between 28 and 470 km (mean 158 km, median 50 km). The then resting 91 (14,6%) had altered their original direction in any angle.

Making use of the same procedure for stage 3 lead to the exclusion of 160 (83,8%) pairs (total: 191) with a difference <2 km. Here we found no pair which had turned to the opposite direction. Among the remaining ones there were 15 (7.9%) retaining their direction, with only 2 (1%) with a difference of >10 km, here <30 km. The examination showed that only 2 of these 15 owls were still in their youth-year (up to end February), but not those two with almost 30 km.

3.7 Far-wanderers

In the data studied here the part of far-wanderers (>100 km) was at 25,7% (area west), 14,2% (centre), and 15,7% (north). For all Heligoland recoveries together this value reaches for the youth-year 21,3%, for all later life-years 16,5%.

Extreme wanderers

Among the far-wanderers there were 39 with distances >1.000 km. Their directions may be seen in figure 26. The weak preference of the direction SW, already mentioned in chapter 3.1, in this distance class is absolutely dominating. It seems astonishing that the two extreme values of >2.000 km were found among the recoveries with direction east. In the recovery data we found nothing about the recovery circumstances, i.e. whether there is any suspicion in the direction transportation. For the owl dispersed direction SW the mean distance is at about 1.800 km, for all other directions at least 500 km less.

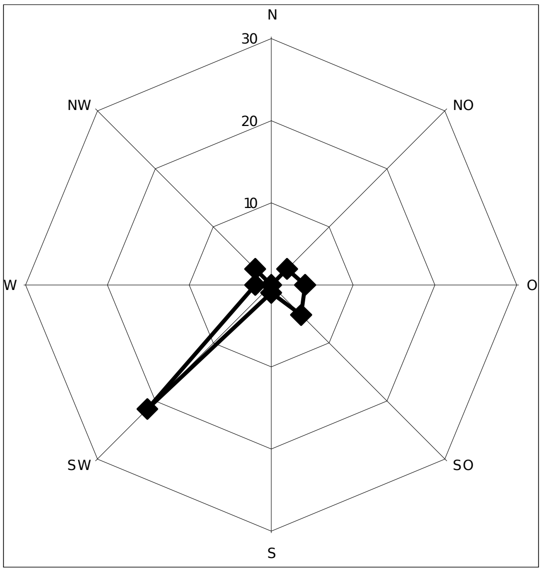


Figure 26: The distribution of the extreme-wanderers (>1.00 km) for the compass directions (n = 39; direction N: no data)

4 The dispersal from smaller regions of origin

As could be imagined that summing the data for indeed large areas (as in chapter 3) eventually would hide regionally caused specificities, here the method of BAIRLEIN (1985) was used: The analysis concentrated on the recoveries of ringing in rather narrow regions. The size of each region mostly depends on the fact that the activities of intensely working ringers of barn owls naturally are restricted to geographically narrower areas.

Material and methods

The maps (fig. 27) very clearly shows these restrictions. There additionally can be seen that the regions analysed are of very different sizes. The numbers of owls ringed in these regions differ considerably as well. So necessarily often only a part of the theoretically possible analyses could be realized.

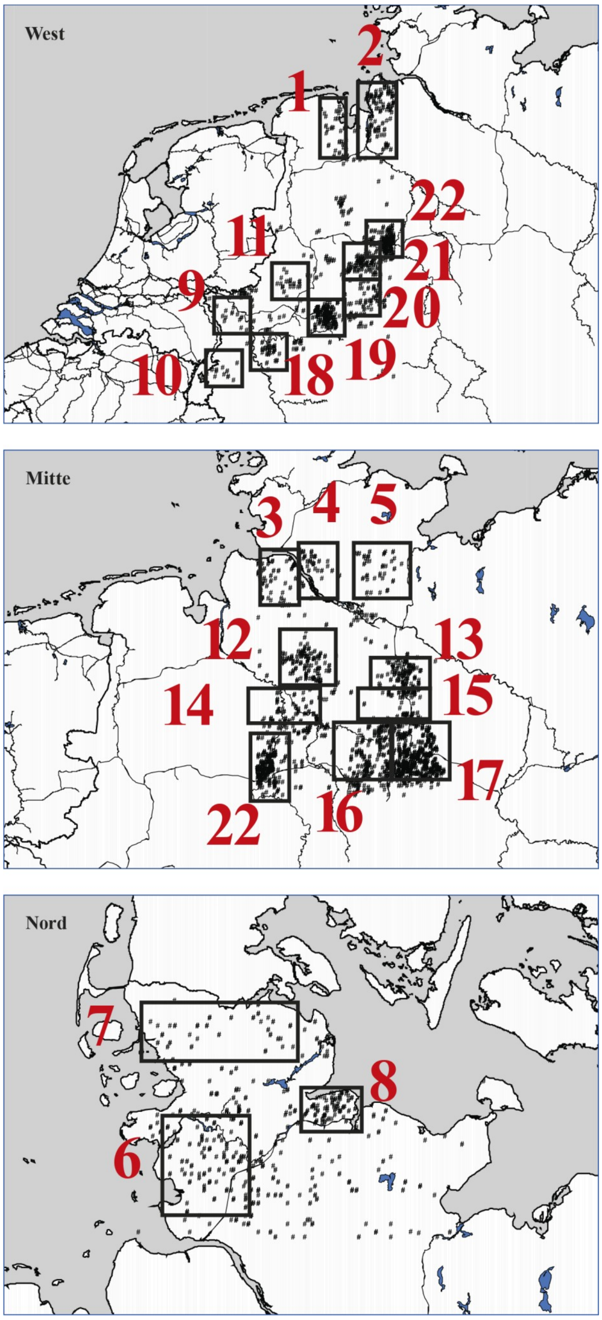


Figure 27: The ringing regions belonging to the recoveries of barn owls ringed as nestling in the lowlands. The three maps are not to scale.

The number of regions defined that way for the North German Lowland amounts 22, where we recognize a clear concentration at the southern border of the lowland. There too we find the greater numbers. Independently we here precede from west to east and then from north to south: from the seaside to the middle inland and then to the southern regions alongside the border of the middle altitude mountains. For all these region first is analysed, into which directions the dispersing owls have moved. The numbers only once allowed to discriminate here for the two sexes. Sometimes the material was great enough to answer the question, whether the tendency in direction is depending on the distance from the ringing site. It seemed possible that the in the beginning undirected dispersal later depending on the structure of the landscape would be narrowed to only some directions.

The data for these regions have been selected by coordinates by an ACCESS query. Then the data were grouped for the compass directions. These directions were reordered from the alphabetic order to the compass as needed here. The figueres have been produced with the diagram type “net” in EXCEL. For each region studied the coordinates of the centre and the approximate height are given.

4.2 The dispersal after regions

4.2.1 *Coast*

Region “Wangerland” (7.78 east, 53.57 north, 3 m)(1 in fig. 27)
For the recoveries in this coastal region west of Wilhelmshaven (Lower Saxony) we obviously attended that the northern directions (pointing to the sea) would be handicapped. The figure 28 confirms this supposition despite the yet small numbers.

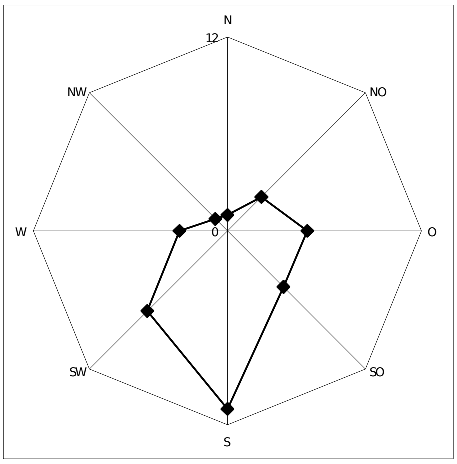


Figure 28: Numbers of recoveries of barn owls ringed as nestlings in the region “Wangerland” after compass directions (n = 36)

Region “Jade-Oste” (8.8 east, 53.4 north, 3 m)(2 in fig. 27)
Immediately following the preceding region direction north this one shows a quite different distribution of the recoveries (fig. 29). Here we recognized only a weak preference of the direction southwest.

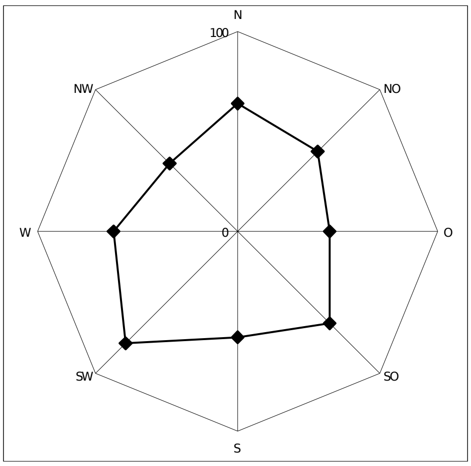


Figure 29: Numbers of recoveries of barn owls ringed as nestlings in the region “Jade-Oste” after compass directions (n = 474)

Then the data were discriminated for the recovery distances. It seemed possible that a preference of a certain direction would become visible only for recoveries at farer distances. For these farer recovery distances we indeed get a different picture (fig. 30). Here the recoveries direction SW are considerably and those direction N as well are accentuated. Additionally the direction NW is lacking totally. Direction NW means wadden sea and open sea. Obviously it is avoided. There also is no recovery of a ringed owl washed ashore. Direction N, that means Schleswig and Denmark. For this direction some owls indeed would have to cross the larger waters of the Elbe estuary (between 2,5 and 6 km). All southern directions from SW to SE by geography would be similarly favourable. The preferred direction indeed is SW. This discrimination as well is obvious (fig. 31) for those owls recovered only after February of the year following their natal year, i.e. which with some certainty already had settled. After excluding recoveries made by ringers (code FINDCIRCUMSTANCES = 8) the picture is not altered. Any influence by eventual controls by ringers in not visible (no fig.).

