An Exploration of Yellowhammer Data: Distribution, Presence, Relative Abundance and Associated Factors in Ireland

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Introduction

- Many ornithological datasets now exist – but with varying geospatial characteristics and resolutions
- Breadth and detail of environmental datasets is expanding continuously
- Bird Atlas has demonstrated significant decline in distribution of Yellowhammer *Emberiza citronella* – now on red-list of species of conservation concern
- Can further insights into Yellowhammer in Ireland be extracted from data gathered to date?

Methods

- 21 ornithological datasets containing 745,162 records (all species) consolidated at 10km resolution and transformed into consistent format: year, season, species, level of breeding evidence, validation status, quantity, location
- 6 environmental datasets consolidated at 200m, 1km square, and 6km square resolutions
- Combinations of datasets mapped and explored via potentially novel visualisations, correlation analyses, and principal component analysis

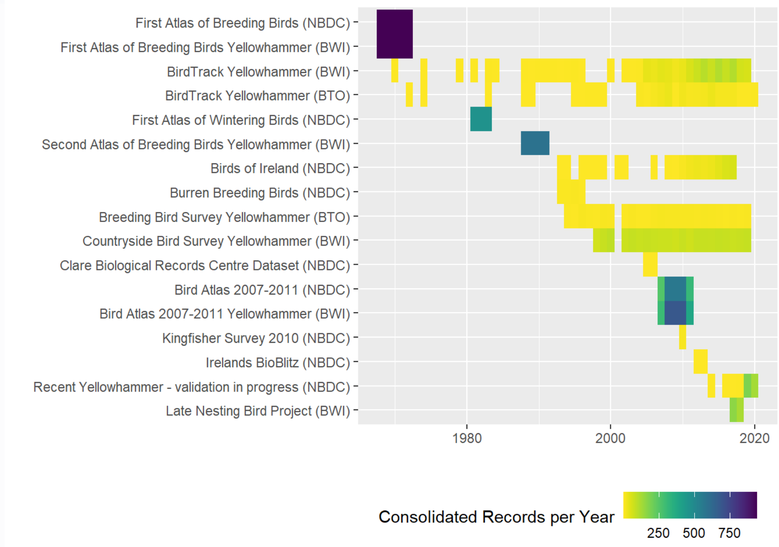


Fig 1: Source and timeline of all 21,974 Yellowhammer records after 10km consolidation

Results

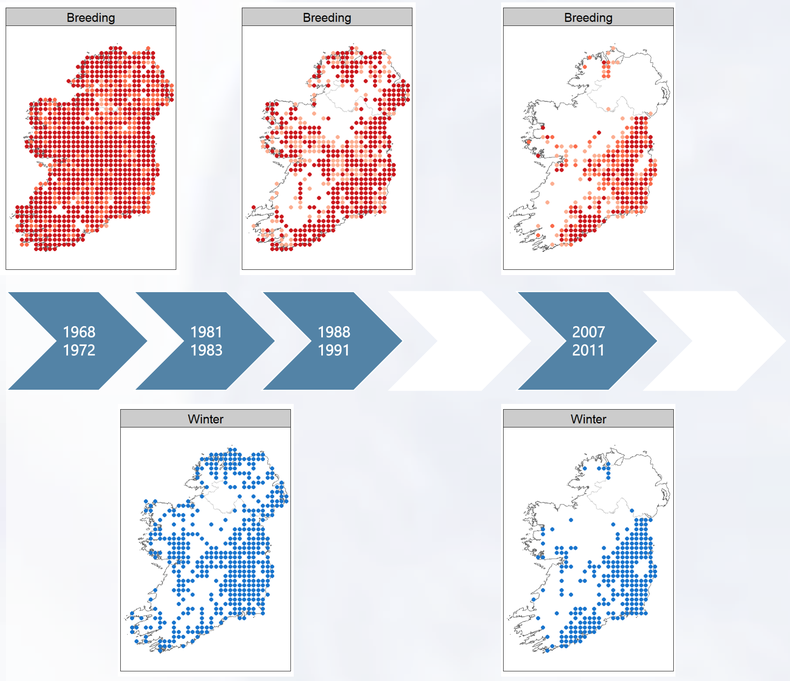
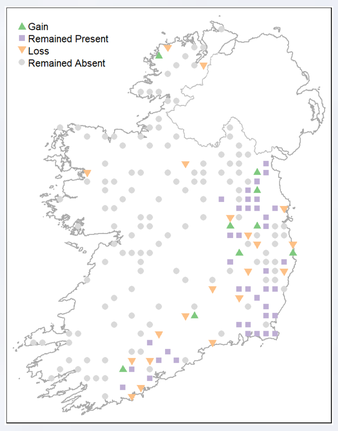
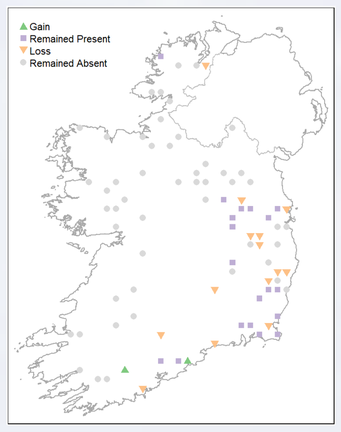


