Réserve naturelle
Schlammwiss
& Bird Ringing Station-Uebersyren

Survey of Standardized Bird Catching in the Nature Reserve Schlammwiss during Spring Migration 2016

with the Main Focus on the Reed Bunting *Emberiza schoeniclus*

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Summary

Reed buntings as well as several other bird species use reed beds such as Schlammwiss in eastern Luxembourg as stopovers during migration mainly for foraging and resting. Results of standardized bird catching during March depict sex and age differentiated spring migration patterns within reed buntings, with male and old individuals migrating earlier, and a migration peak on March 25. All in all effects of tape luring on the catching rate could not be observed during the study. Moreover the analysis of biometrical measurements of reed buntings support sexual dimorphism with significantly higher wing lengths, feather lengths and bill depths of male individuals. Compared to other studies, our measurements fit into the gradient of increasing wing lengths and bill depths in northeast direction of their large distribution range in Europe, confirming the clinal variation in phenotypes. This variation was underlined with the morphometric comparison between individuals caught in Schlammwiss during the breeding season and birds, which were ringed in northern Europe and recaught on passage in Schlammwiss.

1. Introduction

The following study has on the one hand examined the migration phenology of different birds in a vast reed area along the river Syre in eastern Luxembourg during March. To study the migration thoroughly and free from any extern influence, the method of standardized bird catching in mist nets was used. The data output gave information about the migration peak, different migration patterns depending on sex and age and if presumably repeated yearly – about population size or fluctuations. Furthermore the effects of tape playback during the standardized program were analysed and discussed. On the other hand, the analysis was focused on the reed bunting, a species that intensively accumulates and uses the reed bets in the nature reserve outside of the breeding season for migration stopovers during the spring. Apart from the migration phenology and patterns, the morphometric data notably feather and wing length, weight and bill depth from the later were surveyed and analysed whether there is a difference between second year and adult or male and female birds. Based on the assumption that reed buntings within the subspecies E. schoeniclus schoeniclus from different geographically populations may show different sizes in biometrics due to other environmental parameters, resident reed buntings will be compared to passing ones regarding wing and feather length, bill depth and weight. One may expect that, following Bergmann's rule that says that body size varies inversely with ambient temperature, body size increases with latitude. This has been supported by some studies. Additionally variation in wing and feather length or bill depth of different species populations can be due to varying distances travelled in their migratory journeys or different behaviors on their breeding grounds. It is expected that populations travelling long distances will have longer primaries than those travelling shorter distances. Summarizing and structuring the report, the following questions were treated:

Is tape luring positively affecting the bird catches during the standardized program?

Is there a difference between old and young respectively male and female reed buntings regarding the migration phenology and biometrical measures?

Do passing reed buntings diverge in their morphometric parameters from local individuals?

2. Study Area and Methods

Study Area

The study was carried out in the nature reserve „Schlammwiss“ in the Syre valley in Eastern Luxembourg (49.638°N, 6.275°E). As a part of the European protection network Natura 2000, the 375-hectare nature reserve consists of the vastest reed belt in the country. Apart from the reeds, characterized by the dominant *Phragmites australis*, different scarce and valuable humid biotopes are present in this wetland area. To be specific extensively managed meadows and pastures, forest habitats of wet location with willows and black alders, several ponds and a partially restored river system with a natural and dynamic course. The exact location of the study area and the action area of the bird ringing station lies within the nature reserve mentioned above and is situated between the village of Uebersyren and Mensdorf. The bird ringing station was founded in the 1990's along with the progressive act of purchasing an area of 19 ha of those precious biotopes by the national foundation for nature protection (Natur & Ëmwelt). Today the bird ringing station is managed by volunteers, financially supported by donations and is subordinated to the COL (Centrale Ornithologique du Luxembourg), a section of Natur & Ëmwelt. Although the area is heavily polluted by noise from the crossing motorway, the bordering railways as well as from the incoming flights of the national airport, the ecological value is undisputable. Especially for birds, the area plays an important role because of breeding, over-wintering and resting/feeding opportunities. Apart from birds, the area represents a sanctuary for many mammals (fox, wild boar, least weasel), reptiles (water snake, lizard), amphibians (toads, frogs), insects (dragonflies) and not at least for a specialized plant community. It contains many species-rich biotopes, which have been under high pressure through intensification and thus scarcely seen throughout the country.

Standardized Catching

In order to achieve the main goal of obtaining independent data, the method of standardized bird catching is used. It is quite similar to the Constant Effort Sites scheme of the British Trust for Ornithology, with the single difference that this method primarily aims to provide a reliable "picture" of the bird migration during one month and not on a long-term period over many years, although this could be completely feasible.

The applied capture method involves opening the same types (e.g. mesh size) and lengths of mist nets, in the same positions (see figure 3), for the same length of time, over a series of 16 dates during March. Furthermore the nets are alternately opened in the morning (6 am – 11 am) as well as in the late afternoon (16 pm – 19 pm) on each subsequent date, in order to ensure data from bird species with different activity patterns such as nocturnal or crepuscular. This method is held constant through the time study. Additionally were biometrical measurements of adult reed buntings collected in June during the main breeding season, just simply to acquire data from local birds and be able to deal with the matter of divergence between local and passing reed buntings.

The study area is restricted to the large reed bed, where 500 meters of mist nets with the –for small passerines - suitable mesh size of 16 mm are erected. Since the nets are positioned in different small-scale biotopes such as on bridges over the water surface, along the edges of ponds (standing in water and in the reed vegetation) and just in the middle of reed vegetation, the nets are all numbered as to identify them later on. Further information recorded at the beginning of each date is air temperature, rain intensity in mm and wind activity using the Beaufort scale. Another important part of the used standardized method is the tape playback. During the migration period, the probability of catching a migrating species can sometimes be increased by the use of tape playback. As results from monitoring work involving tape playback need careful interpretation (keyword – overestimation), the probability of birds responding to the tape needs to be held as constant as possible. That is by playing the same records from the same species and on the same speakers/spots. During the study, a tape loop of the song of the barred warbler *Sylvia nisoria* was broadcast from five loudspeakers installed in the reed bed and continuously repeated for as long as it is required. The positions of the speakers ensure an evenly broadcasted song and volume. To generate reliable migration data and to detect a presumable effect of tape luring, the playback is just broadcasted for half of the entire survey time. (see the planning in the annex)
During a monitoring session, net controls are conducted every hour with the exception of heavy rainfall events or minus temperatures. In this case controls are doubled. The collection of biometrical data and the ringing takes place in the station's hut, before the birds are released again.

Recording of Biometrical Data

All birds caught are identified, aged, sexed and all un-ringed birds are ringed. Further data collected include fat and muscle deposits, wing length and weight. To detect morphometric diversions within the reed bunting population, the feather length and bill depth is additionally recorded here. (see the form in the annex) All of those criteria are determined using different literature depending on the species. Primarily sex and age determination takes place with the aid of "Moult and Ageing of European Passerines" by L. Jenni and R. Winkler (1994). In case of the reed bunting and the difficult age determination in spring further literature such as the bird studies from Clive Walton & Paul Walton

(1999), Javier de La Puente & Javier Seoane (2001), B.D. Bell (1970) and the digital guide of the Bird Observatory Ottenby are consulted. In order to guarantee a constant data acquisition, biometrics are measured by just two ringers, who control each other constantly along the process. Data analysis takes place using SPSS and Microsoft Excel.