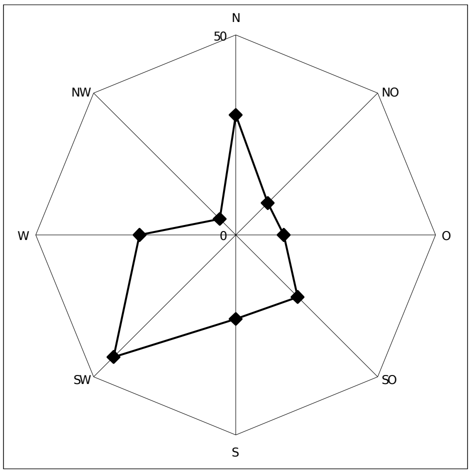
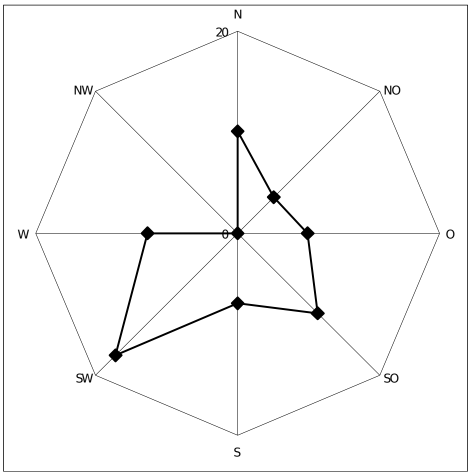


Figure 30: Numbers of recoveries of barn owls ringed as nestlings in the region “Jade-Oste” at distances >50 km from the ringing site after compass directions (n = 169)



Numbers of recoveries of barn owls ringed as nestlings in the region “Jade-Oste” later than February of the year following the natal one after compass directions (n = 66)

Region “Kehdingen” (9.2 east, 53,5 north, 15 m)(3 in fig. 27)

This is the region immediately adjacent east to the preceding one. Despite a considerably smaller number of recoveries it nevertheless shows a clear preference of the direction W-SW. Recoveries by ringers don’t play any role.

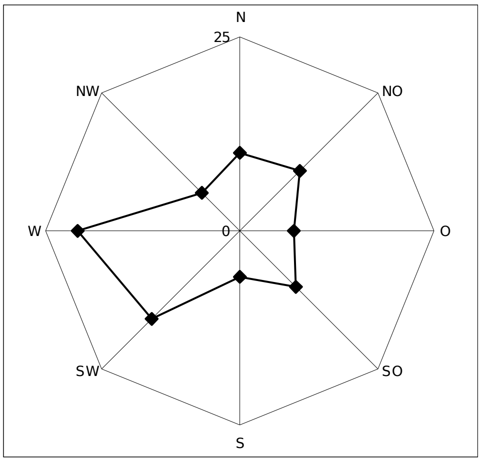


Figure 32: Numbers of recoveries of barn owls ringed as nestlings in the region “Kehdingen” after compass directions (n = 88)

Region “Elmshorn” (9.55 east, 53.8 north 4 m)(4 in fig. 27)
This region continues east of the Elbe estuary. Despite the small numbers we find the same accentuation of SW as there (fig. 33). The direction NE clearly avoided here means the direction Baltic Sea. The weak data set indeed makes all interpretations fairly speculative.

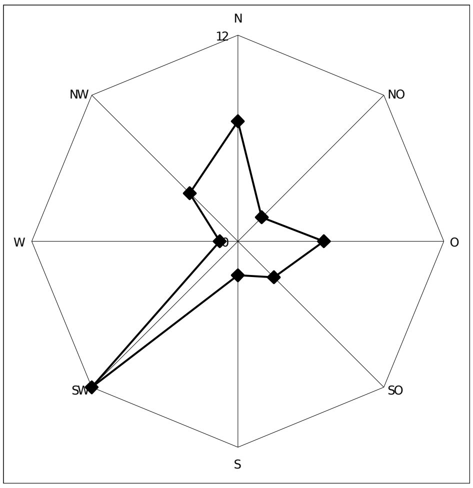


Figure 33: Numbers of recoveries of barn owls ringed as nestlings in the region “Elmshorn” after compass directions (n = 36)

Region “Oldesloe” (10.3 east, 53.8 north, 20 m)(5 in fig. 27)
Though this region is not to far east of the preceding one, the image of the dispersal again is different (fig. 34). The directions N and NW (Schleswig and Denmark) are strongly accentuated. The influence of control activities of ringers is clear: After the exclusion of their recoveries the direction north (and exclusively this one) is very strongly reduced. Only here (especially in the Denish Wohld) adult owls are controlled (MARTENS pers. comm.). The sub-representation of the direction SE points to the

unattractiveness of greater wooded areas. Here the mostly wooded natural park of the “Lauenburg Lakes” is situated.

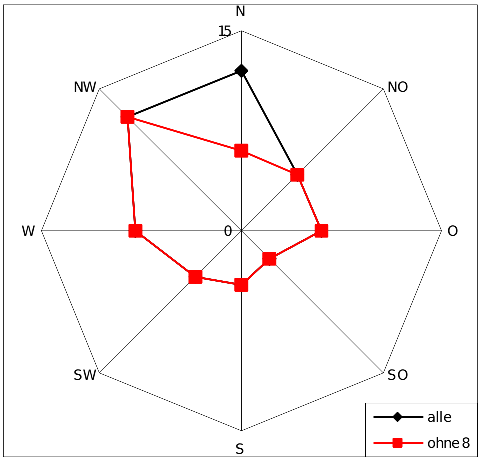


Figure 34: Numbers of recoveries of barn owls ringed as nestlings in the region “Oldesloe” after compass directions (all [black]: n = 56; without recoveries by ringers n = 50)

Region “Dithmarschen” (9,29 east, 54,19 north, 5 m)(6 in fig. 27)
As could be expected in the southern part of the North Sea coast of Schleswig-Holstein the western direction strongly is discriminated against. Interestingly the direction NE-E clearly is avoided (fig. 35).

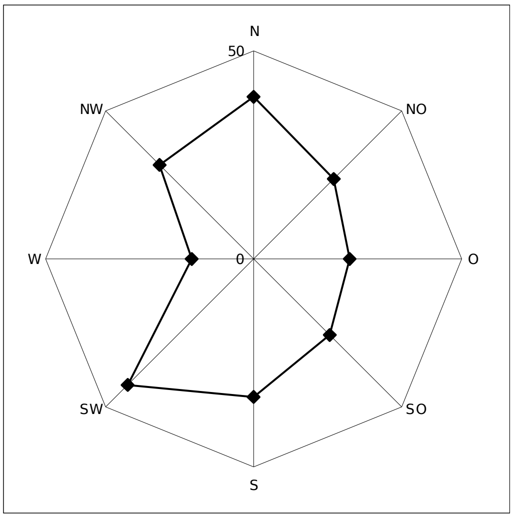


Figure 35: Numbers of recoveries of barn owls ringed as nestlings in the region “Dithmarschen” after compass directions (n = 238)

Region “northern Schleswig-Holstein” (9,12 east, 54,19 north, 10 m)(7 in fig. 27)
Generally it could be expected that both directions to the sea (west the North sea; east the Baltic) similarly were avoided (fig. 36). The supposition that the majority of the ringing had taken place in the western part of the region, whereby the direction E would be more probable, could not be confirmed (n = 345 out of 832).

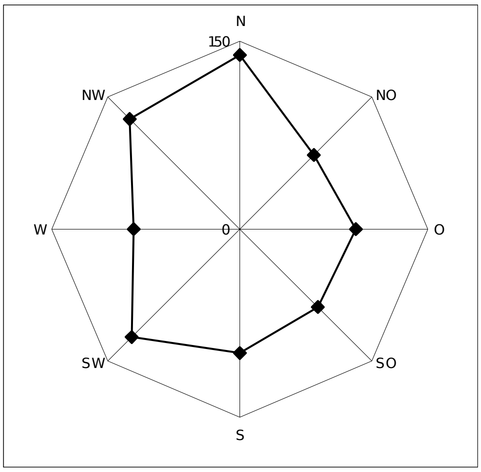


Figure 36: Numbers of recoveries of barn owls ringed as nestlings in the region “Schleswig-Holstein North” after compass directions (n = 832)

Region “Danish Wohld” (10,0 east, 54,4 north, 25 m)(8 in fig. 27)
As this region borders the Baltic, we are surprised by the discrimination of the direction W (fig. 37). Likewise for the distances covered the values in this direction as well as mean as as median (fig. 38) are clearly smaller. Any influence by ringers can be excluded. The part of these latter ones in the recoveries only amounts to 10 (2,6%). An explanation is lacking.

