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Bearded Tit (*Panurus biarmicus*) survey at Stanny House Farm

Dadam, D., Leech, D.I., Clark, J.A & Clark, N.A.

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British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

- Twenty-eight Bearded Tits were colour-ringed at Stanny House Farm in 2012 and 2013.
- Four survey visits were conducted along the perimeter dyke reedbed, from April to June 2013, using a tape-lure to locate birds.
- Parameters of the reeds: height, reedbed width, stem density (mean diameter of reed stems x mean count of reed stems) and amount of dead reed material present at the bottom of the reed, were collected and related to the position of Bearded Tits.
- Over the four visits, 17 sightings were of males, seven of males and females together, three of birds for which sex could not be established, and there were five recordings of contact calls where the bird was not seen.
- None of the birds seen were colour-ringed.
- Three to four pairs were estimated to breed at Stanny House Farm, based on the location of the sightings and the movement of birds during the survey visits. Estimated density of Bearded Tits was between 3.8 and 5.1 pairs/ha, which is higher than that reported by Beemster *et al* (2010).
- The two most important habitat variables to describe Bearded Tit presence were mean reed stem density and mean reedbed width. Mean reed stem height was also important when all visits were combined.
- It is recommended that colour-ringing should continue and that efforts should be made to resight colour-ringed birds. Expanding the survey to winter would also provide data on the use of Stanny House Farm during this critical period of the species' life cycle. Food sampling would also provide an indication of habitat quality, however this work would need professional input because of time constraints on the volunteers.

INTRODUCTION

The Bearded Tit is a specialist reedbed species, which breeds and overwinters in this habitat (Bibby 1983). The species is affected by cold winters (Campbell *et al* 1996), as shown by local decline in Leighton Moss (Wilson 1993), in particular when preceded by exceptional flooding (Wilson & Peach 2006). Breeding distribution in Britain & Ireland has increased by 84% since the first Breeding Bird Atlas (Sharrock 1976), and breeding hotspots are found primarily in East Anglia and more generally in the east of England and Scotland (Balmer *et al* 2013). The spread of Bearded Tits to new sites is due to a combination of their eruptive movements in autumn and winter and mild winters (Wernham *et al* 2002). However, the winter distribution of the species shows almost double the number of occupied 10km squares compared to the breeding season (Balmer *et al* 2013) as the species is dispersive (Snow and Perrins 1998). The latest population size estimates suggest that there are 630 breeding pairs of Bearded Tits in Britain (Musgrove *et al* 2013), and a recent survey showed that Suffolk has an estimated 108 breeding pairs, excluding the population at Minsmere Nature Reserve, making it the county with the highest number of breeding pairs in Britain (Holling *et al* 2013). Ringed individuals have shown that the species is site-faithful in the breeding season (Wernham *et al* 2002).

Nests are built within the reeds using leaves of dry reeds and other grasses (Bibby 1983), therefore the best nesting sites are those where reeds have not been cut often and hence have a layer of dead reed material at the bottom (Bibby 1983). In contrast, feeding areas are close to the water, have little vegetation debris (Bibby 1983) and are located along reed margins, which are the best habitat for Chironomids (Diptera), the main food of chicks (Beemster *et al* 2010, Bibby 1981). Bearded Tits therefore need heterogeneity of reed thickness in their breeding area so that they have both dense and mature stands for nesting and the more open stands that provide the main feeding area (Beemster *et al* 2010).

The species cannot be monitored satisfactorily through existing multi-species surveys such as the Breeding Bird Survey due to their secretive nature (Bibby *et al* 2000). Species-specific surveys, preferably using playback, are therefore the optimal way to count them (Bibby *et al* 2000). Bearded Tit surveys have been carried out in Britain and Ireland during the breeding season (Campbell *et al* 1996) and outside the breeding season have been conducted in Poland (Surmacki 2003, Surmacki & Stępniewski 2003).

Aims

The aims of the project were to:

- Estimate the number of breeding pairs
- Help to target ringing effort by mapping the presence of breeding adults
- Investigate if it was feasible to carry out a Retrapping Adults for Survival (RAS, www.bto.org/RAS) project by reading colour rings in the field.
- Explore habitat associations with distribution of birds at Stanny House Farm

METHODOLOGY

Study site

The study was conducted at Stanny House Farm near Iken, Suffolk, UK (TM432554). The site is privately owned and consists of coastal wet grassland with a dike along the perimeter. Reeds grow along a perimeter ditch at variable width, forming a long stretch of reedbed habitat. More scattered reeds are also present along ditches dividing the fields within the farm.

