

BIRD FOCAL SPECIES SELECTION

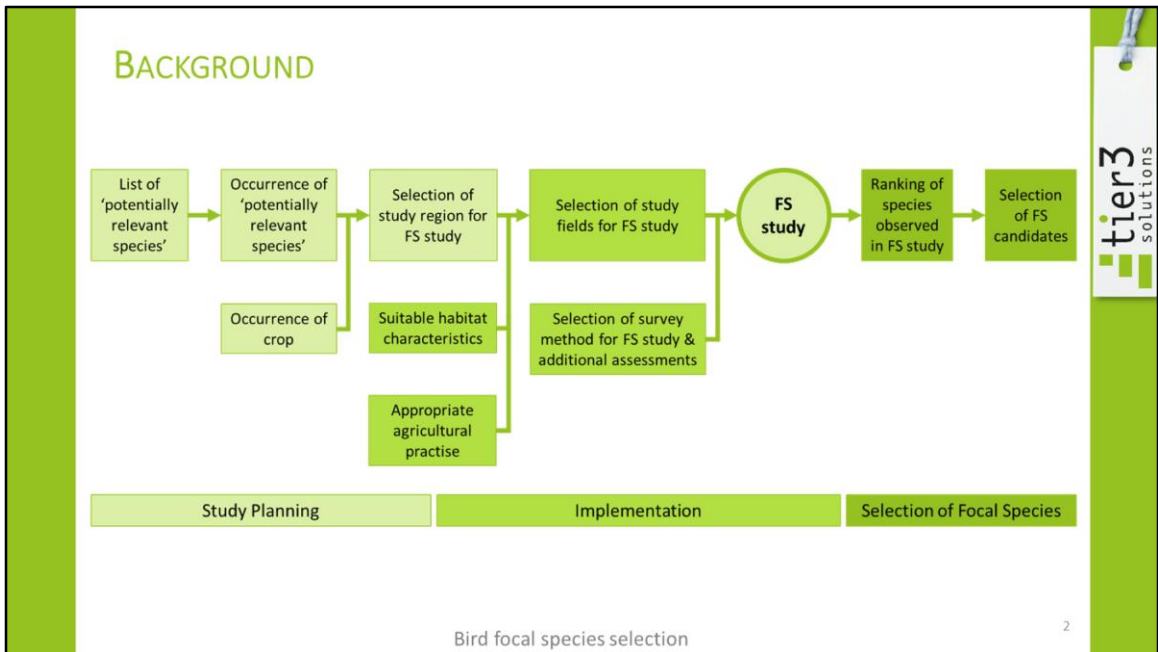
An approach to refine
the vulnerability in bird
focal species selection

tier3 solutions
2024-03-14



© ebird 2023 (*Luscinia svecica*,
breeding season)





- selection of species includes 2 steps
- step 1: ranking of species based of FS study
- step 2: incorporate ecological information of the ranked species to come to a final selection of FS
- presented approach is only a suggestion how to takle the requirements from the new guidance, there might be others

BACKGROUND

BEFORE

focal species was selected based on the frequency of occurrence in study fields ($FO_{\text{field}} \geq 20\%$)

*“A **VULNERABLE** species which is **INFREQUENTLY** observed but nevertheless **CLEARLY PRESENT** may be considered a more appropriate **FOCAL SPECIES** for the risk assessment, and more protective of similar species, than a less vulnerable species with higher occurrence.” (EFSA 2023)*

NOW

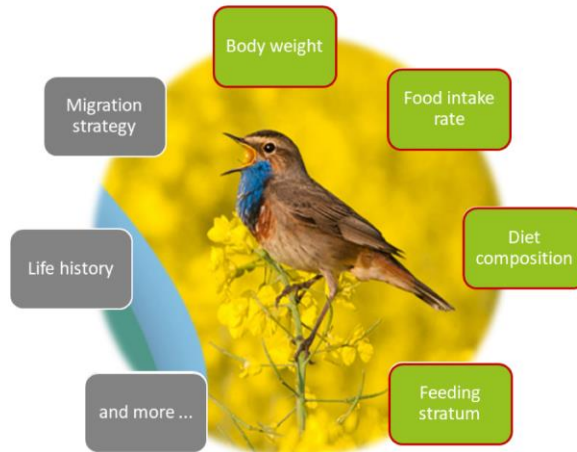
every species recorded in the crop may be considered as a focal species candidate