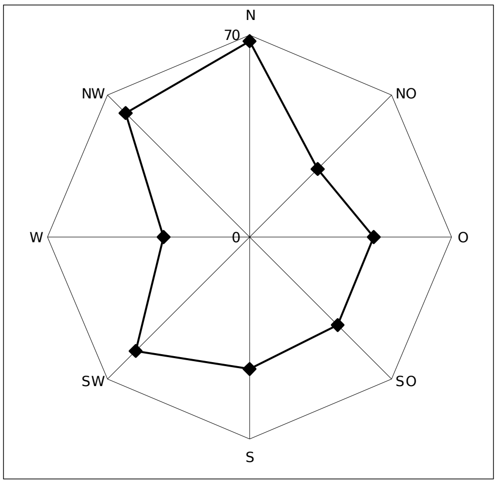


Figure 37: Numbers of recoveries of barn owls ringed as nestlings in the region “Danish Wohld” after compass directions (n = 380)

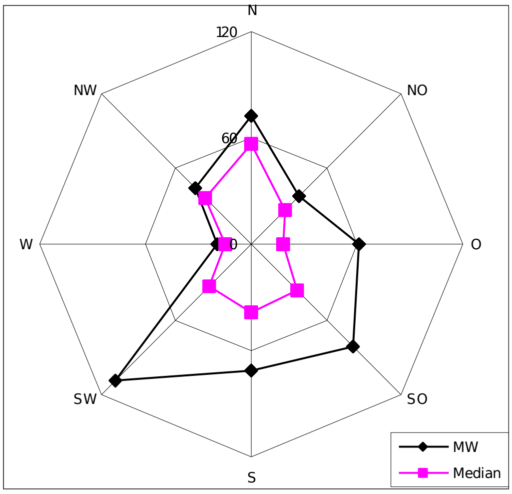


Figure 38: The recovery distances belonging to the values in figure 37 (mean: black; median: violet) in km

4.2.2 Inland

Region “lower Rhine” (6.5 east, 51.6 north, 10 m)(9 in fig. 27)
All ringing took place in the lowland west of the river Rhine. There is no explanation by geographic peculiarities for the somehow preferred directions N and S (fig. 39). The small numbers indeed give great opportunities to hazard.

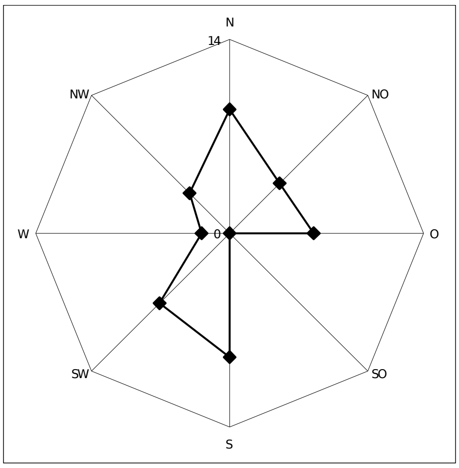


Figure 39: Numbers of recoveries of barn owls ringed as nestlings in the region “lower Rhine” after compass directions (n = 42)

Region “Rur - Erft” (6.3 east, 51 north, 100 m)(10 in fig. 27)
This region means the transition between the lowland and the “Eifel” west of the river Rhine. The graph (fig. 40) shows a preference of eastern directions but without the direction east itself. Here we find the wooden area of the “Staatsforst Ville”. The directions northeast and southeast each represent the by-passing of that wood. The general preference of the direction E could be an illusion: The mean of the three values from NE to SE gives a 3 and thus hardly more than all other directions. Regarding the at all small number of recoveries hazard may play a major role. In this data set there are no recoveries made by ringers.

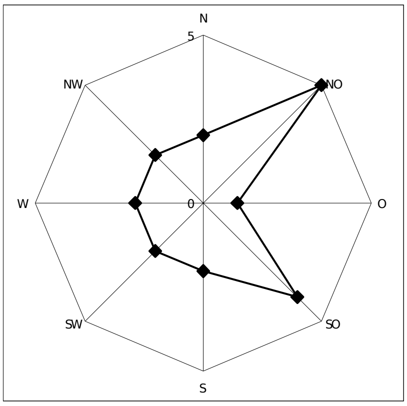


Figure 40: Numbers of recoveries of barn owls ringed as nestlings in the region “Rur-Erft” after compass directions (n = 42)

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 edge of the medium altitude mountains (direction south). The fact that this latter direction totally is avoided (fig. 41) could originate in the coherent wood of the “Naturpark Hohemark” being there. The dispersing barn owls prefer to side-step direction W rather than E but generally prefer southern to northern directions. As the numbers are to small, interpretations would be speculative.

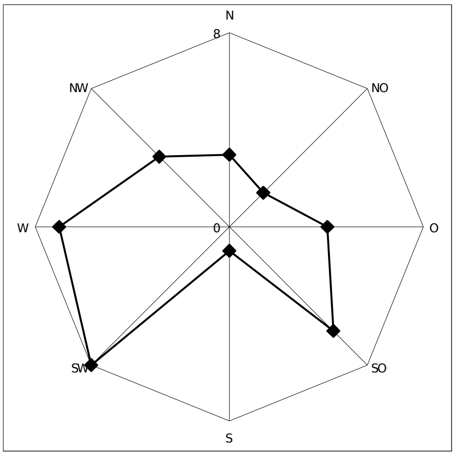


Figure 41: Numbers of recoveries of barn owls ringed as nestlings in the region “Coesfeld” after compass directions (n = 35)

Region “Rothenburg Wümme” (9.4 east, 53.1 north, 22 m)(12 in fig. 27)
Direction W the large town Bremen is at about 30 km and direction east the wooded area of the “Lüneburger Heide”. Only the latter one seems to repel (fig. 42). The direction to the large town still at distances of >50 km (i.e. beyond Bremen) is preferred (no figure). The preference of SW is obvious. No influence of ringer-activities were detected.

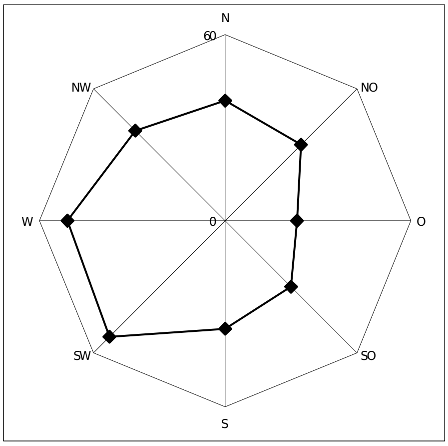


Figure 42: Numbers of recoveries of barn owls ringed as nestlings in the region "Rotenburg Wümme" after compass directions (n = 307)

Region "Uelzen" (10.5 east, 52.9 north, 41 m)(13 in fig. 27)
The graph (fig. 43) makes clear that the dispersal directions E (wooden area "Göhrde") and – less – W (Lüneburger Heide and Südheide) are evidently less attractive than N and S. There is no influence of ringers.

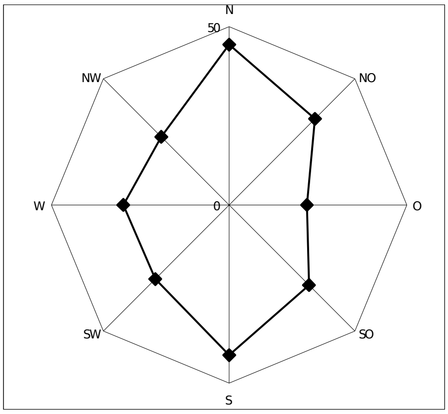


Figure 43: Numbers of recoveries of barn owls ringed as nestlings in the region "Uelzen" after compass directions (n = 262)

Region "Nienburg" (9.2 east, 52.6 north, 26 m)(14 in fig. 27)
This region, situated at the river Weser SW of the preceding one, doesn't show any remarkable structures in its surrounding. The preference of NW S is not explained (fig. 44). In these directions there is no influence of ringers.

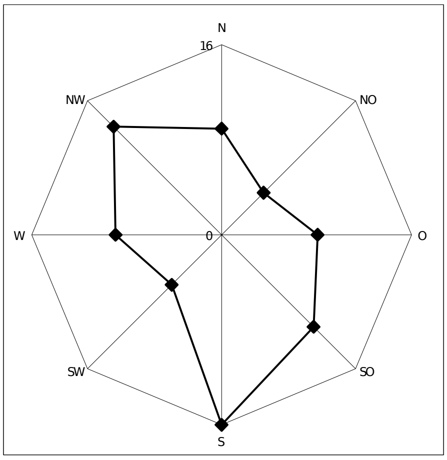


Figure 44: Numbers of recoveries of barn owls ringed as nestlings in the region "Nienburg" after compass directions (n = 77)

Region "Celle" (10.1 east, 52.6 north, 46 m)(15 in fig. 27)
For the eventually preferred directions W and NE-E (Fig. 45) there is no explanation. Though 146 of the recoveries were those of ringers, an influence of the latter ones onto the recovery direction is not detectable (no fig.). These recoveries were those at smaller distances, thus from within the region.