Colour-ringing

Birds were caught using mist nets during summer, from 2011, at several locations within the site (Fig 1). They were attracted, under special licence to cover the breeding season, using playback lures. Each bird was fitted with a BTO metal ring as well as a combination of colour rings on both legs to distinguish each individual in the field without the need to re-capture it. The age and sex of each bird based on plumage (Svensson 1992) was recorded. The study was part of a RAS project, which aims at estimating survival of target species (www.bto.org/ras) by recapturing or resighting individuals. Grit-trays, placed on bridges crossing the main ditch, were located with a Bushnell Trophy Camera to increase the re-sighting, as used successfully by John Wilson in Lancashire (*pers. comm.*).

Bearded Tit Survey

Four surveys were carried out approximately two-week intervals from the end of April to the beginning of June (Table 1) when the weather was suitable. The breeding season for many passerines started over ten days later than in previous years (NRS preliminary results 2013, www.bto.org/volunteer-surveys/nrs/results/nrs-preliminary-results-2013), therefore the start of the survey was delayed compared to mid-April suggested by Campbell *et al* (1996) to compensate for this. A visit was conducted every two weeks, weather permitting, to maximise the chances of recording all birds as their detectability may be affected by the stage of the breeding cycle they are at (e.g. less visible if incubating).

Table 1. Visit dates of Bearded Tit survey and habitat survey.

Date of visit	
Bearded Tit	**Habitat**
21 April 2013	21 May
7 May 2013	26 May
21 May 2013	14 June
10 June 2013	

All reedbed along the perimeter ditch was walked (Fig 1), and every 50 metres a recording of contact calls of Bearded Tit was played for 30 seconds using a Samsung MP3 player and attached speaker. The sound was switched off after half a minute to avoid birds becoming desensitised to the tape lure. A pause of a further 30-40 seconds gave time for any response to the tape to be heard. The position of the reply was mapped as was the position of the bird when first seen or heard. When an individual was seen, a note of its sex and presence or absence of colour rings was also made. Surveys took place on days without rain or strong wind, below Beaufort wind scale 2-3 (10 mph wind), to avoid biases in differences between sound travelling and bird propensity to move.

Habitat survey

A habitat survey was carried out during three visits (Table 1), as the time necessary to collect all measurements meant that the area could not be covered in a single visit. Measurements were taken approximately every 50 metres. The edge of the ditch was chosen as a standard point at which reed measurements were taken so that comparisons could be made between sections. Reed height, reedbed width, amount of dead reeds at the base of the reedbed and stem density (mean diameter of reed stems x mean count of reed stems) were measured. Height of reeds was estimated to the nearest 10 cm, whilst width was estimated to the nearest half metre. The amount of dead reeds at the base of the reedbed was recorded as the percentage of ground covered by dead reed material. The number of reeds was calculated by counting the number of reed stems contained within a 0.5x0.5 metre quadrant, partially open on one of the sides, which was slid within the reeds; counts were taken at waist height. The diameter of 10 reed stems per quadrant, at waist height, was also measured. Three sets of measurements of reed density and diameter of stems were taken at each 50-metre sampling point. Sampling of invertebrates as a measure of food availability within the reedbeds was beyond the scope of this project and it was not carried out.

Statistics

The average of each variable was taken per each 50-metre section. Correlation between variables was investigated using Linear Models (LM) with normal distribution. Separate Generalised Linear Models (GLM) with number of birds detected in each visit were constructed to investigate the pattern of birds observed in each visit separately, and subsequently by combining all birds seen in the four visits in a single variable to increase the sample size. Family error Poisson was specified and results were checked for overdispersion. All models were potentially zero-inflated, therefore Zero-inflated Poisson models (ZIP) were also used, and the difference between ZIP and GLM with Poisson errors were tested using the Vuong test. Explanatory variables considered were: reed height, reedbed width, percentage of dead reeds at the base of the reedbed, and reed density (mean diameter of reed stems x mean count of reed stems within the quadrant – see above for more details). Multi-variable models were constructed using variables that were not inter-correlated, but models with more than two variables did not converge due to small sample sizes, therefore no more than two variables were included in each model at one time. All analyses were conducted in R 2.13.2 (R Development Core Team 2011). All maps and distance between points were plotted in a Geographical Information System (GIS), using ArcMap v.10.0 (ESRI).

