Ecological Parameters

Diet of Farmland Birds

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Diet of Farmland Birds

- Why is this important?
- What factors influence the diet?
- What information is available and how good is it?
- How it can be measured?
- How should it be used in risk assessment?

Why is it important?

- Exposure (mg/kgbw/day) = FIR/bw * C * PD * PT
- FIR is dependent on the calorific value and assimilation efficiency of diet
- C is dependent on the diet and where it is obtained
- Birds and mammals may typically eat a mixed diet

What factors influence the diet?

- Focal species morphology
- Focal species adaptability to its changing environment
- Access to food – crop structure
- Abundance of food – influenced by crop and season
- Availability of food – combination of access and abundance
- Food preference – optimal nutritional requirements

Birds and mammals have generally evolved to exploit different food sources in different habitats

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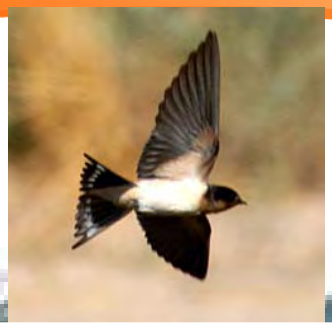

Aerial feeders

Foliar feeders

Ground feeders

Farmland birds and mammals are adapted to exploit food in a continually changing habitat

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Arable

Ground cover only in Plantation crops

Farmland is largely open field (arable) or open woodland (orchard/vineyard) habitat

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Crop height for foliar feeders?

Availability of food is influenced by crop structure

Percentage ground cover for ground feeders?

Preference and Availability?

- Morphology largely determines where an animal obtains it's food
  - Ground
  - Foliage
  - Air
- Preference is mainly driven by nutritional requirements (calorific content) and growth (protein)
  - Example: Adult birds feed their chicks on a higher protein diet than they require for themselves
- Availability is determined by abundance and accessibility of food
- Arthropod and plant communities in the same crops in major geographic regions of Europe are similar. Therefore diets for the same focal species are likely to show similarities

What dietary information is available and how good is it?

- Published animal diets from crop and faecal samples are available;
- Many reports are old and may not be relevant for modern agriculture;
- Often no reference to habitat where were samples taken;
- Diet proportions are not often reported for individuals;
- Diet proportions are often qualitative i.e. based on the proportion of animals where food item detected
- Diet proportions should be quantitative, based on the number or weight of food items present in individual animals
- Source of biases
  - Diet proportions
    - Frequency
    - Numbers of food items
    - Weight
    - Losses during digestion (especially soft bodied invertebrates)

Example of bias when expressing the proportion of aphids and caterpillars in the diet of birds by 3 methods

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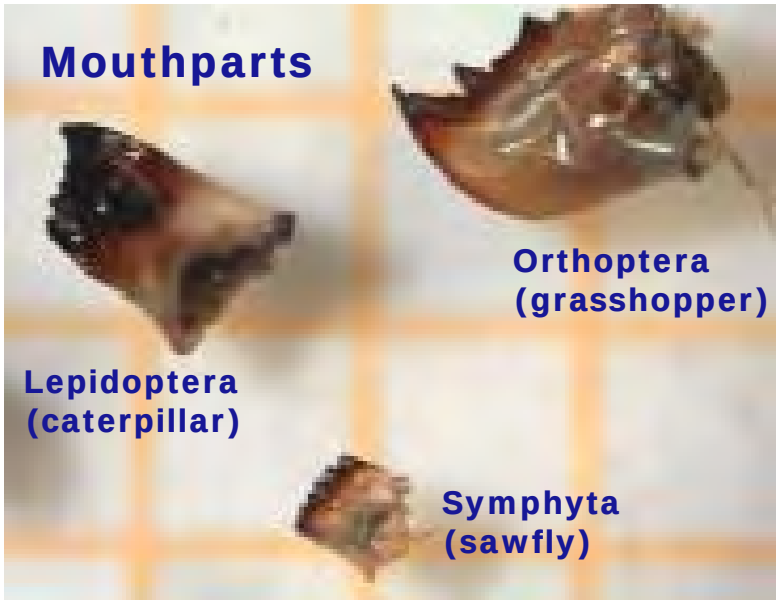
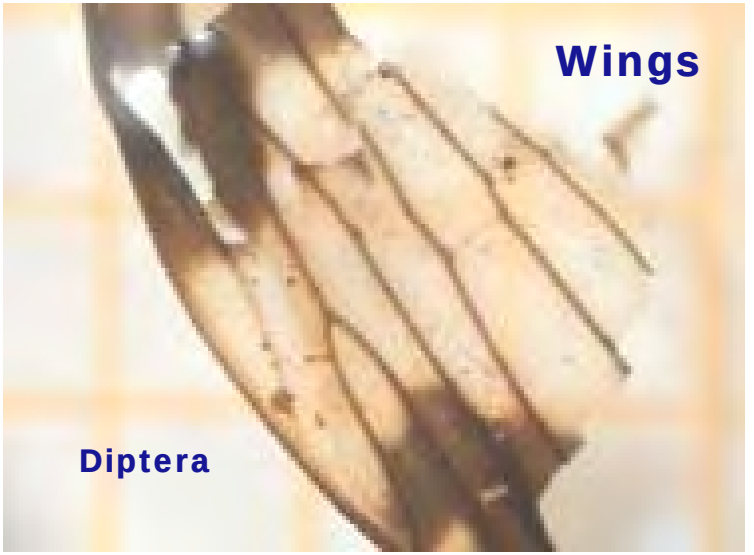
Small food items are over emphasised in the diet if proportions are not based on weight