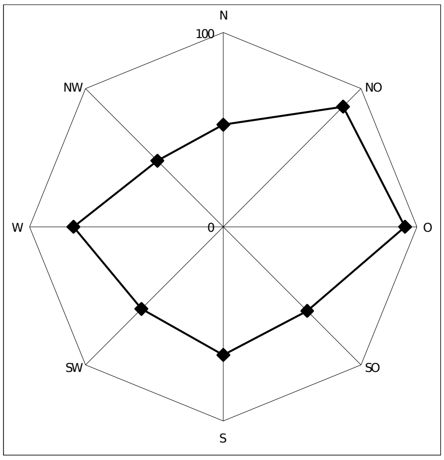


Figure 45: Numbers of recoveries of barn owls ringed as nestlings in the region "Celle" after compass directions (n = 548)

Region "Peine" (10.2 east, 52.3 north, 64 m)(16 in fig. 27)
The general presumption, large towns could be repellent, here again is refuted (see region "Rothenburg Wümme"): Direction W there is Hanover and E Brunswick, both less than 40 km apart (Fig. 46: violet). It seemed possible that the influence of these towns only beyond the distance of 40 km would become effective. Figure 47 (green) proves the contrary: both directions clearly are preferred. West yet beyond 60 km, i.e. already above Hanover is preferred (fig. 46: brown). Already beginning with 40 km (fig. 47: green) a certain influence of the more southern border of the edge of medium altitude mountains could be guessed.
If we then indeed look at the distribution of the recoveries beginning with the breeding season following ringing, the image is fairly different (fig. 48: violet): The accentuation of the direction W is totally lacking. Instead, again we find the predominance of the directions NE and E as already found in figure 46. This one in contrast exclusively is the

result of the activity of ringers in these directions: If the recoveries by ringers are eliminated (FINDCOND = 8), the accentuation vanishes (fig. 48: black). Contemporarily we see that the accentuation of the directions W and S is no such an effect.

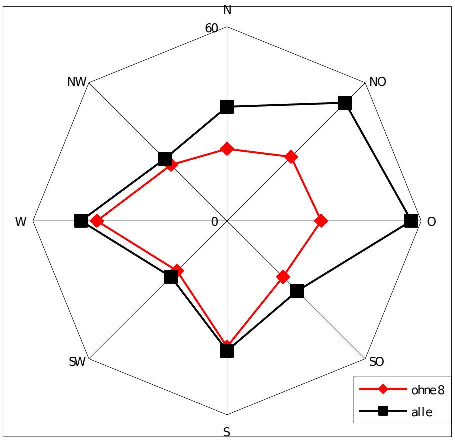


Figure 46: Numbers of recoveries of barn owls ringed as nestlings in the region “Peine” after compass directions (black: all; n = 311; red: without recoveries by ringers: n = 229)

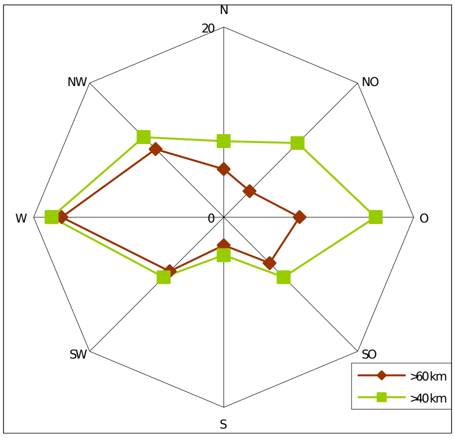


Figure 47: Numbers of recoveries of barn owls ringed as nestlings in the region “Peine” after compass directions (green: only recoveries >40 km; n = 87; brown: only recoveries >60 km: n = 62)

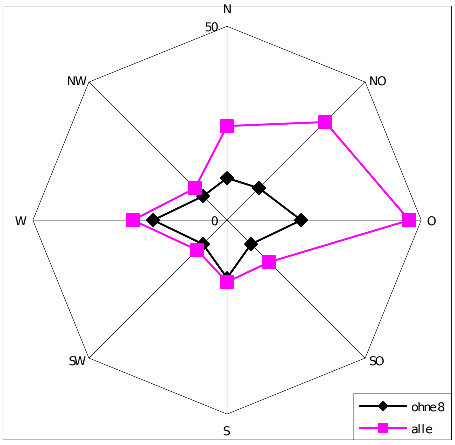


Figure 48: Numbers of recoveries of barn owls ringed as nestlings in the region “Peine” after compass directions (violet: only recoveries from the first breeding season after ringing on; n = 185; black: same but without recoveries by ringers; n = 103)

Region “Wolfsburg” (10.7 east, 52.4 north, 56 m)(17 in fig. 27)
The recoveries at >50% originate from ringers, which control the owls alive and then release the again. Nevertheless, these recoveries do not influence the picture (fig. 49) remarkably. This region, the working area of the group “OAG Wolfsburg”, thus itself is a region of intense trapping and additionally obviously surrounded all over by regions, in which ringers control adult owls. The median of the distances of the data furnished by ringers only amounts 9.7 km and thus confirms that the majority of the recoveries originates in the region itself. The weak under representation of the direction S demonstrates that in this direction there is a barrier: the Harz Mountains. Both curves additionally show some preference of the direction W. These two influences become more obvious for recovery distances of >50 km, the approximate distance of this region from the Harz border (fig. 50).
For the owls controlled by ringers, for 93.45% the sex is known (257 ♂, 228 ♀) (for the rest only for 5.35%). Between the sexes the recovery directions indeed don’t show any interpretable differences (fig. 51).

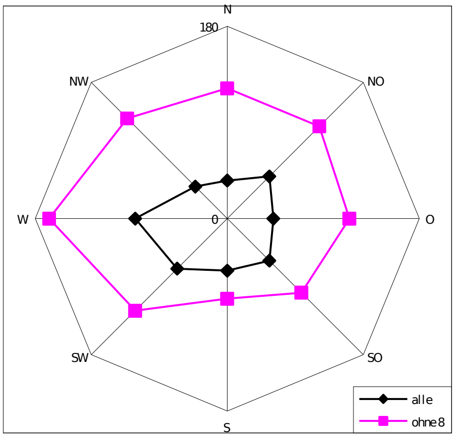


Figure 49: Numbers of recoveries of barn owls ringed as nestlings in the region “Wolfsburg” after compass directions (violet: all; n = 952; black: without recoveries by ringers; n = 433)

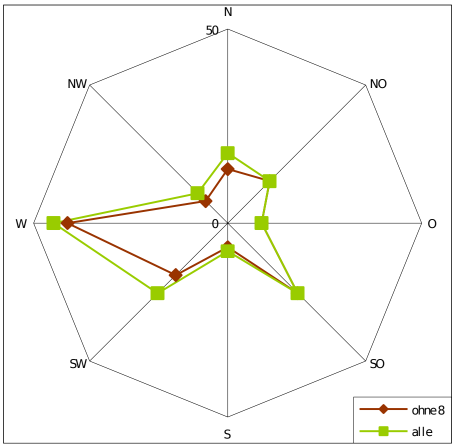


Figure 50: Numbers of recoveries of barn owls ringed as nestlings in the region "Wolfsburg" after compass directions, distance >50 km (green: all; n = 155; brown: without recoveries by ringers; n = 137)

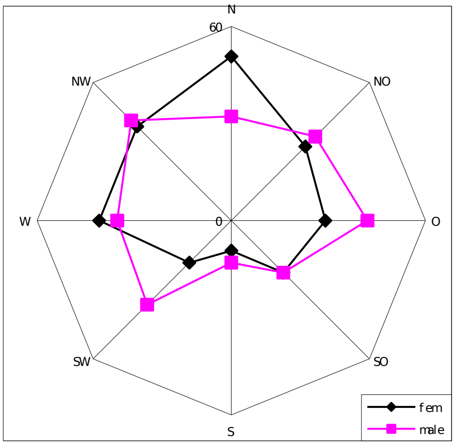


Figure 51: Numbers of recoveries of barn owls ringed as nestlings in the region "Wolfsburg" after compass directions and sex (violet: ♂, n = 263; black: ♀, n = 244)

4.2.3 Border of the low altitude mountains

Region "Niederbergisches" (6.9 East, 51.2 North, 142 m)(18 in fig. 27)

This is a very small region NE of Düsseldorf, which mostly is surrounded by urban areas. Direction S and SE in addition the valleys of the "Bergisches Land" completely are covered by the town of Wuppertal. Even more, the mountains themselves nearly entirely are covered by wood. The graph (fig. 52) makes guess that the major part of the owls has dispersed across or along the town of Düsseldorf direction W. Despite the yet small numbers of recoveries this tendency direction W may also be seen in the distance classes up to 10, to 20, still again above 50 km, and as well for the owls which had settled (no fig.).