RESULTS

Colour-ringing

Seven ringing sessions were carried out in 2013 in different locations within the site (Fig 1) to target fledged birds (adult and first-years) and 28 birds were caught and colour-ringed. Nineteen unringed birds were caught, whilst eight more were retrapped from previous years and one bird caught in May had been ringed the month before at the nearby Hazelwood Marshes (Table 2). Grit-trays were not used by Bearded Tits on site, therefore no photographic resightings were made.

Table 2. Number of Bearded Tits caught in 2013 by ringed status, age and sex.

Numbers	New/retrap	Age	Sex
6	New	Adult	Male
3	New	Adult	Female
10	New	Juvenile	N/A
8	Retrap	Adult	Male
1	Retrap	Adult	Female

Bearded Tit survey

During the four visits, a total of 39 encounters were recorded: 12 on the first visit, 12 on the second, six on the third and nine on the fourth (Fig 1). Birds were scattered along the length of the perimeter ditch.

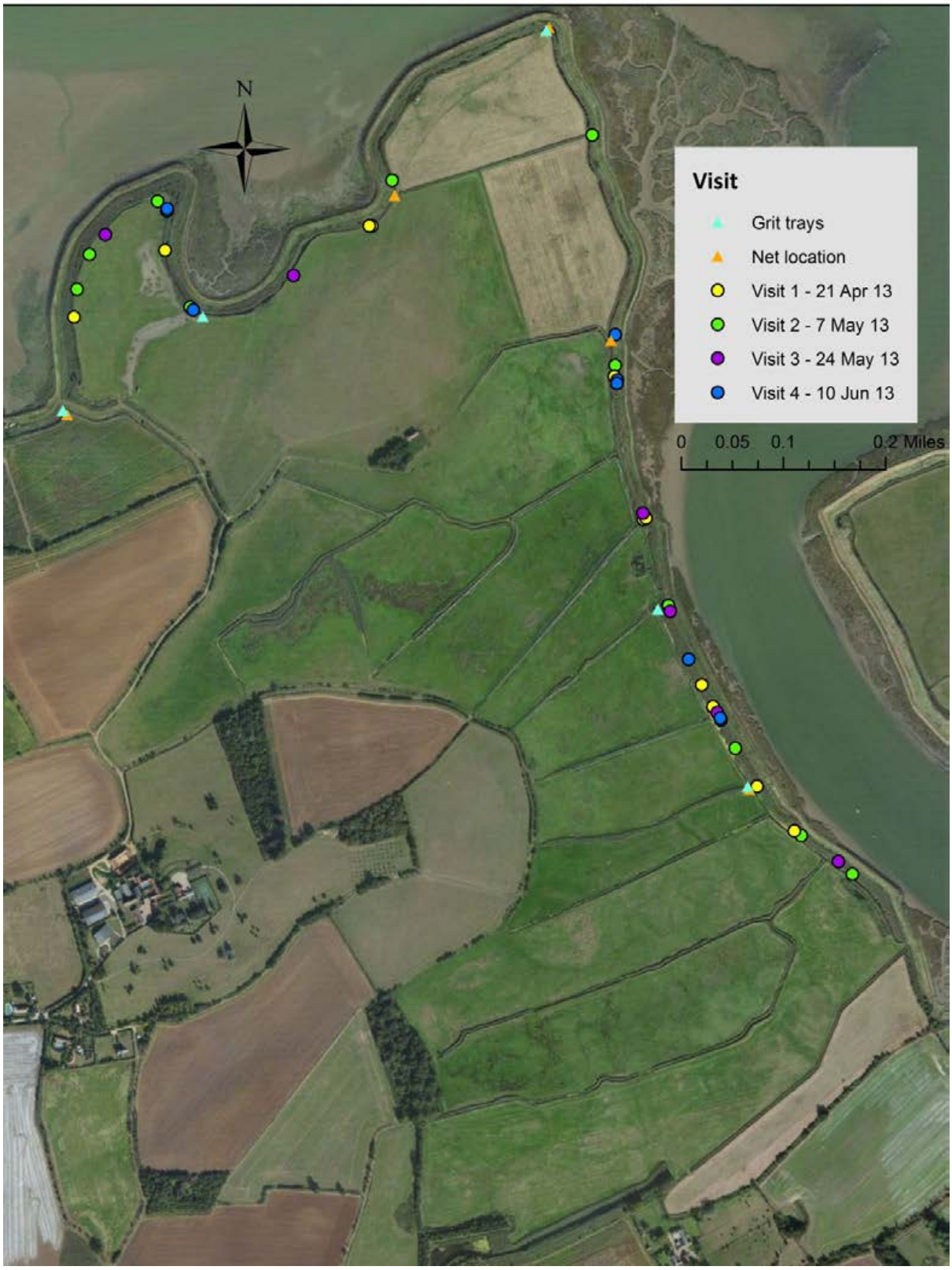

Figure 1. Position of Bearded Tits (birds seen and contact calls) by visit and location of mist-nets and grit trays.