Fig 2: Distribution of Yellowhammer - Bird Atlases

200 CBS Squares fully surveyed both 1999 and 2019



85 CBS Squares fully surveyed both 1998-2000 and 2017-2019



Relative Abundance	CBS Squares	Relative Abundance	% of Initial Relative Abundance
In 1999	59	4.49	100%
In 2019	48	4.04	90%
Change		-0.45	-10%

Relative Abundance	CBS Squares	Relative Abundance	% of Initial Relative Abundance
1998-2000	33	5.55	100%
2017-2019	21	4.95	89.2%
Change		-0.60	-10.8%

Fig 3: Presence and relative abundance - CBS data

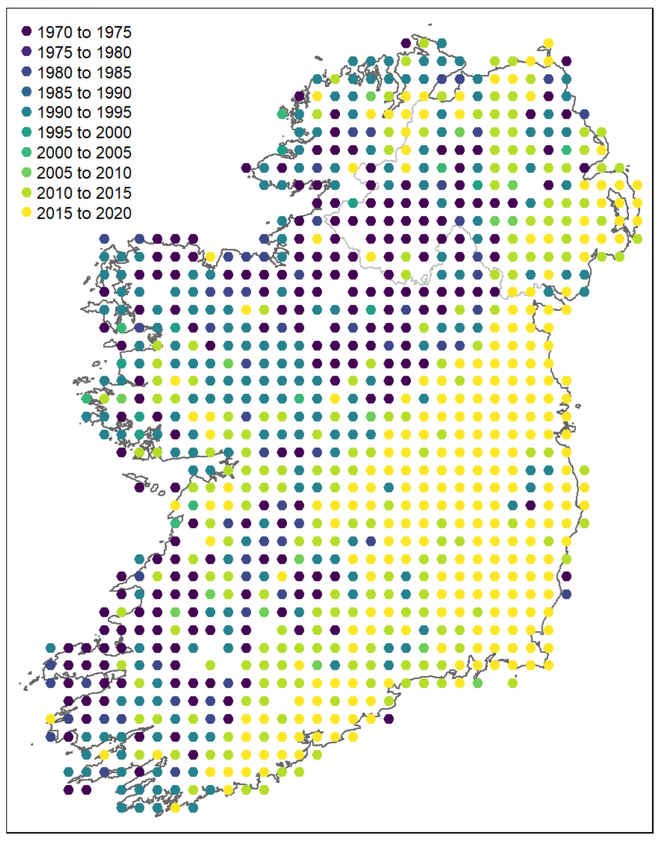


Fig 4: Most recent record of Yellowhammer - all datasets

Table 1: Strongest correlations between Yellowhammer presence and CBS habitat variables (p<0.0001)