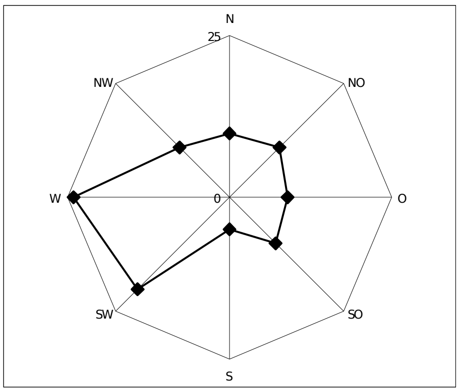


Figure 52: Numbers of recoveries of barn owls ringed as nestlings in the region "Niederbergisches" after compass directions (n = 100)

Region "Soest" (8.1 east, 51.5 north, 97 m)(19 in fig. 27)

The influence of the low altitude mountains border is well visible in figure 53: The direction S is clearly under represented and the directions W and E are preferred. Any influence of recoveries by ringers (n = 12) is not visible. The relatively scarce recoveries in northern directions remain unexplained.

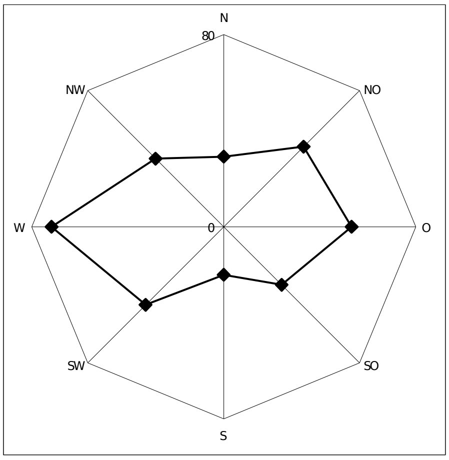


Figure 53: Numbers of recoveries of barn owls ringed as nestlings in the region “Soest” after compass directions (n = 341)

Region “Delbrück” (8.5 east, 51.7 north, 92 m)(20 in fig. 27)
Like the region “Soest” the region “Delbrück” is situated at the border of the low altitude mountains. Additionally, this regions in eastern direction ends at the “Egge-Gebirge”, with altitudes of >400 m. The direction N likewise is closed by the “Teutoburger Wald” (slightly less high bur wooded). The effect of this position in a funnel at all is visible in the distribution of these few recoveries (fig. 54). Here again there is no influence by recoveries of ringers.

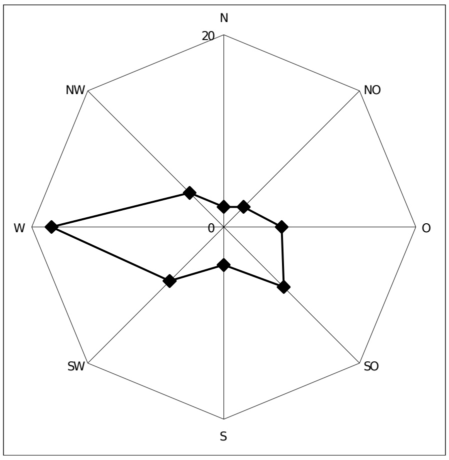


Figure 54: Numbers of recoveries of barn owls ringed as nestlings in the region “Delbrück” after compass directions (n = 55)

Region “Bielefeld” (8.5 east, 52.0 north, 100 m)(21 in fig. 27)
Situated only about 25 km from the previous region, this one is direct north of the “Teutoburger Wald” and so outside the funnel described. So direction S it is bordered by the “Teutoburger Wald” and direction N by the “Wiehengebirge” with altitudes of about 300 m. The in figure 55 accentuated recovery direction NE is the direction to the “Porta Westphalica”, the breaking of the river Weser between the “Wiehengebirge” and the “Wesergebirge”, well reachable by valleys. The directions W and NW are those of the depression between the “Teutoburger Wald” and the “Wiehengebirge”. Of the 11 recoveries direction S four are at distances of >50 km, thus on the other side of the “Teutoburger Wald”. This may indicate that this mountain chain is not invincible. Here there is no influence of ringers (no fig.).

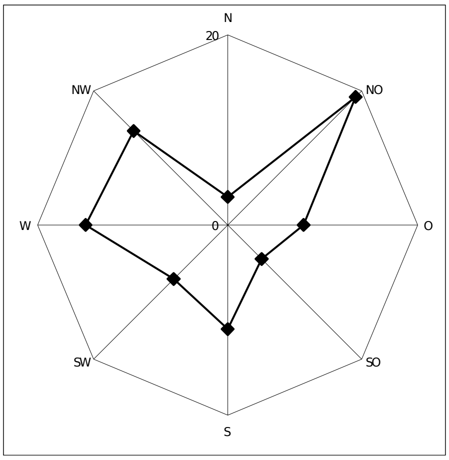


Figure 55: Numbers of recoveries of barn owls ringed as nestlings in the region “Bielefeld” after compass directions (n = 83)

Region “Minden” (8.9 east, 52.4 north, 48 m)(22 in fig. 27)
By the two preferred dispersal directions W and E the orientation of the “Wiehengebirge” and the “Wesergebirge” in the south is well recognizable (Fig. 56). Though 148 (20,4%) of the recoveries are those by ringers, the elimination of these not influences the picture. That may indicate that these recoveries mostly originate from the region itself. The median of the distances of 10.9 km proves this idea.

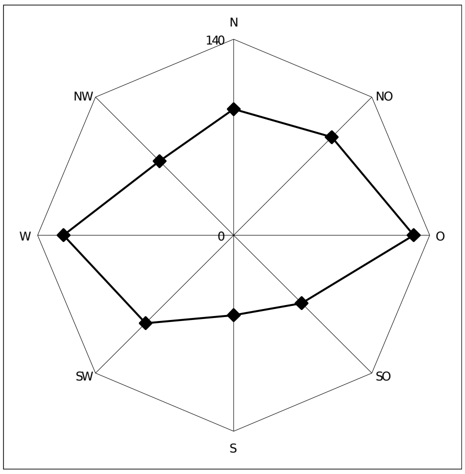


Figure 56: Numbers of recoveries of barn owls ringed as nestlings in the region “Minden” after compass directions (n = 726)

5 Discussion

If in the following we sometimes refer to a literature review appeared earlier (KNIPRATH 2010), this shall not express a disregard of the many authors but help to reduce the extent of this text and also of literature.
We expressively point to that this discussion includes part 1 of this study (KNIPRATH 2012b).
Three of the previous papers on the dispersal of young barn owls especially exceed: SAUTER (1956) for the profundity of the questions and the analyses, KNEIS (1981) for its general discussion, and BAIRLEIN (1985) for the principle to focus the study of larger quantities of data on narrower regions. They all together omitted fairly no aspect.

Concerning their results the present study only presents a few corrections. On the contrary many of their results could be confirmed and some be specified. Owing to the possibilities now at our disposition (electronic data bases, functions of analysis and graphic programmes, for example those of Microsoft-EXCEL) much greater data quantities can be analyzed with much less effort. Also by this reason it was possible to focus on some questions going farther. The generally correct analyses of the older authors are the more admirable as they sometime base on less than 10% of the date which now for the barn owl are at our disposition.
Different from some of the older authors single proofs here play no role. The numbers thus have augmented, that is no more necessary. Indeed, before the substantial results will be discussed, it first is necessary to clarify some terms and to discuss some of the influences by man.
GLUTZ VON BLOTZHEIM & SCHWARZENBACH (1974), KNEIS (1981), BAIRLEIN (1985: 83), DE BRUIJN (1994) and MÁRTINEZ & LÓPEZ (1995) when comparing young and older birds used a not exactly defined "1. (life) year". Here as a consequence of the discussion of KNEIS (1981), who had introduced a theoretical breeding period beginning at the 1.4., we speak of a "youth-year". As demarcation between youth and adulthood the transition from the month of February to that of Match of the second calendar year is fixed. The latest then the young barn owls are mature (KNIPRATH 1999) and begin displaying and breeding. As a consequence of the widely distributed hatching periods this youth-year comprises from owl to owl a very different number of months, indeed always less than 12. This fixation indeed makes comparison with the results of the older authors more difficult, but is nearer to the biology of the owls than a "1. (life) year".
Each wandering passes in space and time. It may be strait-lined or curved or with abrupt changes in direction (until return). As well a continuous course as one with pauses of very different numbers and extent are possible. Also speed may differ from bird to bird and/or from stage to stage.
All hitherto studies on ring recoveries tried to derive at least in part the attributes of this wandering from the few data: ringing site and date, as well as recovery site and date. Thereby the ringing site in narrow limits (if no freighting had passed) is the locality of the start of dispersal. The locality of the recovery merely tells us that the owl at the moment of being captured or found (dead) had been there. At least until the end of the youth-year it doesn't tell us, whether in the case of survival the dispersal of the owl there already had ended. The recovery locality of owls found later in contrast fairly exactly marks the geographic end of the dispersal. Greater dislocations thereafter are no more to be expected (KNEIS 1981, TAYLOR 1994, MÁTICS & HORVÁTH 2000, KNIPRATH & STIER-KNIPRATH 2009). The destiny of the dispersion was to find a fitting site for the first brood. As barn owls already as yearlings are mature (KNIPRATH 1999), they finish their youth-dispersal possibly before their first breeding season or even earlier (GLUTZ VON BLOTZHEIM & SCHWARZENBACH 1979, KNEIS 1981, HILLERS 1998). Start and end of the dispersal in the time indirectly may be deduced from greater quantities of recovery data. Dispersal has begun when at a certain period after ringing mean and median of the recovery distances clearly differ from zero (about 10 lm). As soon as these values still don't alter systematically, the end of the dispersal may be deduced.