For most encounters it was possible to sex the bird. All females were seen with a male, but there were 17 encounters of males when a female was not apparently present (Fig 2). The number of birds in each category, as well as contact calls, are presented in Table 2.

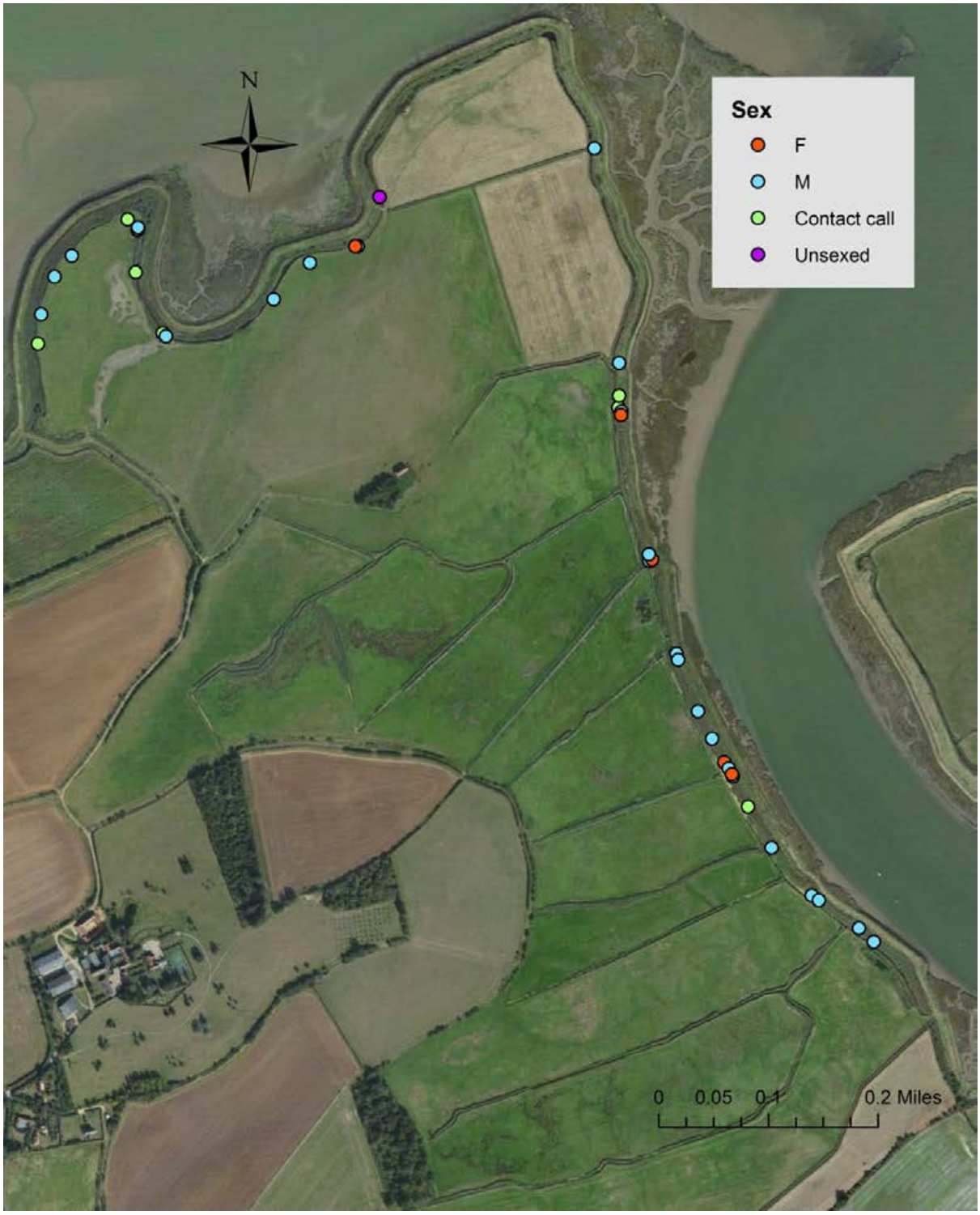

Figure 2. Position of Bearded Tits (birds seen and contact calls) by sex. All four visits combined.