Ethical Treatment of the Birds

The disturbance and impact on the birds caught was minimalized during the net controls and the recording of biometrical data. Above all, health and good condition represented the highest priority while having undertaken the project, anything else would not serve the purpose and idea behind it.

Pic.1: Male reed bunting with the typical white neck and black head plumage, which becomes visible during spring. This picture was taken during May, when the breeding plumage is fully pronounced.

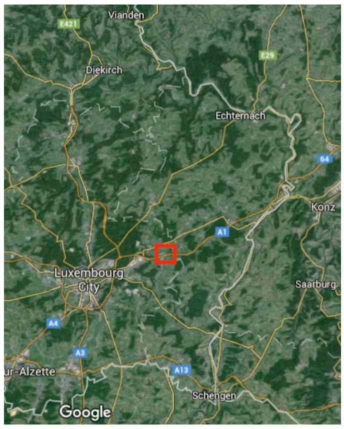

Fig.1: The study area is situated in the nature reserve „Schlammwiss“ in eastern Luxembourg

Time with open nets by Daytime and Sound (hours)

	With Sound	Without Sound	Total
Morning	20	20	40
Evening	12	12	24
Total	32	32	64

Fig. 2: Overview of the survey time with/without tape luring and during the morning/afternoon

Fig. 3: The study was carried out in a vast reed biotop, where nets were fixed in maintained trenches (blue lines) and speakers are spread over the area (orange circles). The nets are spread on bridges over open water surfaces, mainly in R3, whereas R1, R9, R2 and S4 are erected amidst the reeds. R8 and the most eastern part of R2 were standing knee-deep in water because of the elevated groundwater level. Note that the nets have different lengths: R3 – 170 meters, R1 – 100 meters, R9 – 46 meters, R2 – 120 meters and R8, S4 – 32 meters.

3. Results

Summary of the migration phenology during March

The number of birds caught during the period between 29 February and 25 March consisted of all in all two hundred eight individuals from nineteen different species. The average number of catches per day is thirteen, a minimum was reached on the 4 and 7 March with just three captures respectively and a maximum on 25 March with forty one birds in the nets (see figure 4) Whereas the number of species caught during each monitoring session did not rise significantly (Pearson – r: 0,227; p: 0,198) over the study period and varied between two and eight species per session, the number of individuals however rose. As expected the correlation between the number of individuals per session rose significantly (Pearson – r: 0,668; p: 0,002) with the on going dates in March, representing the upcoming spring migration. As one can see in figure 4, when morning temperatures rose above 0°C on the 22 March, the number of birds caught in the nets rose quite intensely. While taking a closer look at the composition in species of the project indicated in figure 5, one can briefly see that primarily numbers in reed buntings *Emberiza schoeniclus* and chiffchaffs *Phylloscopus collybita* rose over March. In the case of the dunnock *Prunella modularis*, the tendency of higher catch rates in late March was quite weak. Other species often caught such as the wren *Troglodytes troglodytes*, the blue tit *Cyanistes caeruleus* and the robin *Erithacus rubecula* did not show much variation in numbers over the project's period. On the contrary, species such as the common starling *Sturnus vulgaris* and the yellowhammer *Emberiza citrinella* were only caught at the beginning of the study period. The water rail *Rallus aquaticus*, the European stonechat *Saxicola rubicola*, the common snipe *Gallinago gallinago*, the long-tailed tit *Aegithalos caudatus*, the wagtail *Motacilla alba*, the great tit *Parus major*, the marsh tit *Poecile palustris*, the green sandpiper *Tringa ochropus* or the three species of the genus *Turdus* were quite rare catches during the study period, making it difficult to deduce phenological assumptions. Beside absolute numbers, it's fundamental to examine the status distribution. Whether an individual bird was newly ringed, recaptured (and recently ringed) or controlled (caught at least last one year ago or ringed abroad), provides supplementary information. The amount of recaptured birds, marked with a "w", ergo individuals who were just recently ringed and recaptured in the same nature reserve, fluctuated just between one and two exemplars per date. These numbers don't include the birds, which were ringed outside of the project's time and recaptured during the project. Those are regarded as new ringed birds. The highest count was reached on 25 March, the date where a maximum of forty-one birds have been caught in total. Whereas newly ringed birds, marked with an "e", were alternating between two and thirty-nine individuals per day, with the highest count on 25 March. As seen in figure 6, the ratio between newly captured and recently recaptured birds fluctuated slightly until mid March, henceforward the part of "e" birds increased strongly. All in all, the most efficient net regarding the count of catches, was net R3 with 68 birds of 12 different species, followed by R8 with 54 birds of 8 species, R1 with 36 birds of 10 species and R2 with 27 birds of 8 species. Although the amount of species caught in net R9 and S4 was high – 9 and 8 species resp. – the individual count per species got never higher than 4 (Robin in R9). In R1, R2, R3 and R8 the reed bunting was the most abundant species caught, whereas it was never captured in net R9 and just once in S4. Since the numbers of captures were not normally distributed over the study period (see fig. 5/6), the non parametric Mann – Whitney U test was used for analysing the effect of tape luring on the actual catching rate. In order to do so, the count of catches per hour was used. With the tape turned on, an average of 4,28 birds per hour was obtained, whilst turned off the mean added up to 2,28 birds per hour (see fig. 8). All in all hundred thirty-five birds flew into the nets whilst the tape was turned on and just seventy-three individuals whilst no tape was playing. Albeit this difference in numbers, the test proved that there is no statistically significant difference between both values (Mann–Whitney U = 595,5 , $n_1 = n_2 = 32$, $P > 0.05$ two-tailed). During the project, ninety-eight birds from sixteen species have been caught in the afternoon and hundred ten birds from thirteen species in the morning. However nets had only been opened for twenty-four hours during afternoons contrary to forty hours during mornings. (see figure 9)

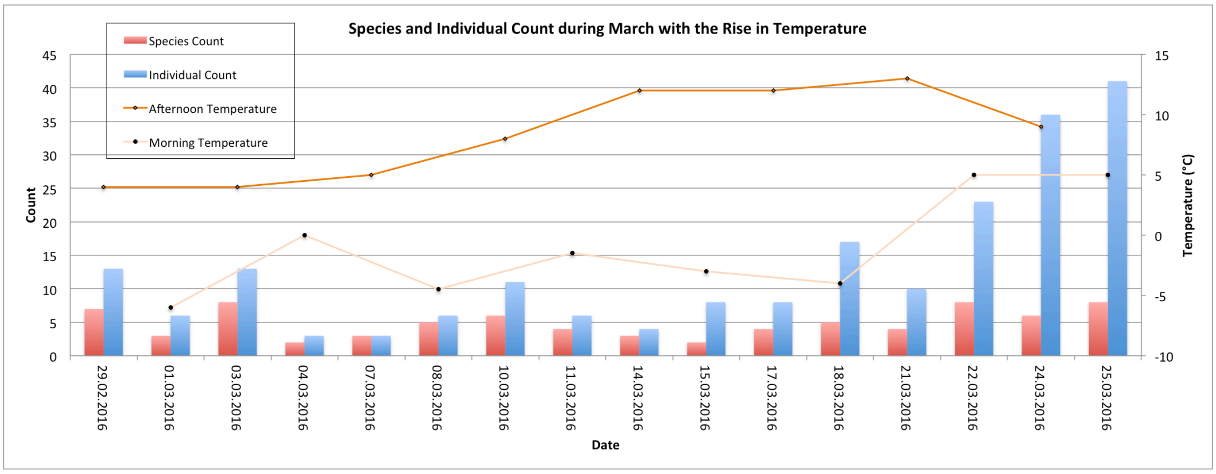

Fig. 4: Distribution of individuals and species caught during the month of March with varying temperatures.