5.1 Human influences

Before the estimation of the dispersal parameters we must clarify, whether there exist human influences on the basic data and which they are. Then their respective influences have to be determined and considered.

It is certain that only from 1998 an the "own recoveries", that is those of the ringers themselves, i.e. mostly nestlings died soon after ringing, with increasing numbers found their way into the databases of the ringing schemes (fig. 57). For the analyses made here this fact is of no greater significance: Recoveries in the nest (recovery distance = 0 km) generally have been excluded, those in the nearer vicinity (recovery distance <2 km) as well if relevant. Such an exclusion always is indicated in the text.

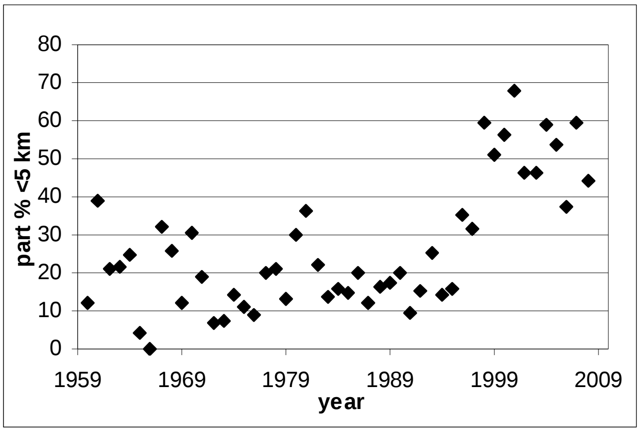


Figure 57: The part (%) of the recoveries nearer than 5 km to the ringing site in the total of recoveries of the Vogelwarte Helgoland

The lack of the "own recoveries" in a greater part of the data of the schemes makes expect that the mean distance values (also in the present study!) in the nearby range generally are to high. For all comparisons (like in fig. 6, part 1) this is of low importance as the fault in the data sets compared certainly is similar. This is not true for statements like "50% of…were recovered within a radius of xx km". These distance values always are to high. By the same reason the part of the far-wanderers (insignificantly?) is overestimated.

As well seen in table 5 the part of the owls found dead decreases parallel to the numbers of recoveries. This only in part represent the eventual decline of mortality with the growing age of the owls. It much more indicates the growing efforts of some ringers to control adult birds at their breeding sites. So the part of life-recaptures increases. These as well increases as only life birds can be controlled more than only once.

The analysis of the recovery directions in the parts of the study area and as well in the regions has shown that there in part are significant differences between these. Owing to the numbers of data sets in some regions splitting was possible and so some influences became visible. Already KNEIS (1981) found that the recoveries by ringers ("gezielt" = intended) gave different, i.e. smaller means of the recovery distances than those by the public. The multiple examination here, whether there is a similar influence on the dispersal directions, made it very evident. If in the vicinity of a region there is another one, in which breeders are controlled, this might lead to a distinct accentuation of exactly that direction. As for the recoveries in the data bank of the ringing schemes is documented, whether the former ones had been made by ringers (code: FINDCONDITIONS = 8), this influence easily may be found and can be taken into account or be eliminated totally (see figs. 34, 46, 48, 49). There is indeed the possibility that a higher portion of controls made by ringers not expresses in the directional distribution of the recoveries (region 15: Celle, see fig. 45; region 17: Wolfsburg, see figs. 49, 50; region 22: Minden, see fig. 56). Then we have found control-recaptures

within the respective region or it is the rare case (region 17: Wolfsburg, see fig. 49) that nearly all around adult owls are controlled as well.
So it proves as forcibly necessary to consider in such studies mathematically and logically the influence of the activity of ringers. Already before it has been discussed (KNIPRATH 2012a) that owl protectors have an influence on the settling distances of young barn owls. For all three areas it was demonstrated that in the course of time the settling distance fairly steadily has decreased (fig. 5, part 1). In agreement with TAYLOR (1994) we here accept that the ongoing position of nest boxes has facilitated for the young owls to settle nearer to their birth locality. Under this supposition we may deduce from figure 12 (part 1) that the number of nest boxes in the central area must be distinctly higher than in the two other areas.

5.2 Course and time interval of the dispersal

The title "3.3 Speed of dispersion" had been chosen badly, as here first the time interval is under focus. To count the speed of dispersion we should know the time of start and arrival. We do know these two only very inaccurately.
Two phenomena will be discussed here separately: far distance wandering (>100 km) and the "normal" dispersal. Already HILLERS (1998) stated that first records of far distance wandering appear beginning with August/September, i.e. very early. (KNEIS 1981 communicates: "beginning with October/November".) Also in the material used here far wanderers were found from August on (as indicated by the clear increase of the means bur not of the medians of the distances). That means that the phenomenon far wandering already appears immediately after the independence of the young. Below (chapter 5.4 Dispersal distances) it will be considered in more detail.
Several authors have written about the "normal" dispersal (see review in KNIPRATH 2010: 60). Following them it begins during September. That means: for the greater majority of the young of a year almost contemporary. Our data confirm this opinion, here visible as the increase of the distance medians (fig. 14 – 17, part 1). This "almost contemporary" only became obvious by controlling for the two influences month of ringing and of recovery separately.
In TAYLOR (1994: 190) we find that the dispersal (of the British owls) already ends after three weeks.
Almost all authors agree that the juvenile dispersal ends in November. Different from that HILLERS (1998: 60 & 64) found for Schleswig-Holstein that the recovery localities with the beginning of the first winter (January-March) again approach the birth places. Indeed the means and the medians of the recovery distances in our study for the majority of the ringing months in all three areas studied (fig. 14-17, part 1) decline after December. However, I don't like to deduce a return from that. I favour as being closer at hand the interpretation that the higher winter losses met the majority of the birds, which had wandered farer, already during the months November and December. The owls, which stayed in the lowlands influenced by the Atlantic Ocean, were reached more likely later by the winter weather. So in the recovery material the distance values decrease. It seems to be in a certain conflict to that that in our study the means and medians of the recovery distance of owls controlled several times at least up to the third control clearly decrease (fig. 23). Here indeed we could demonstrate that the wrong data had been compared. Only after we compared only the data of the same birds, the effect disappeared (fig. 24). Young owls stay at those localities, where they are in the first winter of their lives.
BAIRLEIN (1985) states for southern Germany that the recovery distances (of birds ringed as nestlings) in later years exceed those of the first year. So the owls still after

their first brood (breeding period) should have dispersed away from their birth place. This is valid for all areas studied by BAIRLEIN in southern Germany. In contrast, MÁTICS & HORVÁTH (2000) insist that Hungarian birds after their juvenile dispersal don't pass further significant distances. The present study as well came to the same result (tables 3+4, part 1). In addition the examination of the dispersal distances of owls not ringed as nestlings in the material of the Vogelwarte Helgoland until 2008 (n = 2.412) gave a median of 1,2 km. That means that the far most greatest part of the young owls already in their first breeding period are in the area in which they stay for their lives. This interpretation still is supported by eight threefold controls (breeding period 1 - winter - breeding period 2) from the study area of the author, for which the maximum distance between the control sites amounted 16,4 km, mostly indeed was <4 km (KNIPRATH & STIER-KNIPRATH 2009). They prove the faithfulness of the owls to the breeding site once chosen, this the more as seven of the eight individuals were females, which following KNIPRATH (2007) also in their adult lives have a clearly greater tendency to move than the males. The first ones after loss of mate mostly move in the neighbourhood, whereas the latter ones preferably stay.
The careful examination of the text of BAIRLEIN (1985) gave an indication of the possible reason for such different results. BAIRLEIN in his data for the interval in question found a greater part of far wanderers. That was interpreted as a proof for a prolongation of the juvenile dispersal. As we saw above the young owls after the turn of the year in their youth year don't still wander worth mentioning. So the greater part of recorded far wanderers must have other reasons. Here we don't count the numbers of far wanderers as an appropriate measure for dispersal movements.
For all owls found dead during the months until February of the youth year we never can be sure, whether the recovery place indeed is the place, where they already had finished their dispersal. This certainly, if we as above shown, reject a prolongation of the juvenile dispersal, is true for owls found from the 1st of March on, especially for breeders then found. Concerning the settlement of the owls BAIRLEIN (1985: 99) writes (translated): "….almost half of the breeding settlement at the end of the first live year in more than 50 km from the birth place…". The distance values given here (tables 2 & 3, part 1) for all ringing months and breeding years are clearly below this value (almost half). This difference in part may be explained by the (as explained above) in the study of BAIRLEIN mostly lacking "own recoveries". Certainly we here as well see that the settlement distances since have declined clearly, due to the numbers of nest boxes installed TAYLOR (1994).
Let's look nearer to the settlement. Already the sums of all distance values (fig. 8, part 1: 194) had shown that the recoveries of the first breeding period for all three areas are closer to the ringing place than those during the first autumn and also the first winter. From that we may deduce that settling near to the birth place increases the probability of survival. On the other hand figure 21 (part 1: 109) shows that the mean distance of the owls settled increases following birth month and figure 22 (part 1: 109) that early birth generally has a positive influence on the probability of settlement (what in consequence means: on survival probability): Owls born earlier in the year more often find a place for settlement, settle nearer to their birth place and also have a greater survival probability.