None of the birds seen were ringed or colour-ringed, so it was not possible to identify any individuals. Estimation of the number of breeding pairs and their territory was therefore difficult, but based on the number of males and females present, and their movement noted during the survey, there are probably three to four pairs in the stretch of reeds considered. The area of reedbed considered occupies about 0.78 ha, therefore density of Bearded Tits can be estimated as 3.8-5.1 pairs/ha.

Habitat survey

The summary description of each explanatory variable (Table 3) showed that for debris percentage, diameter of reeds, reed count, height and width the distribution was not skewed, with mean and median having similar values. Density distribution was skewed to the right as indicated by the difference between mean and maximum value being twice as big as the difference between the mean and the minimum value (Table 4).

Table 3. Number of birds divided by sex and visit.

	Males alone	Females alone	Male+Female	Unsexed	Contact calls	Total
Visit 1	3	0	3	0	3	12
Visit 2	7	0	0	3	2	12
Visit 3	6	0	0	0	0	6
Visit 4	1	0	4	0	0	9

Table 4. Summary statistics of explanatory variables.

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Debris percentage	0	20	50	46.61	70	100
Diameter of reed stems (mm)	2.947	3.482	3.747	3.888	4.307	5
Reed count	28.33	53.67	71	73.05	92	137.7
Reed height (m)	1	1.55	1.8	1.822	2.05	2.7
Reed width (m)	1	1.5	2	2.569	3	8
Density	98.22	218	265.6	285.9	345.4	620.4

Correlations between variables are shown in Table 5. The percentage of dead reed material was positively associated with number of reeds (r^2=0.1, p<0.05) and reed height (r^2=0.25, p<0.001). Density was positively correlated with reed height (r^2=0.25, p<0.001). Finally, reed height was also positively correlated with number of reed stems (r^2=0.13, p<0.01).

Table 5. Significance of correlations between response variables. * p<0.05; *** p<0.001; N.S.= not significant.

	Debris percentage	Diameter of reed stems	Reed count	Reed height	Reed width	Density
Debris percentage		N.S.	*	*	N.S.	N.S.
Diameter of reed stems	N.S.		N.S.	N.S.	N.S	***
Reed count	*	N.S.		***	N.S	***
Reed height	*	N.S.	***		N.S.	***
Reed width	N.S.	N.S	N.S.	N.S		N.S.
Density	N.S.			***	N.S.	

Bearded Tits in relation to habitat

Density of reeds and mean reed width were the only two significant variables explaining the number of Bearded Tit contacts in visit 1 when both variables were considered in the model (density: $z_{2,58}$=2.1, p<0.05; reed width: $z_{2,58}$=1.97, p<0.05). However, only density was significant ($z_{1,58}$=1.99, p<0.05) when single-variable models were tested, and reed width was marginally insignificant ($z_{1,58}$=1.89, p=0.058). Figure 3 shows the density of reeds and position of Bearded Tits during visit 1.

Figure 3. Density of reeds (number of reeds per m^2) and location of Bearded Tits during visit 1 (21 April 2013).

No variables could explain the number of encounters in any of the other visits, but density was almost significant using data from visit 3 and in models where the variable was included alongside percentage of debris or reed width. Combining all visits together to increase sample size showed that density was positively associated with Bearded Tit distribution when considered as the only explanatory variable in the model ($z_{1,58}$=2.18, p<0.05) as well as when in a model with reed width (density: $z_{2,58}$=2.24, p<0.05; reed width: $z_{2,58}$=1.96, p<0.05). Reed width was almost significant when considered as the only explanatory variable in a model ($z_{1,58}$=1.9, p=0.056), as was reed height ($z_{1,58}$=1.99, p<0.05) (Fig 5). However, there were no colour-ring data to control for repeated sampling of single individuals, therefore combining visits may lead to a more significant result due to pseudoreplication of bird sightings. Vuong tests did not indicate that ZIP models fitted the data better than GLM with Poisson errors. Figure 4 shows the density of reeds and position of Bearded Tits when all visits were combined.