Species	Diet classification to Order	Frequency of occurrence in diet (%)	Numerical proportion in diet (%)	Dry weight proportion in diet (%)
Yellow wagtail	Hemiptera	28	1.7	NA
	Lepidoptera larvae	24	9.0	NA
Cirl bunting	Hemiptera	25	1.0	0.75
	Lepidoptera larvae	35	1.4	14
Great tit	Hemiptera	35	67	8.2
	Lepidoptera larvae	60	7.8	35
Woodlark	Hemiptera	75	33	10
	Lepidoptera larvae	40	7.9	19

Example of faecal remains



1mm

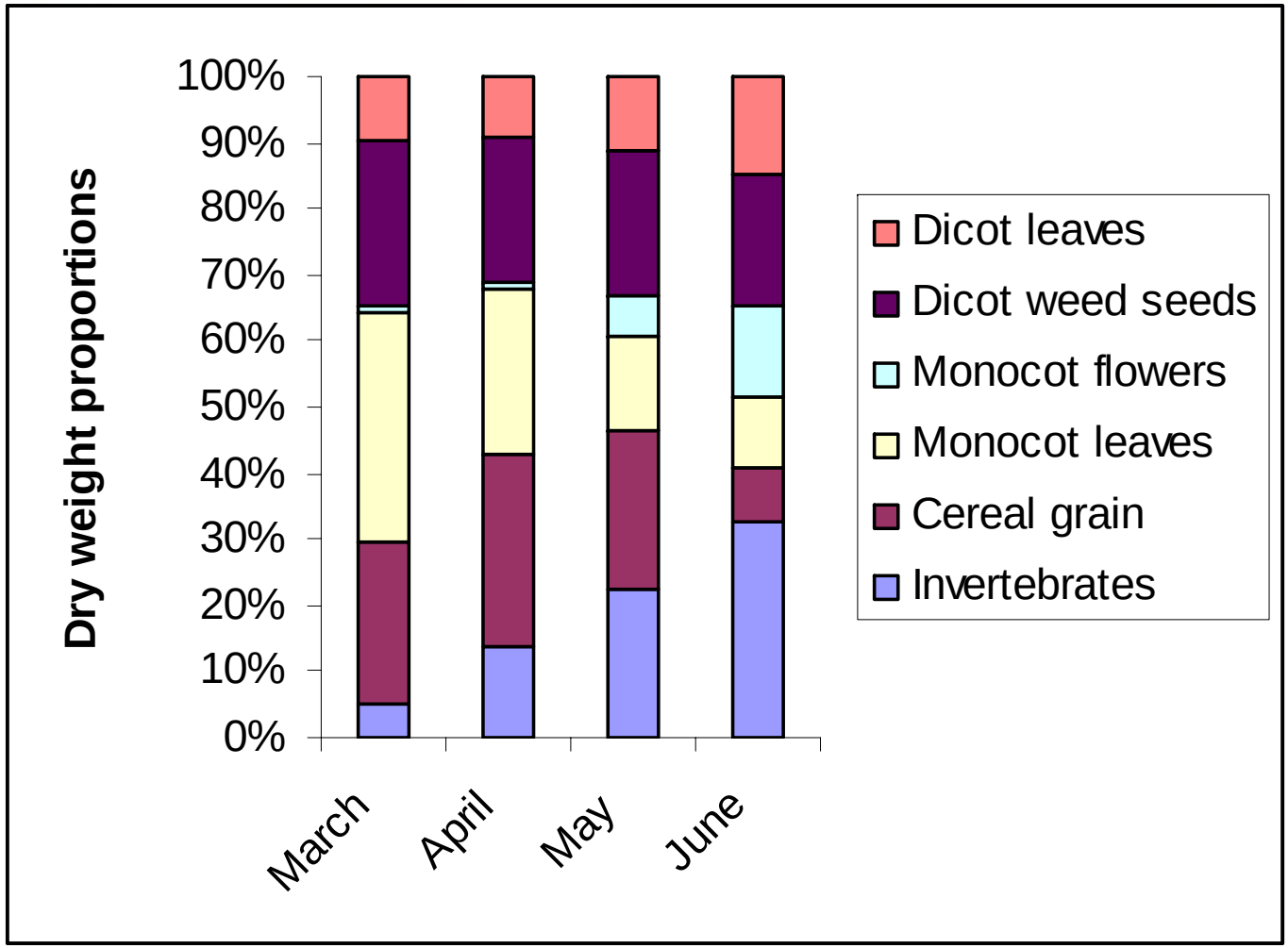


Correction factors - Examples

- Digestion (for faecal analysis)
  - Coleoptera, Myriapoda and Formicidae = X 2.5
  - Diptera, Hymenoptera, Neuroptera = X 3
  - Araneae, Lepidoptera, Larvae, = X 4