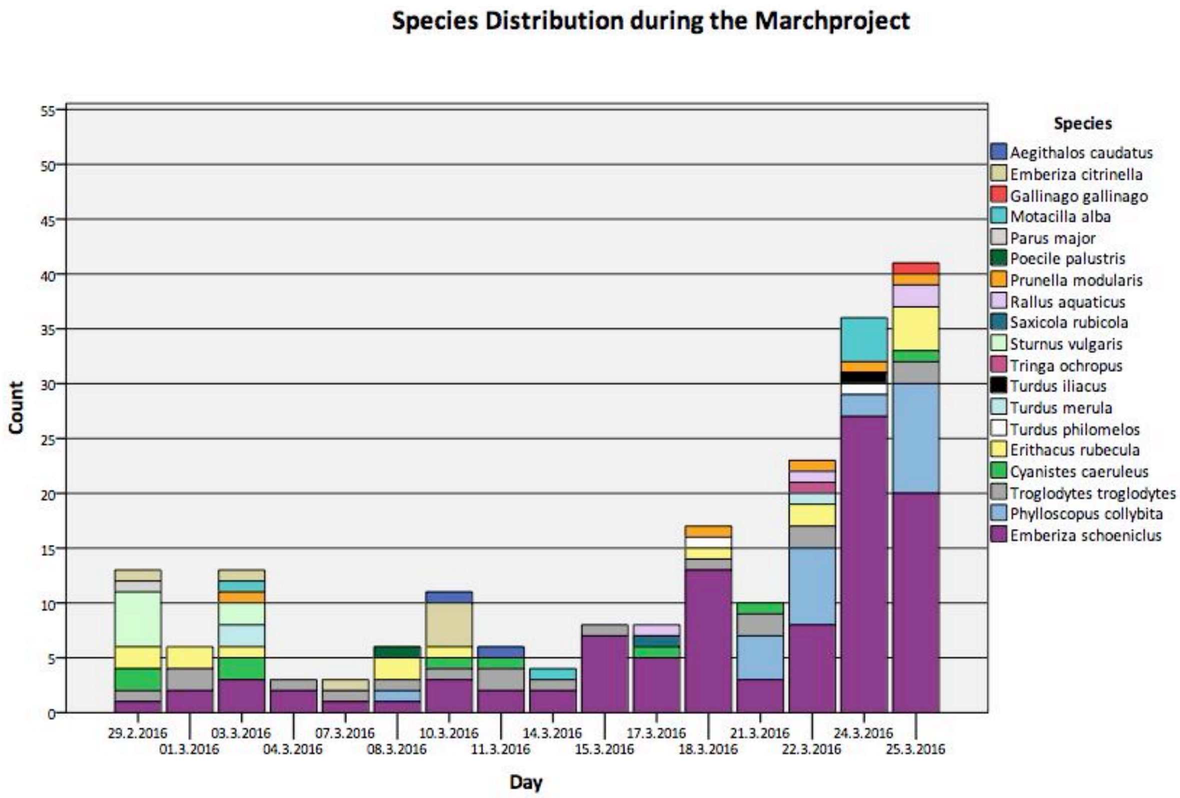

Fig. 5: Distribution of bird species during the different project sessions.

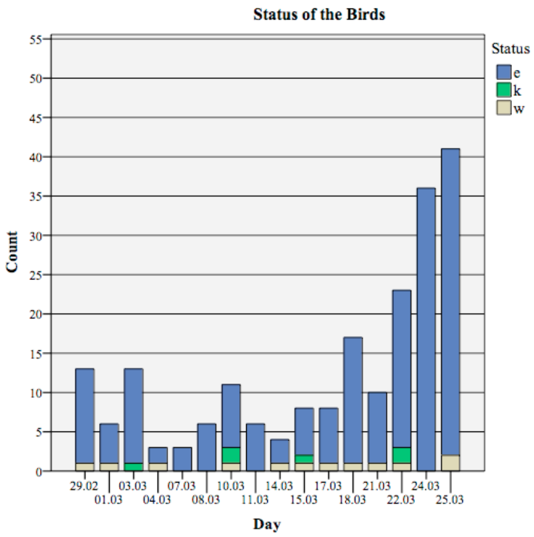

Fig. 6: Absolute distribution of the different statuses of ringed birds during the standardized program in March.

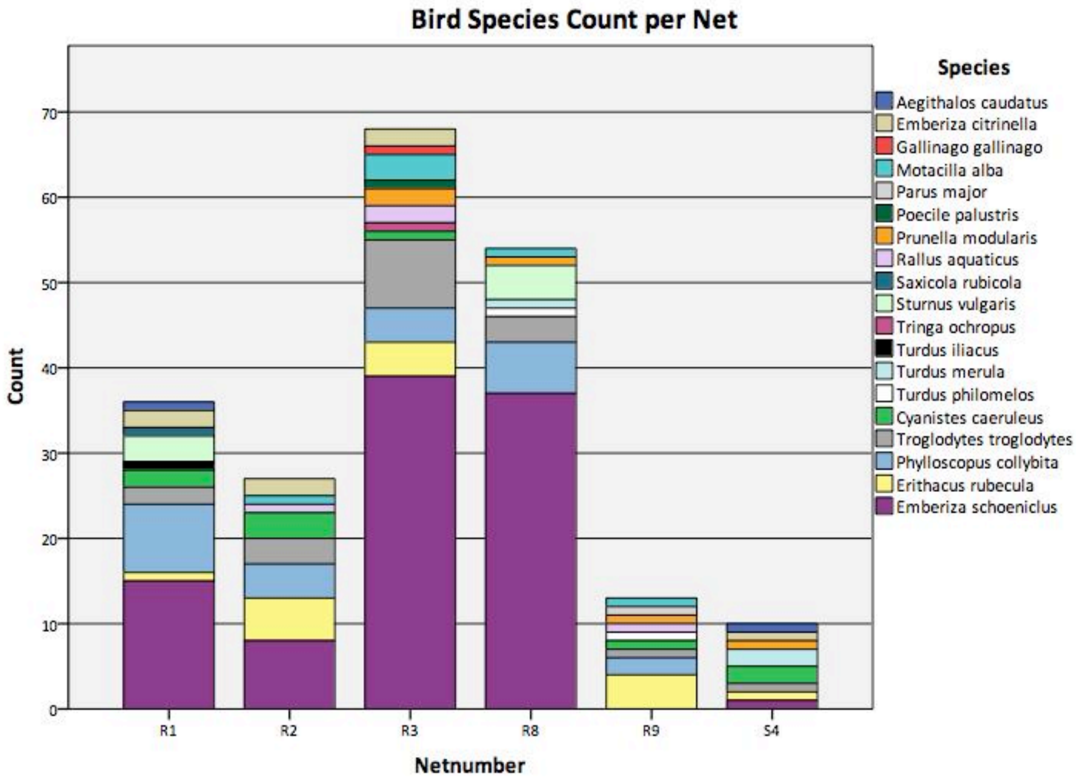

Fig. 7: Summary of catches of bird individuals and species for the different nets during the project.

	Mann-Whitney U Test	
	Sound on	Sound off
Mean	4,28	2,28
Median	2,00	1,50
Sample Size (hours)	32	32
U-Value	595,50	428,50
P-Value	0,8689	

Fig. 8: In order to test for significance, the numbers of birds per hour with luring sound respectively without it, were checked with the Mann-Whitney U Test. The P-Value amounts to 0,8689 (>0,05) which indicates the unsignificant result.