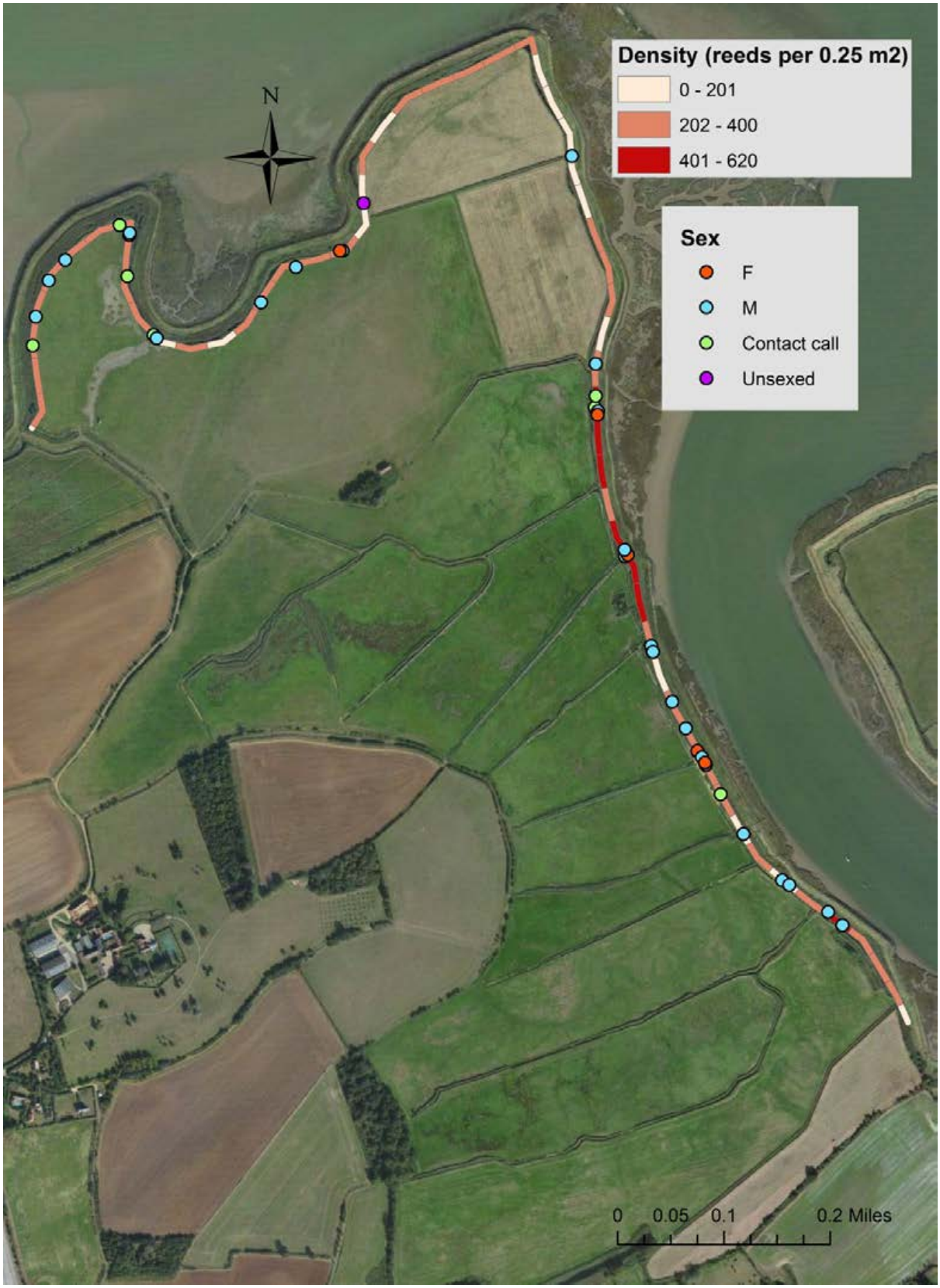

Figure 4. Density of reeds (number of reeds per m^2) and location of Bearded Tits during all visits, by sex of individuals.