  - Lumbricidae = X 4.5
  - Homoptera (aphids) = X 18
- Length to Weight (for faecal - examples only)
  - Araneae - Weight = $0.08 \times \text{length}^{2.3}$
  - Lepidoptera larvae - Weight = $e^{-5.9} \times \text{length}^{3.1}$
  - Homoptera - Weight = $0.03 \times \text{length}^{2.6}$

Correction factors have been derived from regression analysis using several published sources including Jenni, Green etc

Good example from the literature for skylark (Green 1978)



- No individual bird data are available
- Availability of food on fields may have changed since 1978

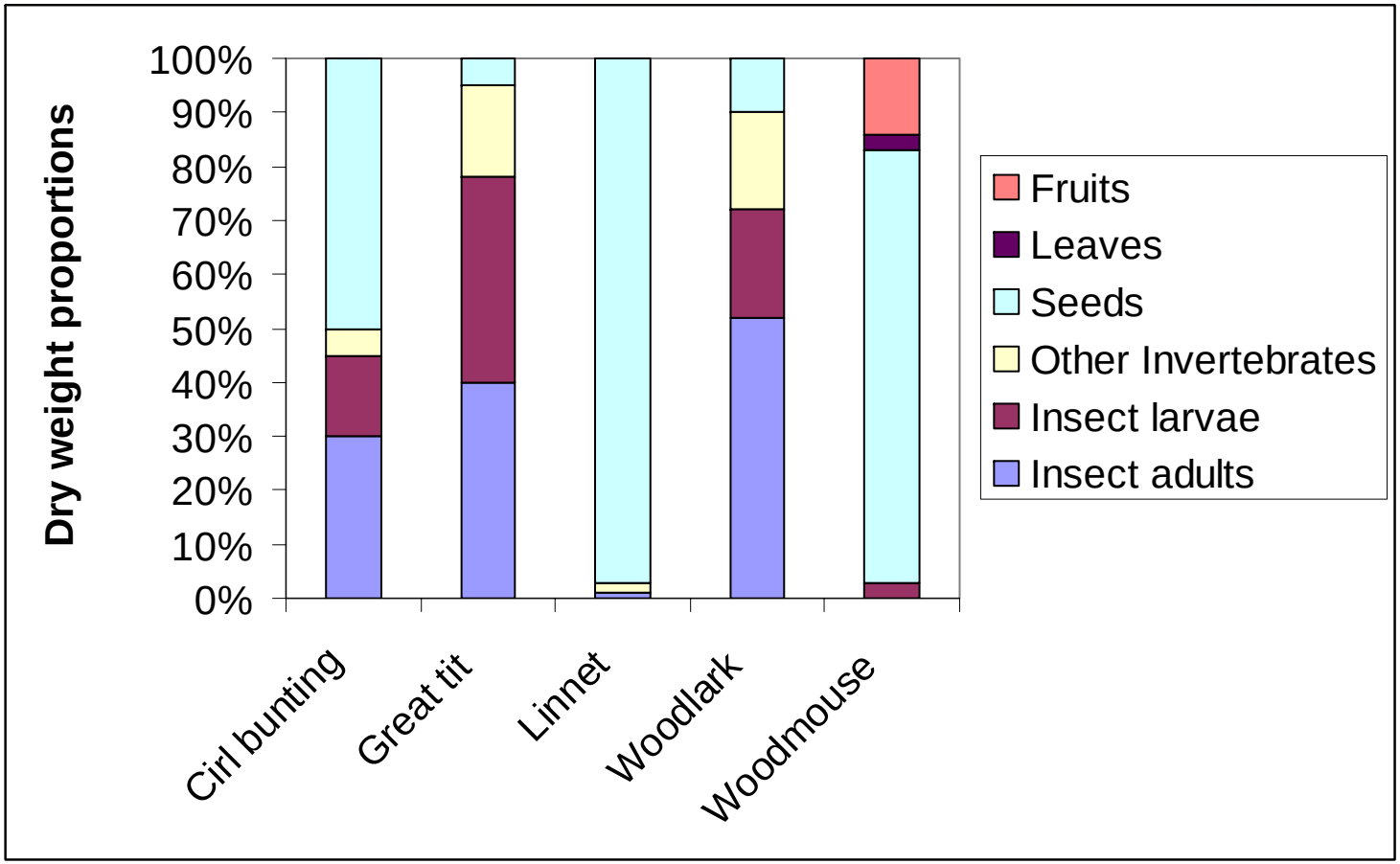
Requirements for risk assessment?