	Bird Species and Individual Count depending on the Time of Day		
Daytime	Individual Count	Species Count	Hours of catching
Afternoon	98	16	24
Morning	110	13	40

Fig. 9: Nearly as many birds have been caught in the afternoons between 16 and 19h, despite the shorter time spans.

The reed bunting: status, sex and age distribution, migration phenology and biometrics

Over the project's period, 94 different reed buntings were caught in the nets. As seen in figure 10, 92% of all the reed buntings caught during the standardized program were first caught and ringed, 6% were recently ringed (during the project) and recaptured and 2% or 2 individuals were controlled. The next step is to find out for how long the migrating reed buntings were staying in the nature reserve. Therefor the average time span between the first catch and the recapture is evaluated. Since there have only been 6 birds recaptured during the whole project, the reliability of the findings is not fully granted. As one can see in figure 11, the time spent in the nature reserve varies from 13 to 86 hours with an average of 40,8 hours per stay. The sex and age ratio of the reed buntings caught in the nature reserve Schlammwiss over the spring migration is depicted in figure 12. Due to the fact that the age determination of reed buntings in spring is rather difficult, a quite high amount of 66 individuals (37 males, 27 females) had to be registered as 6, which means that they were born last year or older ergo a neutral designation. Over and above, 2 individuals could not be sexed. The struggle with age determination in spring will be further treated in the discussion. Furthermore 25 reed buntings were surely identified as second year birds (5) of which 12 were male and 13 female. However, only two male reed buntings could be surely identified as being adult or born minimum two years ago (8). Due to the deeper insight of the controlled birds, another male could be surely appointed as a three-year-old bird and the other control as a second year bird. If one ignores the 6-aged birds, 3 of 28 birds or 10,71% would be adult. While summarizing these two variables namely age and sex over the month March, one can identify sex/age - differentiated patterns within the spring migration. When having a look at the sex distribution in figure 13, just male reed buntings were caught from the beginning - 29 February until the eight catching date or the 11 March and never more than 3 on each day. First female individuals were caught on 14 March, rose over 5 catches per date after 17 March and reached a peak on 25 March with 20 individuals. Otherwise did male numbers rise suddenly on the tenth catching date or 15 March and were caught until the sixteenth date with appr. 5 catches on each date. All in all the migration peak deduced out of the following figures, can be set upon late March, accurately on the 25 March. The age distribution during March migration showed at first glance lesser favourable results. Since quite many individuals could not be sexed, there is little data to build on. What can be said for sure is that the adult birds (8/9), caught on the 10 and 22 March, are situated ahead of the peak migration date. Second year birds (5) were caught since the third date or 3 March until the last date, quite spread out, reaching never more than 3 individuals except on the 24 and 25 March with 7 and four individuals respectively. (figure 14) While having a look at figure 15 at the variation in feather lengths of male reed buntings in the course of migration, the interpolation line is slightly skewed to the right. Giving indication that with progressing migration, feather lengths are decreasing. One has to consider that the first values within the scatterplot are quite unstable, because just a few feather lengths were collected during early March. With rising numbers of individuals per day, the results are becoming more meaningful and steadier against outliers. Regarding the basic morphometric parameters such as weight, wing length, feather length (length of the third primary feather) and bill depth depending on sex or age, figures 16 and 17 in the annex give a brief summary of the means, medians, standard deviations, minima and maxima. All summarized: male reed buntings had higher means in all of the four parameters, whereas there always was a high overlapping range. As to the age differentiation, the adult birds, categorized as number 8 or higher, consisted of three individuals in total and had higher means in all parameters. With such a small sample size however, these results are too insignificant. Comparing the measures of category 6 (born last year or older) with measures from the second year birds, the later ones have slightly higher means in bill depth and weight, whereas category 6 birds have slightly higher means in feather and wing length. Furthermore a two-way ANOVA was conducted that examined the effect of sex and age on the four parameters feather length, wing length, weight and bill depth respectively. Simple main effects analysis showed that males held significantly larger values in feather length, wing length, weight and bill depth ($p<0,05$). The independent variable of age however is not influencing the four dependent parameters in a statistically significant way, neither is a statistically significant interaction between age and sex present. The scatterplots in figure 18 and 19, as well as the plots of the estimated marginal means of the different parameters in the annex (figure 20) can furthermore describe the results and correlations between the four different parameters. As seen in figure 17, the scatterplot between wing length and weight depicts moderate positive correlations for both male and female birds, however with low R-squared values or high dispersion along the regression lines. Correlating feather length and bill depth on the contrary as in figure 18, show a moderate to zero correlation between both variables with quite low R-squared values.

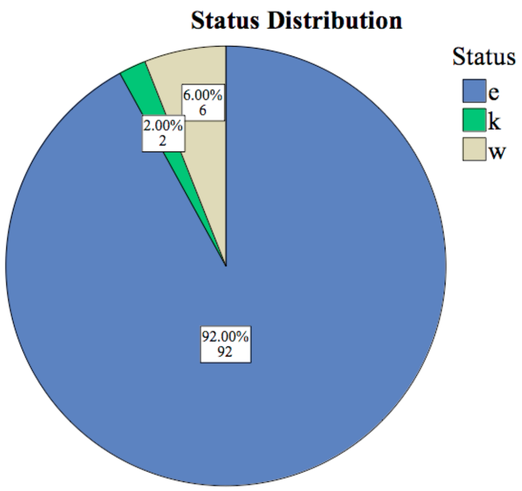

Fig. 10: During the standardized program, 94 reed buntings were ringed, 6 were recaptured and 2 controlled, ergo recaught after at least one year.

Length of Stay of Reed Buntings in the Nature Reserve

Ringnumber	Time span (h)
14375164	13
14375206	72
14375269	86
14375474	17
14375506	16

Fig. 11: The time span that the ringed birds spent in the nature reserve before being recaptured again, varies from 13 hours to 3,5 days. The first column shows the ringnumber of the relevant birds.

Fig. 12: This histogram depicts the sex and age distribution of reed buntings during the project. The age code can be translated as follows: 3 – born this year, 4 – born this year or older, 5 – born last year, 6 - born last year or older, 7 – born two years ago, 8 – born two years ago or older, 9 – born three years ago.

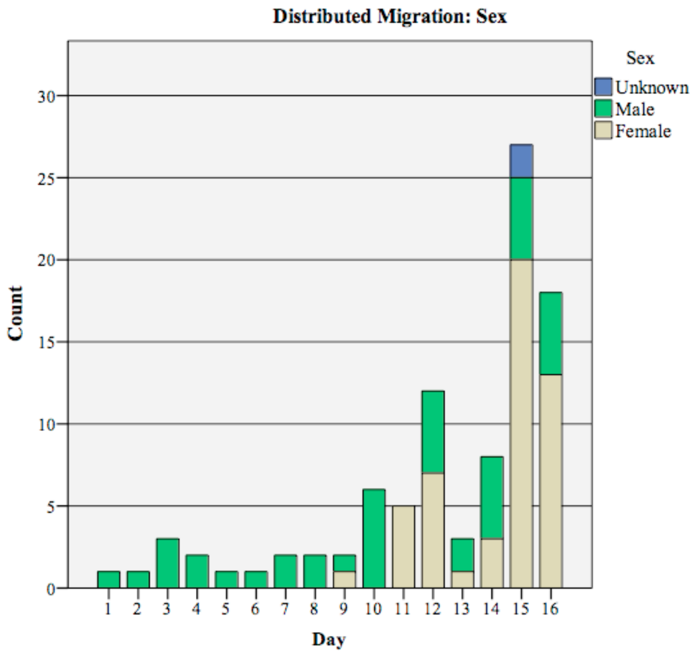

Fig. 13: Male reed buntings were caught from the first until the last date, whereas female birds were firstly caught in mid March.