Bird focal species selection

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- selection of FS is crucial as it should be protective of other species of the same feeding guild
- before: selection criteria was based on prevalence
- the revised EFSA guidance on birds and mammals emphasizes the vulnerability of species
- now: potentially each species has to be considered as a FS candidate, based on vulnerability rather than prevalence and distribution

BACKGROUND - VULNERABILITY



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- What indicates the vulnerability of a bird species occurring in the relevant crop?
- Vulnerability is related to certain life history traits, migration strategy, body weight and many other traits
- In terms of exposure it is influenced by: Food intake rate, diet composition, and where the bird forages
- For the presented approach, we focussed on the exposure-related traits that causes inter-specific differences in sensitivity to a pesticide.

BACKGROUND

⇒ RANK SPECIES ACCORDING TO THEIR EXPECTED MAGNITUDE OF EXPOSURE¹

- Calculating a species-specific daily dietary dose (DDD)
- Identify species with a high vulnerability as focal species

- DDD calculation based on
 - ✓ Body weight
 - ✓ Food intake rate
 - ✗ Estimated 'proportion of diet an individual obtains from the (potentially) treated crop' (PT)

DIFFICULTY: real PT is assessed through radio-tracking field study

⇒ Weyers et al. suggest estimating a PT using literature values

¹Weyers, A., Sprenger D. & Kragten S. (2022) Focus matters - Bird focal species for higher tier risk assessment. Poster at SETAC Copenhagen

- How can vulnerability be assessed?
- Weyers et al. (2022) made an attempt to quantify vulnerability by calculating a species-specific Daily Dietary Dose (DDD) to assess exposure, species ranked by DDD
- DDD calculation includes
 - body weight and FIR – data available
 - a measure for intensity of crop usage (PT) – data not readily available
- Is there an information that can be used that is already assessed in the focal species study, to achieve a measure that can be used as surrogate for the PT?

BACKGROUND

- in focal species studies several surveys (*scan or transect counts*) per study field conducted
- presence of one or several individuals of a species during a high proportion of surveys (high FO_{survey})
 - ⇒ Indication of a high proportion of foraging time in this crop
- Fields without occurrence of species are excluded from calculation of FO_{survey}
 - ⇒ Also less widely distributed species that only occur on a few fields but there at a high frequency, are considered for focal species selection

⇒ FO_{SURVEY} AS A SURROGATE FOR PT TO RANK POTENTIAL FOCAL SPECIES

During FS studies, surveys are conducted to record all bird species that are present on the study fields. If individuals of one species forage intensively on a field, they will be present during a high proportion of surveys, i.e. a high Frequency of occurrence. Thus, a high FO_{survey} indicates a proportionally high foraging time in the crop. Because fields where a species does not occur at all, are not considered in the FO_{survey} calculation, also less widely distributed species that are only present on a few fields (but there frequently) can also obtain a high FO_{survey} and thus be considered as FS.

FO_{survey} seems to be a measure to rank the species and might be used as a surrogate for PT in theoretical DDD calculations.

It needs to be emphasized: FO_{survey} is not to be used as a replacement for a real PT obtained from a PT study!

CALCULATION OF FO_{FIELD} , FO_{SURVEY} AND A DDD_{SURVEY}

FO_{field} = proportion of study fields with observations of a species

⇒ PREVALENCE

FO_{survey} = proportion of scans or transect counts with observations of a species per field

⇒ INTENSITY OF CROP USAGE

$DDD_{\text{survey}} = FO_{\text{survey}}/100 \cdot \text{FIR}/\text{bodyweight} \cdot \text{RUD}$

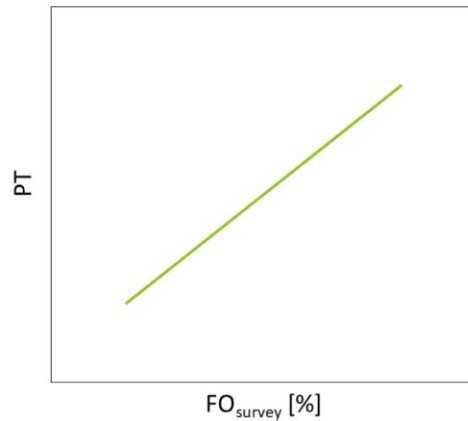
FIR : Food intake rate

RUD : Residue per unit dose

Bird focal species selection

- 2 important information from FS study:
 - FO_{field} → measure of prevalence, used as selection criteria before
 - FO_{survey} → measure of the intensity a field is used by a species
- DDD includes
 - 90 percentile of FO_{survey} , excluding scans/transects without any observations of a species, to be protective of rare species that show only up on a few fields, but there are frequently observed
 - bodyweights from literature
 - species had to be classified into feeding guilds due to calculation of exposure (for determination of FIR and RUD)