5.3 Dispersal direction

The generally irregular dispersal direction as found by the authors (review see KNIPRATH 2010: 61) here is confirmed as well as a slight preference of the direction SW. This latter one – as here in the study of the regions – often is hidden by other influences, but

mostly becomes obvious, if data of greater geographical unities are analysed (here for the areas west and centre, fig. 4, part 1).
The influence by ringers, especially that of those, who systematically control the adult birds, here becomes evident: In some of the “regions” analysed in more detail for the dispersal direction we found peaks, not explainable by topography (figs. 30-54). These indeed vanished as soon as the recoveries by ringers were eliminated. The explanation given here is that in the pretended “preferred direction” there was working an enthusiastic ringer, who controlled also adult birds. So the number of recoveries in that direction increases. Such an influence had disappeared in the analysis of the three areas of the lowland at a whole (fig. 4, part 1) or should we say: has been neutralized?

Influence of the topography on the dispersal direction
Hardly in the greater areas but at least in the regions the influence of topographic peculiarities became evident. A near coast (region 1: Wangerland, fig. 28; region 4: Elmshorn, fig. 33; region 6: Dithmarschen, fig. 35) becomes visible by the under representation of that direction. This influence indeed sometimes becomes visible not earlier than when analysing greater distances (region 2: Jade Oste, fig. 30). In two other region of that kind the influence obviously is hidden by other influences (region 7: northern Schleswig-Holstein, fig 36; region 8: Danish Wohld, figs. 37 and 38).
In the material analysed, there was now ringed owl which had been washed ashore by the sea, but there no ringed owls already were found. These finds and also other proofs for longer travels over sea have been summarized by KNIPRATH (2010: 61). These cases must be completed by the description of YOUNG (1954): West of the Strait of Gibraltar on open sea a barn owl came aboard of a ship and again disappeared the evening.
Broader waters obviously sometimes are crossed as well. From region 2 (Jade-Weser, fig. 29) owls reach Schleswig and Denmark probably preferably by crossing the Elbe estuary (2,5-6 km) by flight than by flying round.
Repeatedly discussed in the literature is the barrier function of high mountainous regions (review see KNIPRATH 2010: 61). In the analysis here the influence of the Harz (all mountains and mountainous regions in the areas studied here at most are of medium altitudes) was obvious (region 17: Wolfsburg, figs. 49-50). This corresponds to the statement of ZANG et al. (1994). MÖNIG & REGULSKI (1999) name the “Bergisches Land” less attractive for the owls dispersing from their study area. KNEIS (1981) speaks of a “guide-line-action” (term used in the study of bird migration!). GÜNTHER (1985) describes for Thuringia that the surrounding mountains as well as the “Thüringer Wald” and the “Frankenwald” inside the area a repellent effect.
But as in the study area there no unwooded mountains, we cannot simply decide, whether it indeed mostly is the wood which repels. That wood outside mountains during dispersion is a significant barrier is recognizable in several graphs (region 5: Oldesloe, fig. 43; 10: Rur-Erft, fig. 40; 11: Coesfeld, fig. 41; 12: Rotenburg, fig. 42; 13: Uelzen, fig. 43).
Four larger towns so are situated in the surrounding of singular regions that their action can be estimated. Neither Bremen (region 12: Rotenburg, fig. 42), nor Hanover and Brunswick (region 16: Peine, fig. 46), nor Düsseldorf (region 18: Niederbergisches, fig. 52) had a recognizable influence on the dispersion direction.
Nevertheless the graphs have shown further, not explicable preferences and also rejections of certain directions.
Already SAUTER (1956) had stated and KNEIS (1981) had found more evidence for it that the owls indeed generally and also repeatedly might change movement direction. The

present study has underpinned these statements (chapter 3.6). Of course the majority of the dispersing owls in general keeps the original direction but changes of this direction up to a return are not to rare. These changes might be caused by topographic peculiarities.

How do dispersal barriers act?
Generally two different mechanisms are imaginable: either the owls realize the disadvantage of a topographic structure (large water, wood, (wooded mountains), when they actually reach them, and end their wandering, turn back or aside. Or they only realize the disadvantages when over flying the structure, over fly it (accelerated?) or turn back. There are some circumstantial proofs which my help us at the decision: Over flying would have no effect on the recovery direction as the owls keep their original direction and are not missed in the final sums. Nevertheless we might postulate that the indeed over fly but here have greater losses. These actually are not recognized as dead barn owls rarely are found at sea or in the wood. Indeed in the wash margin of the North Sea and the Baltic no ringed birds have been found, but not ringed ones. And flight over the open sea also has been proven (se above).
Would the owls finish their wandering in front of such a barrier or even turn back, there likewise were no action on the general recovery numbers in that direction. Such a situation indeed could be detected, if the recovery numbers for the short distances were increased considerably. For a decision the numbers in the fitting regions of this study mostly are to small. Additionally we could not decide whether the accentuation of exactly the opposite direction is an original preference or whether the eventual overturners had wandered in the opposite direction even beyond the ringing site (as in fig. 42). The “rebounding” of the dispersing owls at the Harz Mountains is very significant in the figure 3 in ZANG et al. (1994).
If the owls avoid a barrier, i.e. fly around it, the deficit in the original direction should be compensated by higher values in the two neighbouring directions, as became visible in the regions 10: Rur-Erft (fig. 40) and 11: Coesfeld (fig. 41). In the case of an ocean flying around just by reason of its extension is not possible, lateral avoiding certainly is.

5.4 Distances of dispersal
Already KNEIS (1981) had stated that the dispersal distances are influenced by the ringers. He wrote of “intended” recoveries. Ringers, which in their area occasionally or systematically control adult birds, thus provoke that the minor distances become more prominent. They do that also indirectly when the in praxis and also by propaganda care for that owls recovered in their areas more often as usual are communicated to the schemes. This also leads to a more prominent accentuation of the lower distance values, as these bird more often are locally ringed ones. The influence detected by KNEIS is much more than confirmed by the present data: Analyses, which do not take that in account easily lead to false results.
Already for the fundamental question, how far young owls move away from their birth places, we obtained different results for the three areas: western, central, and northern low land. In the western area the dispersal ended for 50% of the owls within a radius of 32 km, for those of the central low land already of 21.5 km, and for those of the northern one at 28 km (fig. 6, part 1). Even though these differences scarcely become visible in the graph, they are of importance for the owls. If we accept that the number of nest boxes installed in the areas compared had increased over time with about the same speed, there should be no difference by this reason. But there still is another possibility: The main mass of the ringings used here could originate from different time intervals.

The test indeed gave a difference. The mean ringing year in the area west is 1985 (median 1989), whereas that in the central area is 1991 (1993). The values from the western area so originate from clearly earlier years with presumably also fewer nest boxes. Merely by this reason greater recovery distances result.
Under the supposition, an eventual difference in the number of nest boxes in earlier times would have adjusted sometime, the recovery distances were tested only for the years from 1990 on. The figure 58 surprisingly shows that the difference now is considerably greater. Probably the numbers of nest boxes in the areas compared: west and centre indeed are very different, what here means, in the area west today in the surroundings of ringers there are much more barn owl boxes. The owls can settle nearer to their birth place. A different explanation as well is possible: In the central area during the interval studied ringing and controlling was done in regions with much more boxes, in the western are not (no more). For this supposition we have no numbers.

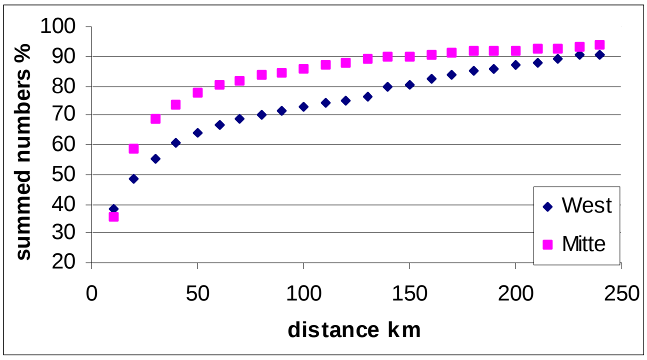


Figure 58: Summed recoveries by distances for recoveries for ringings since 1990 in the areas west and centre.

Comparing the results of earlier studies and between areas with different numbers of nest boxes thus is very unreliable, if the aspect is not considered.
The figure 5 (part 1: 103) identically for all three areas shows that the recovery distances of barn owls ringed as nestlings in the study area constantly have diminished. This here means that for the owls the steady nearer settling was made possible by the posting of steadily more nest boxes. Already TAYLOR (1994) had pointed to this influence.
The decline as well of the means as of the medians of the distances from recovery to recovery of owls controlled repeatedly is visible in figure 23. But it merely shows that in these recoveries the part of those from the public steadily in- and that of the intended ones (named “gezielt” by KNEIS 1981) decreased (fig. 59). We may expect more than two recoveries for the same individual only if intentionally adult birds are captured. As these control captures by ringers preferably are made on smaller areas, these (nearby!) recoveries steadily get a greater importance.