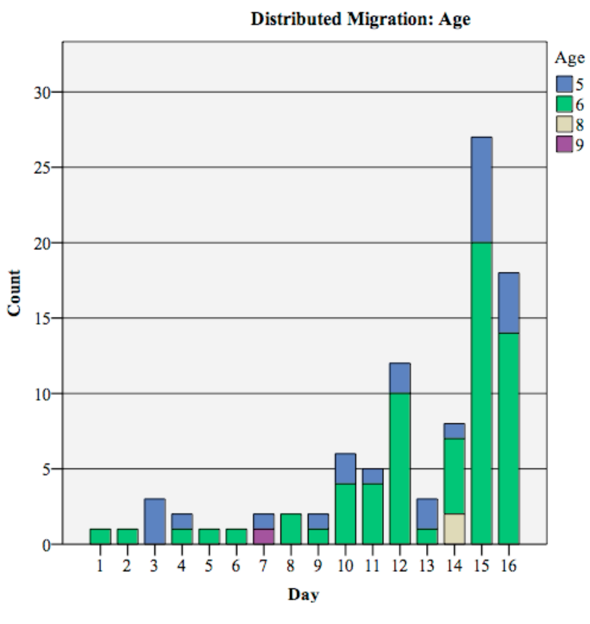

Fig. 14: Most of juvenile birds, encoded as 5, were caught on the 15/16. date. The three confirmed adult birds, encoded as 8 and 9, flew into the nets before this main migration peak on the 7. respectively 14. date.

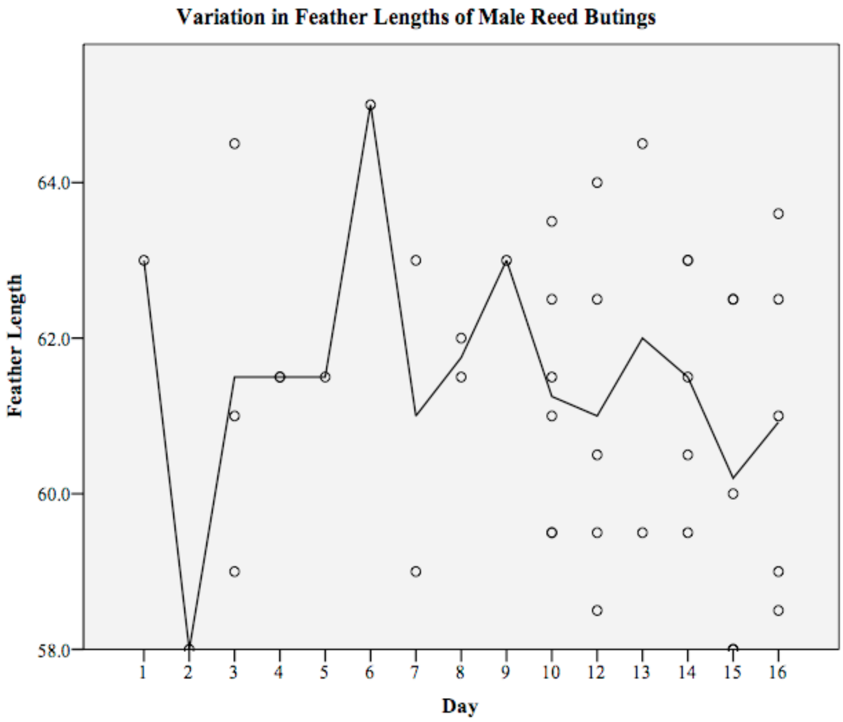

Fig. 15: Scatterplot depicting the variation in feather lengths (mm) of male reed buntings over March. An interpolation line was added in order to outline the negative trend.

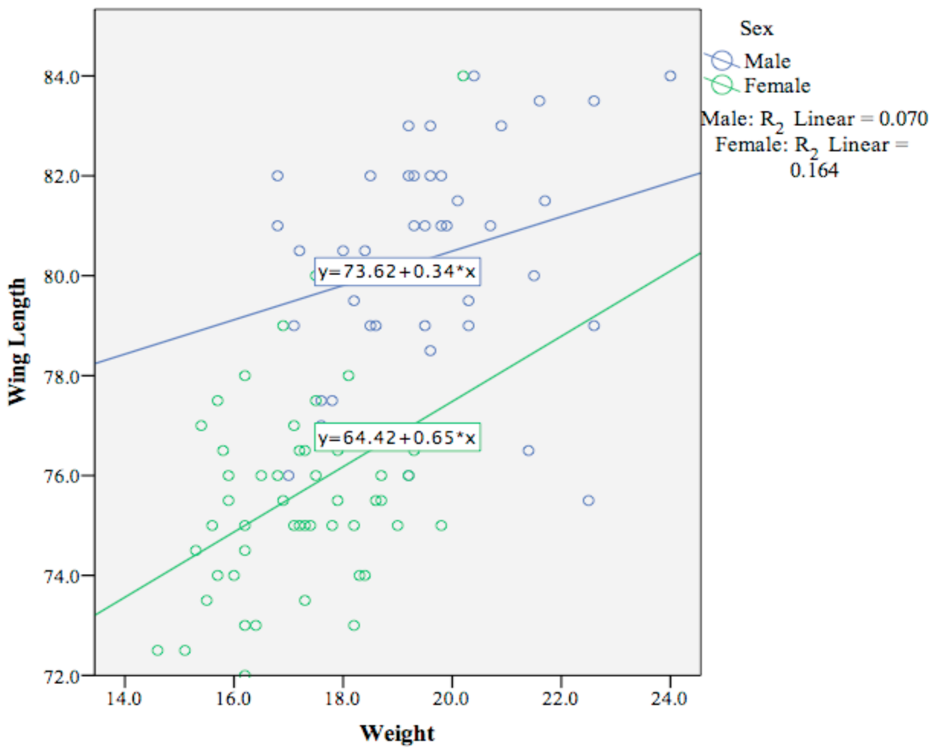

Fig. 18: The Scatter plot between wing length (mm) and weight (gr) depict moderate positive correlations with high dispersions along the regression lines. Increasing values in wing length are linked with increasing weight values, both for male and female individuals.