HYPOTHESIS $FO_{\text{SURVEY}} \sim PT$



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- hypothesis: FO_{survey} is a suitable indicator for the intensity a crop is used by a species'
- if assumption is true, there should be a positive correlation between FO_{survey} and PT
- hypothesis can be evaluated with FO_{survey} values from focal species studies and the PT values that were obtained in subsequently conducted radio-tracking studies

FIELD STUDY DATA

- 10 focal species – PT study pairs identified

Zone	Crop	BBCH
South	spinach	0 - 9
South	vineyard	0 - 75
South	citrus	0 - 75
South	pome fruit	0 - 79
Central	leavy vegetables	10 - 49
Central	maize	0 - 19
Central	oilseed rape	> 96, 0 - 9
Central	pome fruit	7 - 81
Central	pome fruit	51 - 79
Central	cereals	0 - 83

Bird focal species selection

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- Scanned 44 FS- and PT-studies provided by industry
- Could identify 10 focal species-PT study pairs, according to crop, BBCH, region/regulatory zone

FIELD STUDY DATA

- 10 focal species – PT study pairs identified
- Feeding guilds considered
 - Insectivorous
 - flying and foliage dwelling insects
 - ground dwelling invertebrates
 - granivorous
 - herbivorous

TRANSECT COUNT

- Actively going through field, counting all birds that fly off
- 3-4 surveys per field
- Ø 22 fields per study

SCAN SAMPLING

- Passive observation from field margin
- > 75 (often > 1000) surveys per field
- Ø 13 fields per study

Bird focal species selection

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- feeding guilds considered:
 - insectivorous - foraging on flying and foliage dwelling insects
 - feeding on ground dwelling invertebrates
 - granivorous
 - herbivorous
- FS studies either conducted as transect count or scan samplings.
- The two methods were considered separately in the analysis due to the differences in the two methods.

EXAMPLE 1: SCAN SAMPLING

	FO _{field} [%]	FO _{survey} (90 th percentile) [%]	DDD _{survey}	PT (90 th percentile consumer)
Species 1	100.0	97.04	4.34	0.35 (n=20)
Species 2	100.0	81.19	4.14	0.39 (n=20)
Species 3	75.0	61.30	3.47	0.19 (n=20)
Species 4	25.0	49.97	3.35	-
Species 5	37.5	28.58	1.43	-
Species 6	12.5	2.70	0.16	-
Species 7	12.5	1.35	0.07	-
Species 8	12.5	1.35	0.07	-

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Example 1: scan sampling with 8 granivorous bird species below 50g body weight observed in study fields

- green highlighted values in the FO_{field}-column indicate values $\geq 20\%$, those that were FS candidates based on the old guidance
 - DDD_{survey} – approach: no threshold defined yet
 - Would be feasible to chose the four top most species as FS candidates due to the gap in DDD_{survey} values between species 4 and 5
 - in a next step, ecology of the FS candidates has to be taken into account
 - In the original study, the three top most species were selected for a PT study
- Here, ranking of different approaches is consistent.

EXAMPLE 2: TRANSECT COUNT

	FO _{field} [%]	FO _{survey} (90 th percentile) [%]	DDD _{survey}	PT (90 th percentile consumer)
Species D	36.67	100.00	2.21	0.09 (n=20)
Species F	16.67	86.67	2.01	-
Species E	36.67	100.00	1.96	0.77 (n=20)
Species A	66.67	100.00	1.93	1.00 (n=20)
Species G	13.33	56.67	1.50	-
Species C	40.00	66.67	1.39	-
Species H	10.00	60.00	1.39	-
Species B	56.67	100.00	1.21	-
Species J	3.33	50.00	1.02	-
Species I	10.00	33.33	0.75	-