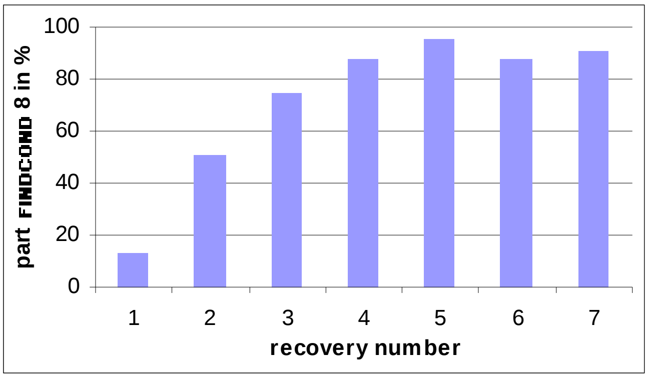
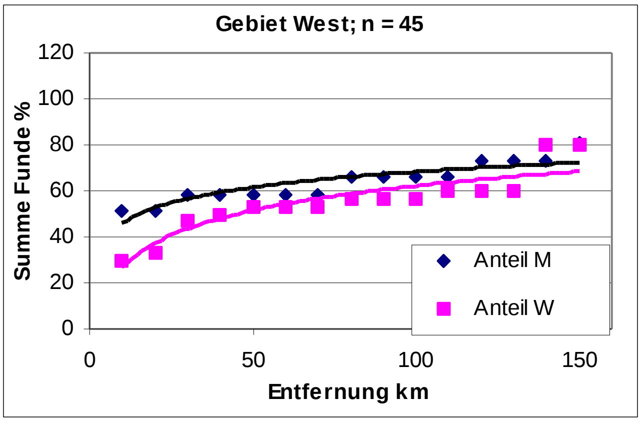


Figure 59: The part (%) of recoveries communicated by ringers (intended recoveries by KNEIS 1981) among the multiple recoveries (selection: FINDCOND code 8)

The great extent, which in nearly all studies on the dispersal of the species is consecrated to the far distance wanderers, seemingly is due to the search for migrators. An importance of far wandering for the original population can not be detected. Naturally far leading dispersal promotes gene exchange between far distant (sub-) populations (KNEIS 1981, MÁTICS 2003) and equally is significant for the refilling of locally crashed populations and as well for the colonisation of hitherto uninhabited areas.
Probably the part of far wanderers differs by regions. BAIRLEIN (1985: 83) for southern Germany found a mean of 24.5%. In the material studied here this value is at 25.7% (area west), 14.2% (centre) and 15.7% (north) (fig. 11, part 1: 105).
BAIRLEIN (1985: 84 table 1) as well calculated different parts of far wanderers for owls in their first year (22.1%) and those in later years (30.2%). A continuation of the juvenile dispersal, as deduced from these data, already above (chapter 5.2) had been refused. This higher portion of far wanderers in the adult owls as well could signify that far wandering would mean a survival advantage. In contrast to that MÁRTINEZ & LÓPEZ (1995) stated that for Spanish young owls a far going dispersal already in their first year implicated death. In the material here (all Helgoland recoveries together) the value for later years is 16,5%, whereas that for the youth year (until end of February) 21,3%. This minor part of distant recoveries better fits to the deduction above, nearer settling means a survival advantage. DE BRUIJN (1994) for the recoveries of the first year of a population tin the Netherlands had found a part of 18%. In that paper there is given no value for later years.
Already GLUTZ VON BLOTZHEIM & BAUER (1980) (different from GLUTZ & SCHWARZENBACH 1979), GIRAUDOUX (1985), HILLERS (1998) and KNEIS (1981: fig. 3a) had elaborated that it is of influence on the recovery distance, in which month the owls had been ringed: Those hatched earlier were recovered nearer to their birth place. In the present study this statement not had been confirmed in such an overall extent. Indeed we found that owls hatched earlier on their settling at least in the areas west and centre had an advantage (fig. 21, part 1). The advantage of an earlier birth also expressed in that that the part of those, which at all reached their first breeding season, in the ringings from Mai to July steadily, later strongly decreased (fig 22). Who comes first, naturally first finds the settling possibilities still free, and that equally nearby as well as far away. This advantage of an early birth indeed doesn't exist for the Spanish barn owls (MARTÍNEZ & LÓPEZ 1995).

By sex
Earlier studies (Jjuvenile dispersion: TAYLOR 1994: 193; later ages: Kniprath 2007, KNIPRATH & STIER 2008), had stated that the ♀ wander over greater distances than the ♂.

In the material here we initially did not succeed to prove a general influence of sex on the dispersal distance (fig. 7, part 1), exclusively as the values for the ♀ the area west were lower. Already the four fold higher number of ♀ should have made rise the suspicion that in this area an obviously greater number of breeding ♀ had been controlled. Following the admonition above for this surprising deviation later the influence of ringers has been tested (fig. 60. For the area north there only were 11 values.). Now it became visible that also in the area the ♀ had passed greater distances up to the recovery: For them the part per distance class generally is lower than for the ♂.



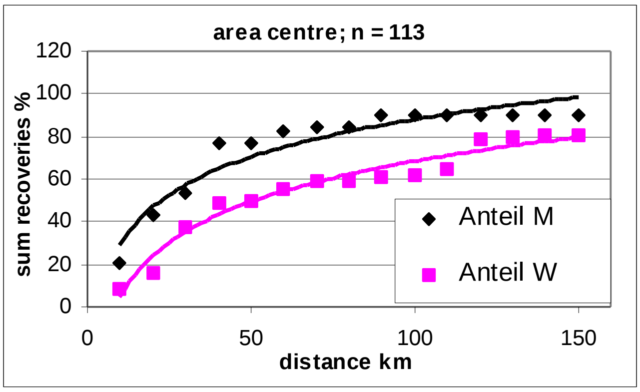


Figure 60: Cumulated part of recoveries (%) in dependence of the recovery distance by sex; without recoveries by ringers

Causes of differing dispersal distances
Already several times the numbers of nest boxes installed, more generally: the number of prospective nesting sites, have been pointed to as a not unimportant cause for dispersal with differing distances. But we hardly can imagine that the requisite nesting site is of primary importance for not yet mature young owls. More important seems first safety, i.e. the existence of undisturbed resting sites over day. Generally the importance of these is emphasized by the authors (GLUTZ VON BLOTZHEIM & BAUER 1980; BRANDT & SEEBASS 1994, TAYLOR 1994). The real influence of the requisite resting site indeed can not be valued.

It looks better concerning another claim of the owls upon their surrounding, i.e. the sufficient presence of prey. The importance of this latter one may be deduced from fact that in lesser rodent years the wandering distances covered, especially the settling distances, are greater than in better rodent years (SCHÖNFELD 1974, KNEIS 1981). The greater part of settling owls around the birth places as well proves this interpretation (KNEIS 1981). Farer dispersal from areas less densely inhabited (by barn owls) likewise strengthens this interpretation: Those areas indeed mostly are less densely occupied as there the prey-stock is worse. As for the study presented no data on the rodent quantities in the study area are at disposition, we tried to estimate this influence by substitute values (numbers of recoveries per year-cohorts: figs. 9, 10 (part 1); Yearly oscillation of the brood numbers). This trial was not successful.
The recoveries do not give information on the time at which a prospective breeding site gets importance for the dispersing young owls. ROULIN (1998) indeed had found during his box-controls that pairs unite already during February. As this uniting of pairs is preceded by courtship, nesting possibilities at least end of January may be of importance for the young owls.

Causes for farer wandering
BAIRLEIN (1985) based on the assumption that far-wandering was (co-) caused by prey-shortage. In parallel he thought that the mortality rate was increased by food shortage. These two assumptions of course lead to a dilemma: Especially the regions in his study area with the favourable surviving rates had the greater part of far-wanderers. KAUS (1977: 29) mentions the years 1967 and 1972 as those with extended wandering. But then he writes: “A correlation of extreme prey shortage with wandering for these two cases is to be excluded.” Probably this dilemma may avoided by the following hypotheses:

1. Only in part the European population has the inheritance for far-wandering. This might originate in a time, during which barn owl, coming from southern regions, immigrated into the temperate zones.
2. This heritage only can become effective, if the prey basis during the nestling phase and as well during the first weeks of independence is extremely good. The owls then are able – in analogy to the migrating bird species – to store greater fat quantities. Especially this good food supply and not the contemporaneous density of young owls (density dependence) was original as SAUTER (1956), KAUS (1977) and also KNEIS (1981) assumed.

Dispersal direction and distance
Above we stated an - even if not to strong - preference of the direction SW. The figures 12 (part 1) additionally have shown that in this direction also the greater mean distances were reached. For the far-wanderers the preference is still visible, but here is obvious that generally in the southern directions greater distances were reached than in northern ones. This may not astonish to much as in these latter direction on one hand there is the North Sea and on the other hand direction Scandinavia the distribution border of the species is near.
Dispersing young barn owls reach extreme distances (>1.000 km) as well in SW-direction (southern France, Spain) as also in direction SE (Romania). Rather astonishing are the four extreme far-wanderers in eastern and north-eastern direction until near to the distribution border or even beyond it (for authors see KNIPRATH 2010: 62). The two first directions are those to climates very favourable for barn owls, the latter one to a more unfavourable one. Also for these distances in the present material

the direction SW obviously is predominating (fig. 26, the two most far distances (>2.000 km) in fact were reached by two owls in direction E).

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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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