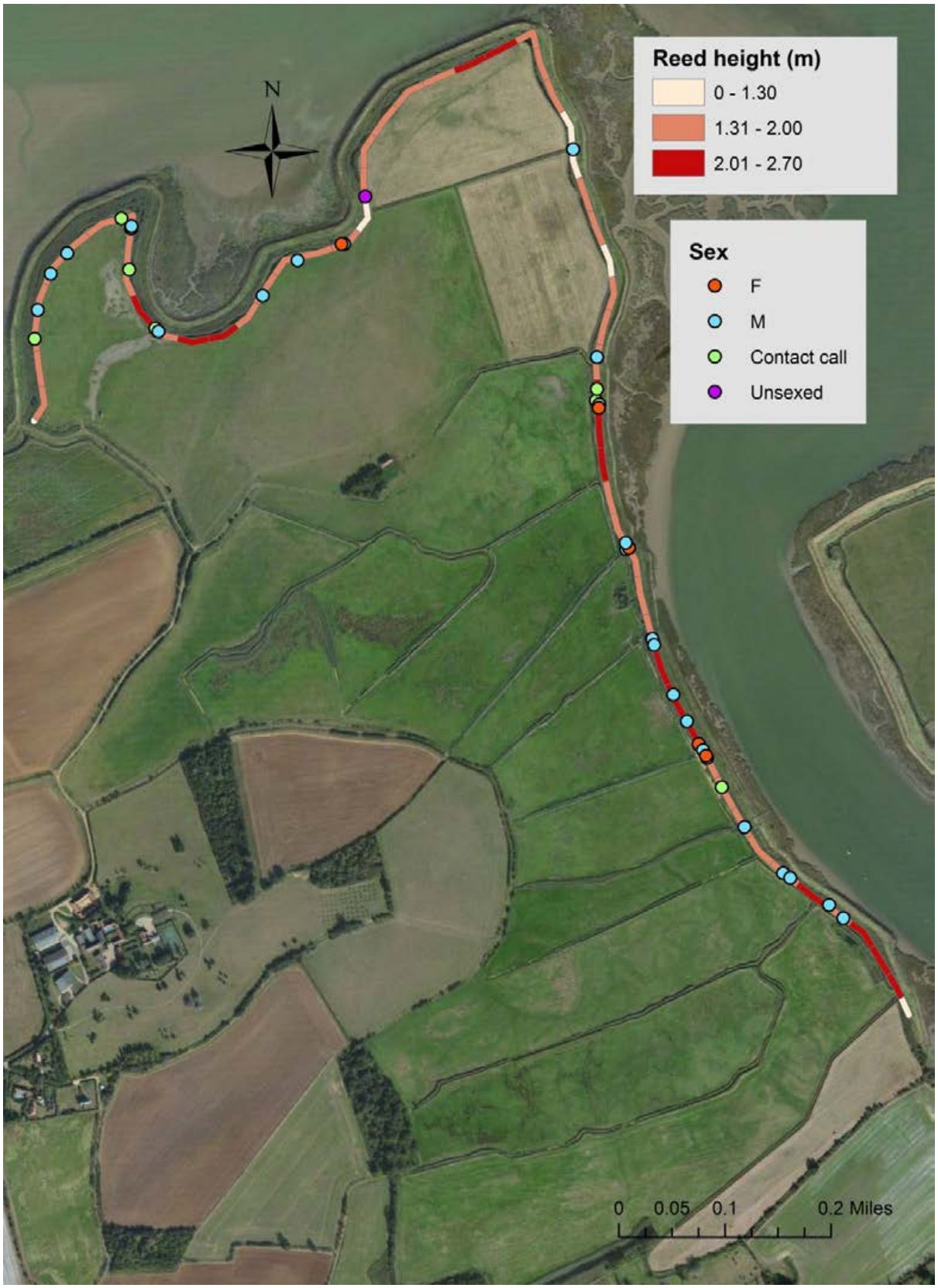

Figure 5. Reed height and location of Bearded Tits during all visits, by sex of individuals.

DISCUSSION

Bearded Tit survey

The higher number of birds during the early visits may reflect the progress of the breeding season as birds of both sexes were moving around the area more than later in the season, possibly still prospecting nest sites. In later visits, individuals might have been on the nest or feeding young and therefore be less receptive to the playback lure. Indeed, during visits 2 and 3 no females were identified, presumably because they were on the nest, whilst there was a peak in males, presumably moving around foraging. However, some unsexed birds were also recorded during those two visits (Table 3), and it cannot be excluded that those individuals were females.

Birds were checked for presence of colour rings but none of the individuals recorded was ringed, therefore it is possible that none of the colour-ringed birds bred at Stanny House Farm. It cannot be excluded that some contact calls had come from ringed birds, but this is unlikely as no birds with colour rings were seen during the four visits, although unringed birds were seen in the vicinity of contact calls in previous or following visits (Fig 4). One possible explanation is that in winter the site may be used by over-wintering birds, as influx of Bearded Tits in Britain during the winter months is a well-known phenomenon (e.g. Campbell *et al* 1996) and Bearded Tits are recorded in autumn and winter outside their breeding sites (Surmacki & Stępniewski 2003). Ringing recoveries from Britain have shown that some adults migrate in autumn, sometimes in pairs, away from the breeding sites most to distances over 20 Km with many birds returning to the same breeding site in spring (Wernham *et al* 2002).