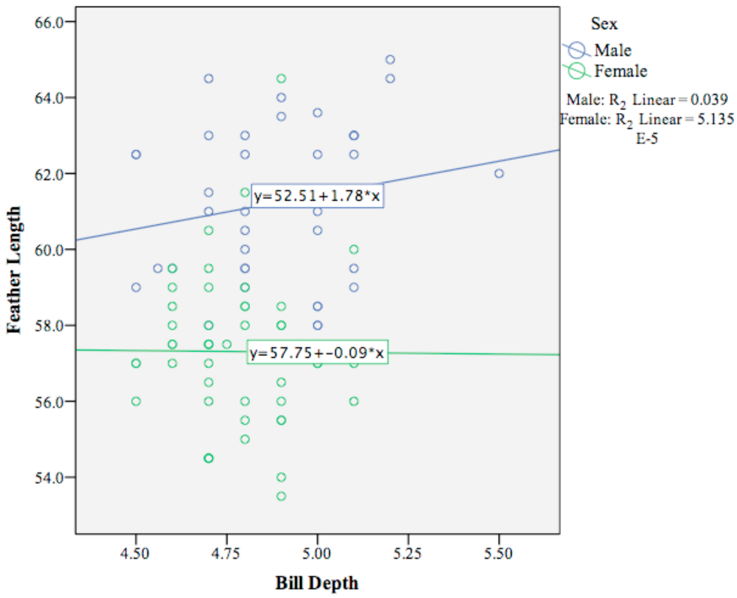

Fig. 19: The Scatter plot between feather length (mm) and bill depth (mm) depicts moderate to zero correlations with very high dispersions along the regression lines. Increasing feather length values cannot be linked with higher bill depth values.

Pic.2: A female reed bunting aged as juvenile with the typical striking defined eye stripe.

Pic.3: A male reed bunting aged as juvenile bird. The typical black head plumage is partly still concealed by the brownish feather tips. Due to wear, these will become more prominent with progressing spring.

Morphometric divergence between passing and local breeding birds

In order to depict different biometrical measurements between passing / northerly breeding individuals and local breeding birds just with the provided means, two possibilities showed up, of which only one was chosen. Firstly one can compare the totality of birds caught during spring migration with those caught during the breeding season. Since the number of northern reed buntings caught each year in Schlammwiss in Spring should be relatively low, the supposed higher measurements in wing length or bill depth wouldn't significantly affect the means in biometrics and thus would not depict differences in biometrics. Another more certain and effective way presents comparing measurements of foreign ringed birds controlled in Schlammwiss with local breeding birds. For this comparison, all of the former catches of reed buntings with rings from ringing stations from northern Germany or higher latitudes were chosen. All in all eight northern reed buntings were controlled at Schlammwiss, three birds ringed in Stavanger, Norway, four from the German north-eastern Island of Hiddensee and one from the German north-western Island of Heligoland. These measurements were compared to those of 14 adult reed buntings, caught during the breeding season in Schlammwiss. Since only the wing lengths had been collected during the past years, this was the only comparable biometric. A two-way ANOVA was conducted that examined the effect of origin (local or northern bird) and sex on wing length. First of all means in wing lengths of reed buntings of both male and female sex were respectively higher in northern reed buntings (♂: 83,5+-0,7; ♀: 77,3+-1,5) than in local birds (♂: 80,25 +-0,98; ♀: 73,68+-2,59). Whereas the two-way ANOVA did not show a statistically significant interaction between the effects of origin and sex, simple main effects analysis showed that northern reed buntings had significantly higher wing lengths than local ones ($p = 0.002$). Although sample size was not very large, statistical power of the concerning test proved to be 0,928. Depicting a 98 % chance that (with a sample size of 22, a p-value of 0,02 and a effect size of 0,437) the test is detecting a difference that is really there and the 2% unlikelihood of a type II error.

4. Discussion

Before discussing certain results from this study, that is specifically to say catching rates, migration peaks and distribution patterns of sex or age, one has to point out that the results from work involving the use of tape luring need always careful interpretation, this has been pointed out by several studies (Wojczulanis-Jakubas et al. 2016; Gregory et al. 2004; Schwilch et Jenni 1999; Arizaga et al. 2015). Especially when estimating migration intensity. As tape luring with its effects on the catching numbers in the reed bed was part of the research goals and was indispensable, the only way to create more reliable data was by standardizing the manner in which the tape was played (recording, time of day) (Gregory et al. 2004; Schwilch et Jenni 1999). Furthermore can differences in measuring techniques between the ringers (especially wing lengths and bill depths) potentially be a problem for age, sex or population comparisons because they will result in significant differences given not enough sample size.

The seasonal course of spring migration in March started with the usual calm catching rates; primarily species who used the reeds as roosting quarters because of its quiet and protected character such as yellowhammers, blue and great tits, robins, white wagtails and common starlings were caught. Hence catches during late afternoon were until mid March considerably higher. Partly this was also due to the fact that on the first four mornings, the nets were covered in frozen moisture until dawn and thus visible for birds. From 15 March onwards passage migration of reed buntings slowly increased from under 5 individuals per day to 27 individuals on the 24 March, which is considered as migration peak. The passage migration of chiffchaffs however started with an early bird on 8 March, increased from 4 birds on 21 March to 10 birds on the last recorded day, 25 March. Whereas the migration peak of reed buntings in the nature reserve Schlammwiss during spring 2016 is definitely situated in late March, chiffchaffs' passage migration could be still increasing after March with the peak situated in early April. The increasing spring migration in the second half of March is obviously also accompanied by an increasing ratio between new ringed birds and recaptures due to the influx of new migrators. Regarding the catching rates of the different nets, logically longer nets showed higher catching numbers. However some nets seemed to be particularly effective for catching lots of birds especially reed buntings such as R3 and R8. This may be linked to the fact that these nets were erected over the open water surfaces of the ponds (R3) or stood in knee-deep water where quite many flying insects are found which may attracted foraging reed buntings and increased the chances for catching the birds. Byers et al. comment in the work of buntings and sparrows in the reed bunting's abstract on the habitat preference as being among others marshy areas with reed growth and intense soil moisture. As to the effect of tape luring on the catching rates, the main expectancy is that with tape luring a considerable number of new birds would be attracted to the site as well as the capture probability of birds already present would be increased. However in this study the results of the Mann – Whitney U test could not underline this hypothesis and could not depict a significant difference in catching rates. Nonetheless just accepting the null hypothesis would be too short-sighted, since the real reason could lie within different problems. On the one hand is analysing data, which is not normally distributed, and so using a non-parametric test linked with less statistical power than parametric equivalents. On the other hand, could the catching rates on the days without tape luring have been affected by the days with tape playing. Since reed buntings can obviously stay in the nature reserve as long as up to 3,5 days and the tape was turned on and off alternately during one week, it is well possible that a bird attracted by the sound would stay longer in the reed bed and eventually get caught during a session without the speakers turned on. This complementary effect is likely to have influenced the collected data. Furthermore could the song of the barred warbler, which was used for luring, have different effects on different species and unevenly influence the catching rate and composition.