Positive Correlation		Negative Correlation	
Variable	Spearman's Corr. Coefficient	Variable	Spearman's Corr. Coefficient
Primary Farmland: Near road (within 50m)	0.171	Secondary Semi-Natural Grassland: Cattle	-0.115
Primary Farmland: Horses	0.122	Primary Semi-Natural Grassland: Cattle	-0.113
Primary Human Sites: Gardens	0.100	Primary Heathland and Bogs: Mixed Heath	-0.109
Primary Woodland: Mixed (10% of each)	0.098	Primary Heathland and Bogs: Heath mixed with Rough Grass	-0.103
Secondary Human Sites: Area of large gardens	0.083	Primary Heathland and Bogs: Wet Heath	-0.094
Primary Human Sites	0.083	Primary Heathland and Bogs: Cattle	-0.093
Secondary Farmland: Horses	0.083	Primary Heathland and Bogs: Low Disturbance	-0.093

Table 2: Strongest correlations with environmental variables

Environmental Dataset	Variables	Resolution	Years	Presence		Relative Abundance	
				Positive Correlation	Negative Correlation	Positive Correlation	Negative Correlation
CBS Visit Data & Elevation	13	1km	All	Easting	Northing Elevation	Easting	Northing Elevation
CBS Habitat Data	463	1km	All	Dominant habitat of farmland near road or with horses, or human sites with gardens Secondary habitat of farmland with large gardens or horses	Semi-natural grasslands with cattle, heath habitats	Dominant habitat of farmland with horses, or near a road	Dominant habitat of farmland with improved grassland or treeless hedges Secondary habitat featuring scrub or young woodland
BBS Habitat Data	343	1km	All	Dominant habitat of farmland with tilled land, bare-earth or recently ploughed, or planted with spring cereal Secondary habitat of scrubland and ponds	Dominant habitat of scrubland, farmland with unimproved grass, mixed woodland	Dominant habitat of farmland with tilled earth, bare-earth or recently ploughed, or near a road Secondary habitat of farmland with improved grassland, horses and hedgerows without trees	Dominant habitat of farmland with sheep, unimproved grassland, improved grassland Secondary habitat of coniferous woodland and semi-natural grassland
CBS Habitat Data	463	200m	All	Dominant habitat of farmland near a road or with horses Farmland with autumn cereal, or hedgerow with trees	Dominant habitat of heathland, bog	Dominant of farmland with autumn cereal, tilled land, spring cereal, other stock or horses	Dominant habitat of farmland with improved grassland, or with hedgerows without trees
CORINE Land Cover	30	1km	2018	Non-irrigated arable land Complex cultivation habitat, construction sites, pastures	Peat bogs, coniferous forest, land principally occupied by agriculture with significant areas of natural vegetation	Non-irrigated arable land	Coniferous forest
CORINE Land Cover	30	1km	2000	(Construction sites not statistically significant)	(Negative correlation with coniferous forest not as strong as in 2018)	Non-irrigated arable land	Pastures
CORINE Land Cover	35	6km	2018	Non-irrigated arable land Complex cultivated patterns	Peat bogs, water bodies, land principally occupied by agriculture with significant areas of natural vegetation	Non-irrigated arable land	
Small Woody Features	5	1km	2015	Non-woody features	Additional woody features e.g. rejuvenating patches of scrub	Non-woody features	Additional woody features e.g. rejuvenating patches of scrub
Dominant Leaf Type	5	1km	2015	Non-forested areas	Coniferous forestry		Coniferous forestry

Acknowledgements

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- Analysis developed in R and QGIS, published open source by the open source community

Conclusions

- Disparate ornithological and environmental datasets can be merged to build a more complete understanding
- CBS Habitat data provides novel insights
- CBS Yellowhammer observations reveal ongoing decline in both presence and relative abundance

Photo of male Yellowhammer by David Prendergast

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In Memoriam

In memory of
Martin Charlton
1957-2021