The estimated density of 3.8-5.1 pairs/ha was higher than 2.6 pairs/ha found in a study based on a large area of reedbeds in the Netherlands (Beemster *et al* 2010). This difference may be due to two main factors:

i the habitat at Stanny House Farm can sustain a higher density of birds than in the Dutch study; this may be due to an 'edge effect', as the above study was conducted on patches of reedbeds, instead of along a linear feature such as in the current work.

ii the birds also use the reeds growing between fields, an area that was not accounted for in the density estimate, therefore the total area of reeds considered should be greater (and consequently the estimate number of pairs per hectare would be smaller).

During surveys visits it was noticed that Bearded Tits that were replying to tape lures were moving to the playback lure from up to around 20 metres away (or become visible from that distance whilst travelling towards the tape), and they subsequently returned to where they had come from. This suggests that, in absence of colour-marked individuals in the survey, the estimate may be high as the same individuals may have been sighted in different locations. The species is non-territorial even during the breeding season (Bibby 1983) and several authors have noted that birds moving up to 400 metres in search for food during the breeding season (Bibby 1981, Beemster *et al* 2010), although flights shorter than 100 metres are the most frequent in habitats with high food abundance (Beemster *et al* 2010).

Bearded Tits in relation to habitat

The two most significant habitat features explaining presence of Bearded Tit were reed density and reed width. Density of reeds had been found to be positively associated with Bearded Tit presence in a large reedbed system in France (Poulin *et al* 2002), whilst one of its components, diameter of stems, had been identified as important during a study in Slovakia (Trnka & Prokop 2006). In this study, however, the same feature was not significant when not included as the combined-variable "density". The third habitat feature associated with the presence of the species was height of reeds. This was significant only when all visits were combined together, suggesting that it may not be as an important feature as density and width. An alternative explanation may be that in 2013 the growth of reed stems occurred very late (*pers. obs.*) due to the cold weather, therefore measurement was taken on old stems. It was surprising that the amount of dead reed material was not significant, as previous authors had reported that this feature is associated with good nesting sites (Poulin *et al* 2002, Bibby & Lunn 1982), but the late growth of reedbeds may also have influenced this aspect. Another explanation could be that the species does not breed in the reedbeds considered, but they use them only for feeding. Nest finding was beyond the scope of this project due to time constraints, but adults were seen carrying food and dropping into the reeds at a distance from the observer, suggesting that there were active nests in the stretch of habitat considered.

CONCLUSIONS AND FURTHER WORK

The Bearded Tit survey at Stanny House Farm suggests the presence of three to four pairs along the perimeter ditch during the breeding season. None of the birds seen had a colour ring, therefore it was not possible to be certain about the number of pairs, and the figure above remains an estimate. The number of pairs suggests a higher density than that found by previous authors (Beemster *et al* 2010) and a wider survey within Stanny House Farm, including the thinner reedbeds along the ditches between fields would increase the chances of re-sighting colour-ringed individuals. In addition, point counts from a vantage point, such as the sea wall, may help to identify nest locations (Campbell *et al* 1996) and target ringing efforts. Invertebrate sampling, especially of Chironomids (Diptera), which are the main source of food for nestlings (Bibby 1981, Beemster *et al* 2010), would help identify reasons for the apparently higher density estimated at Stanny House Farm.

The main habitat features that were associated with Bearded Tit presence were reed density and reed width. These variables have been associated with good nesting sites by previous authors, as the species needs a combination of drier and open water-edge habitat, associated with wide strips of dense reedbed to breed successfully (Campbell *et al* 1996, Poulin *et al* 2002, Trnka & Prokop 2006).

Further work should include continuing to colour-ring individuals and re-sighting them, trying to catch birds at different sites within Stanny House Farm to maximise the likelihood of subsequent resighting of colour-ringed birds in the same area. A RAS project is likely to be possible, but its feasibility was not clear from this first year of the project, as no colour-ringed individuals were re-sighted, although some individuals were retrapped. The use of grit-trays with associated cameras should continue, varying their location to help re-sighting of birds. Food sampling would also

provide an indication of habitat quality but it would need professional input because of time constraints on the volunteers.

Presence of the species in winter could also be included by surveying the narrower reedbeds along the dikes between fields. This would allow data on the importance of Stanny House Farm in winter to be gathered – important information for a species which is sensitive to cold winters and experiences high mortality during that period (Campbell *et al* 1996).

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