According to some studies about migration periods of reed buntings, adult males depart sooner on spring migration than younger and female birds (Christen 1984; Villarán et Pascual- Parra 2003), mainly because they try to occupy the best suitable breeding territories as early as possible due to intra- and interspecific competition. Whereas the breeding success of female individuals is not linked to acquiring /defending the best possible habitat. Our study did confirm that male birds are the first migrators, which were caught from the beginning of the study on that is 29 February, whereas female birds showed up from 14 March. In total, 42 male and 50 female reed buntings were caught, whereas 2 individuals could not be sexed due to difficulties in identification. The general migration peak of the reed buntings was situated on 25 March with 27 birds caught in an afternoon ringing session lasting no longer than 3 hours. Byers et al. (1995) depicts in the reed bunting's abstract that northward migration begins around mid-February to early March and that the birds have left the wintering grounds by April. Concerning former ringing results from the station Schlammwiss, the date of migration maximum of reed buntings falls into the average time span and that is the last decade in March. Regarding the age distributed migration, a first obstacle was given by the difficulty in ageing reed buntings in spring. In autumn, the adult birds, which undergo a postnuptial moult including the complete plumage, are fairly distinguishable from juvenile birds with a summer partial moult. During this season, within a first calendar year bird, moult contrasts are often present in tail feathers, alula and tertials, which is however hard to detect. Adult birds generally show a uniform and freshly moulted plumage. In addition, the shape, texture and condition of tail feathers and primary coverts are helpful. Since the partial pre-breeding moult in winter is rather restricted and confined to the head, these criteria are theoretically still applicable in spring. However, the plumage of both juvenile and adult undergo a strong wear and abrasion in winter (Bell 1970; De La Puente et Seoane 2001; DigiGuide Ottenby). Hence the mentioned identification criteria from spring are weakened. Thus there was obviously a high proportion of birds, which could not be really aged and were encoded as "at least one year old". In order to avoid this ageing problem and nonetheless find out whether older birds are migrating before younger ones, an analysis of the variation in feather lengths of just male birds over the course of migration was executed. After general consensus and the biometrical results from this study, adult reed buntings show generally higher values in wing and feather lengths (Blümel 1982; Byers et al. 1995; Haukioja 1969). This analysis depicted the trend that feather lengths of male reed buntings are decreasing with the progressing migration, suggesting that larger proportions of second year birds are migrating in late season and vice versa adult birds ahead. Several studies showed similar results (Christen 1984; Villarán et Pascual- Parra 2003; Blümel 1982). Our biometric data confirm sexual size dimorphism. Males caught in the nature reserve Schlammwiss during spring migration had significantly higher means in wing/feather length and bill depth. Furthermore we found that males were heavier than females. These results could be confirmed by many studies in different regions spread over the species' distribution (Villarán et Pascual- Parra 2003; Haukioja 1969; Schmitz et Steiner 2006; Christen 1984). The same result can be drawn comparing different ages, although too few adult birds were identified and measured in this study to significantly confirm the statement. When comparing biometrical measurements to other studies, great care is needed since some measures can highly vary between seasons and populations from different regions. When comparing 'our' wing lengths (♂: 80,3 +- 2,25; ♀: 75,6+-2,1) to the measures in the comparison table shown in the study from Villarán and Pascual - Parra (2003), corresponding both to the *schoeniclus* subspecies, it becomes clear that reed buntings caught in Schlammwiss can be situated exactly between western and central European populations. Measures from Great Britain and Belgium show smaller means in wing lengths (B - ♂: 78,6 ± 2; ♀: 73,2 ± 1,9; GB - ♂: 78,0; ♀: 72,8), whereas means from Finland (♂: 80,9 ± 1,3; ♀: 75,1 ± 1,3) and Germany (♂: 80,5 ± 2,15; ♀: 74,6 ± 1,93) show comparable means in wing lengths (Collette 1972; Fennell & Stone 1976; Haukioja 1969; Cramp & Perrins 1994). Furthermore the same study distinguishes between populations overwintering in central Spain, northeast Spain, south eastern France (Camargue) and Venetia. Our measurements come closest to the means in wing lengths collected in north eastern Spain (♂: 80,3 ± 2,6; ♀: 74,8 ± 2,7), suggesting the interpretation, that reed buntings migrating through or breeding in eastern Luxembourg, are likely to overwinter in north eastern Spain. Quite high means were collected in the Camargue (♂: 81,3 ± 2,04; ♀: 75,9 ± 1,75) and in the province of Venetia (♂: 81,8 ± 2,3; ♀: 76,7 ± 1,4), implicating an overwintering area of larger eastern populations (Olioso 1987; Amato et al. 1994). Recapitulatory, the gradient within wing lengths of reed buntings in Europe is rather orientated in a west-east axis with increasing means in wing lengths with increasing continentality. Hence populations of reed buntings east northwards are increasingly longer winged because of selection pressure; since they are forced to migrate longer distances due to harsher climate situations on their breeding grounds during winter, the longer winged individuals are favoured because of an improved energetic efficiency during flight (Leisler et Winkler 2003). The results from the two way ANOVA, made during the study, support this fact. The northern reed buntings, which were ringed on Heligoland, Hiddensee and in Stavanger and controlled in Schlammwiss, showed significantly higher wing lengths than birds, which spent the breeding season in Schlammwiss. When analysing different geographical populations, bill depth can be considered a more reliable and repeatable measurement. This is due to the fact that it is a highly heritable trait and not as variable (with age or season) as wing lengths (Schmitz and Steiner 2006). According to Cramp and Perrins (1994), a continuous cline of increasing bill depth exists towards the northeast of the Western Palearctic reed bunting populations (ssp. *schoeniclus*). Thus bill depths of male reed buntings measured in St. Petersburg, Russia showed 5.4 ± 0.3 mm, in Lapland and Finland 5.3 ± 0.2 mm, in south Sweden, eastern Germany and Poland 5.3 ± 0.18 mm and in Ruthland, UK about 5,1 mm (Cramp & Perrins 1994). Our measurements with 4,9 ± 0.2 mm in mean bill depths of male individuals respectively 5,1 mm in bill depth of just adult male birds are aligned in this southwest – northeast gradient. As the reed bunting is the most variable species within the large *Emberizidae* family, having numerous subspecies described on the basis of bill size, body size and plumage colour, the variation in phenotype is complex and to a large extent clinal. When glancing over the different subspecies, birds with thick bills occur in the southern part of the distribution, whereas the thickness of the bill (as well as body size) increases towards the east and thin-billed birds occur further north (Neto et al. 2013). Variation in bill sizes within different subspecies of reed buntings is quite common and significant. For example has the subspecies *E.s. intermedia* in Italy significantly thicker bills than the nominate form (Grapputo et al. 1998), so does the subspecies E.s. witherby on the Iberian peninsular. This is mostly due to different foraging ecology, which has been associated with divergent selection and speciation (Neto et al. 2013). Reed buntings from the *schoeniclus* sp. are thought to have generally smaller bills, because they are feeding predominantly on small seeds during winter, whereas larger billed subspecies found in southern Europe seem to feed during winter on insects lying dormant inside the reed stems. The latitudinal climate gradient and the availability of different food sources especially during winter is thought to be the reason of this specification. When analysing different populations just within the ssp. *schoeniclus*, the above-mentioned variation in bill sizes towards north eastern regions however stands contradictory to the trend between the mentioned subspecies. Bill depths of reed buntings of the nominate form increase towards north eastern regions.

5. Conclusion

In conclusion, quite meaningful results concerning the analysis of the reed buntings derived from the standardized bird catching project in March. That the effects of tape luring in this study could not be highlighted is rather because of failing methods and a too short study length. Male and old reed buntings proved to be among the first returning individuals in spring migration, probably due to the improved experience concerning flyways and the need to procure the best habitats as soon as possible. When taking a closer look at the biometrics, male reed buntings show significantly higher measurements in wing and feather length, bill depth and weight. Due to the fact that age identification of reed buntings is quite difficult in spring, not many elder individuals could be identified as such. Therefor, significant difference of biometrical measurements between ages could not be observed. When comparing the measurements of bill depth and wing length with other European studies from different reed bunting populations, our data fitted neatly into the southwest – northeast gradient, with increasing values towards the northeast. This observation was supported by the results from the morphometric comparison between individuals caught in Schlammwiss during the breeding season and birds, which were ringed in northern Europe and recaught on passage in Schlammwiss with northern reed buntings having significantly longer wings. After all wing and bill morphology are both products of important selection pressures of migrating passerines, notably migration behaviour and general ecological factors such as habitat, food type, size of prey and feeding habitats (Winkler & Leisler 1992; Nowakowski et al 2014) and show in the case of the reed bunting *Emberiza schoeniclus* a demonstrable gradient towards the north east. To analyse them and point out differences between populations, proved rather difficult especially when being somehow locally restricted. Nonetheless with the reed bunting and its wide distribution, a perfect and most interesting case study is given. Further studies could be heading towards topics such as migration flyways or further population comparisons, especially with increasing data collection of biometrical data such as bill size combined with wing length.