- Identify focal species
- Need quantitative proportions by weight
  - Faecal samples (or stomach flushing)
  - Reference collections for identification of food fragments
  - Recovery correction factors
- Collect in the crop of concern at the appropriate time of year
- Record crop structure and measure food abundance

Faecal sampling procedure

- Collect potential food material (arthropods, seeds and plants) as reference material to estimate
  - weight of food ingested from the lengths of fragments recovered
  - fresh and dry weights
- Catch bird or mammal in the crop
- Place them in the dark to defecate
- Disperse faecal sample in salt solution
- Examine sample macroscopically
  - Identify and measure the length of fragments to estimate numbers and weight of food items
- Apply appropriate correction factors to take account of losses of soft bodies animals during digestion
- Generate correction factors through additional feeding experiments if necessary

Recent example of dietary information for 5 focal species feeding in vineyards



Modern data collected in the crop during the main period of chemical treatment

Dry weight proportions corrected for losses during digestion

Use of dietary information

- The different food items may have different calorific values, dry matter contents and assimilation efficiencies
- This will affect the quantity of food eaten and has to be taken into account along with the RUD and bodyweight when estimation exposure (ETE)
- This can be done using a mixed diet model
- PSD have made one available on their Web Site
- Use appropriate RUD values and bodyweight for the focal species studied
- Estimate the daily exposure (mg/kg bw/day)

Use of the PSD mixed diet calculator for a Cirl bunting diet in vineyards

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Daily Consumption and Energy Expenditure for 24g Passerine

Species:	Passerine
Body Weight (g):	24
Proportion of diet based on	Dry

Food	% in diet DRY wt	KJ/g Dry weight	Non standard Assimilation efficiency	Assimilation efficiency	Wt (g) dry food consumed	Wt (g) wet food consumed
Dicot leaves		11.19		0.76	0.00	**0.00**
Grasses and cereal shoots		17.96		0.76	0.00	**0.00**
non-grass herbs		17.98		0.76	0.00	**0.00**
Browse		20.70		0.76	0.00	**0.00**
Orchard topfruit		11.61		0.67	0.00	**0.00**
Cereal seeds		17.27		0.80	0.00	**0.00**
Weed seeds	0.5	21.34		0.80	2.78	**3.18**
Small mammals		21.66		0.76	0.00	**0.00**
Bird and mammal carrion		23.23		0.76	0.00	**0.00**
Arthropods	0.3	22.60		0.76	1.67	**5.62**
Caterpillars	0.15	21.65		0.76	0.83	**4.05**
Soil invertebrates	0.05	19.12		0.76	0.28	**1.85**
Fish		20.15		0.76	0.00	**0.00**
Aquatic invertebrates		18.78		0.76	0.00	**0.00**
Aquatic vegetation		14.50		0.76	0.00	**0.00**
Sum	**1**				5.56	**14.70**

Daily Energy Expenditure for 24g Passerine **93.87 KJ/animal**

Stepwise Approach – Tiers 1,2 &3

1. Indicator species
   - Single diet defined
2. Generic Focal species
   - Single or simple mixed diet defined expressing highest range of exposure from published literature
3. Real Focal species
   - Modern data for specific crop
   - Quantitative data