Annex

Statistics

Sex			Winglength	Featherlength	Weight	Billdepth
.0	N	Valid	2	2	2	2
		Missing	0	0	0	0
	Mean		74.750	57.000	18.150	4.8500
	Median		74.750	57.000	18.150	4.8500
	Std. Deviation		.3536	.0000	1.2021	.07071
	Minimum		74.5	57.0	17.3	4.80
	Maximum		75.0	57.0	19.0	4.90
1.0	N	Valid	42	42	42	42
		Missing	0	0	0	0
	Mean		80.333	61.264	19.538	4.9062
	Median		80.750	61.500	19.500	5.0000
	Std. Deviation		2.2569	1.9604	1.7320	.21719
	Minimum		75.5	58.0	16.8	4.50
	Maximum		84.0	65.0	24.0	5.50
2.0	N	Valid	50	50	50	50
		Missing	0	0	0	0
	Mean		75.640	57.310	17.180	4.7780
	Median		75.500	57.500	17.200	4.7750
	Std. Deviation		2.1477	1.9997	1.3297	.15524
	Minimum		72.0	53.5	14.6	4.50
	Maximum		84.0	64.5	20.2	5.10

Fig. 16: Overview of morphometric parameters such as wing/feather length (mm), weight (gr) and bill depth (mm) separated into the different sex classes. Sex code: 0 – sex unknown, 1 – male, 2 - female

Age			Winglength	Featherlength	Weight	Billdepth
5.0	N	Valid	25	25	25	25
		Missing	0	0	0	0
	Mean		77.420	58.880	18.464	4.8880
	Median		76.500	59.000	18.200	4.9000
	Std. Deviation		3.6017	3.1201	2.3683	.16912
	Minimum		72.0	53.5	14.6	4.50
	Maximum		84.0	64.5	22.6	5.20
6.0	N	Valid	66	66	66	66
		Missing	0	0	0	0
	Mean		77.621	58.986	18.126	4.8070
	Median		76.750	58.500	17.800	4.8000
	Std. Deviation		2.9795	2.6236	1.7437	.19688
	Minimum		73.0	54.5	15.3	4.50
	Maximum		84.0	65.0	24.0	5.50
8.0	N	Valid	2	2	2	2
		Missing	0	0	0	0
	Mean		82.500	62.250	19.400	5.0500
	Median		82.500	62.250	19.400	5.0500
	Std. Deviation		.7071	1.0607	.2828	.07071
	Minimum		82.0	61.5	19.2	5.00
	Maximum		83.0	63.0	19.6	5.10
9.0	N	Valid	1	1	1	1
		Missing	0	0	0	0
	Mean		82.000	63.000	19.200	5.1000
	Median		82.000	63.000	19.200	5.1000
	Minimum		82.0	63.0	19.2	5.10
	Maximum		82.0	63.0	19.2	5.10

Fig. 17: Overview of morphometric parameters such as wing/feather length (mm), weight (gr) and bill depth (mm) separated into the different age classes. Age code: 5 – born last year, 6 - born last year or older, 7 – born two years ago, 8 – born two years ago or older, 9 – born three years ago.

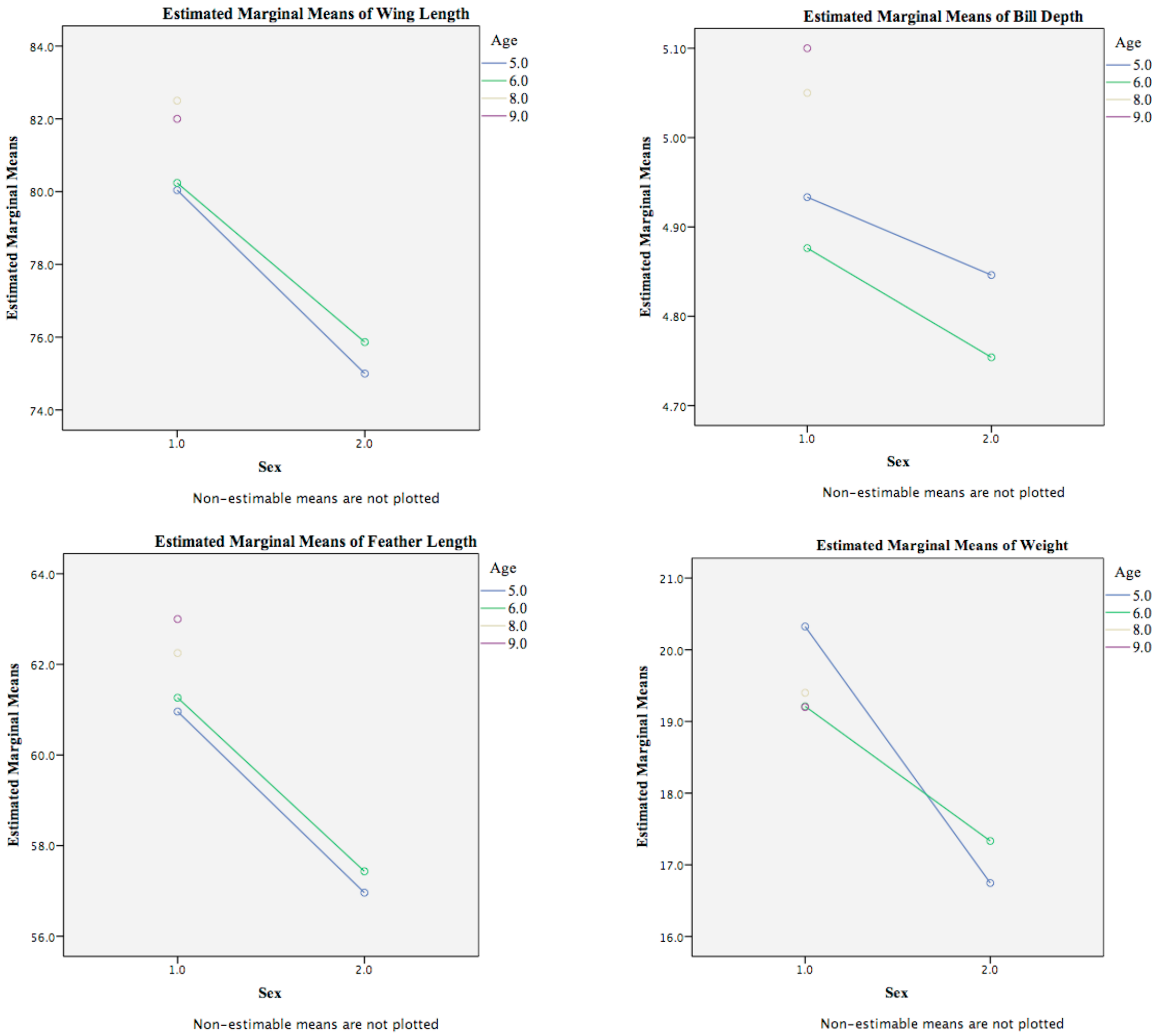

Fig. 20: Overview of the estimated marginal means of wing length, feather length, bill depth and weigth

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(Picture 1 – 3 are self-made)

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