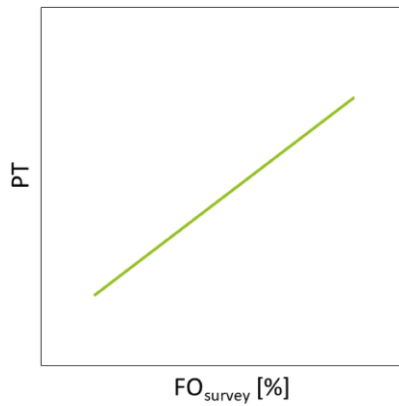
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Example 2: transect count, 28 species feeding on ground dwelling invertebrates were observed in FS study (only first 10 shown here)

- 5 species selected based on previous FO_{field} > 20% criterion
- based on DDD_{survey}, 4 species ranking relatively high
 - species F (probably rare species) was not considered with the former approach, as its FO_{field} was below 20%, however, its DDD_{survey} is the second highest and thus, this species would be considered in the new approach
- Disadvantage with transect counts becomes obvious here: Due to usually low number of surveys in Transect counts, FO_{survey} lacks differentiation (takes on only 7 different values here)

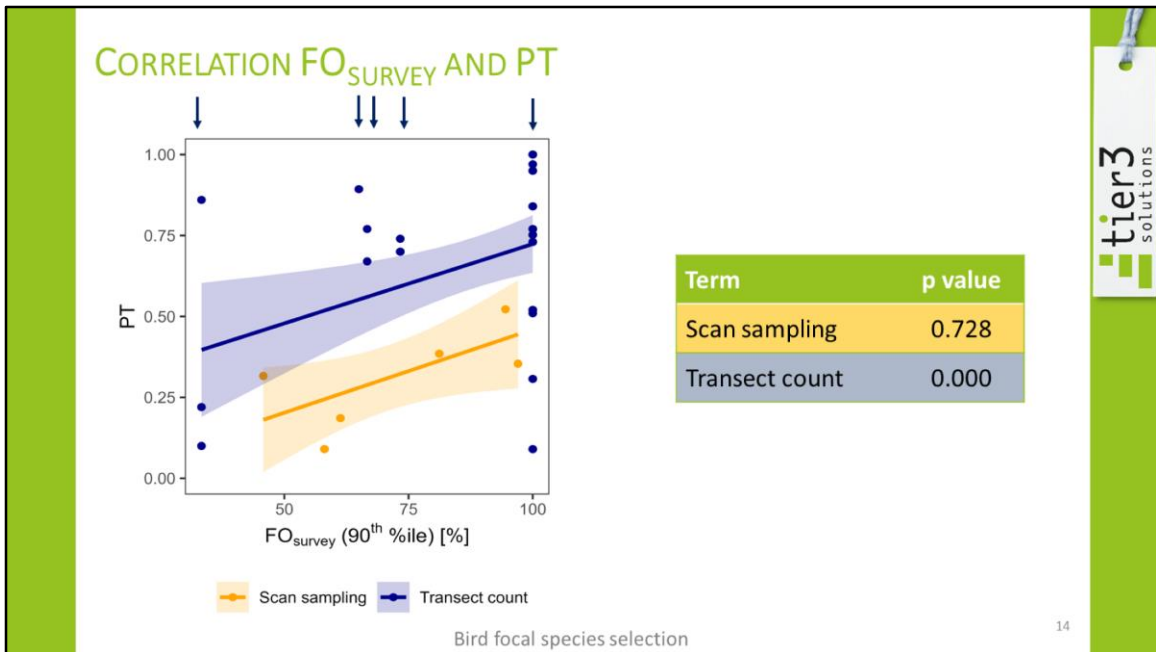
CORRELATION FO_{SURVEY} AND PT



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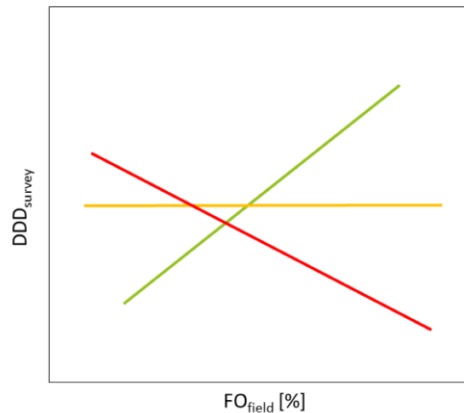
Reminder: if hypothesis (FO_{survey} is a suitable indicator for the intensity a crop is used by a species) is true, we shall see a positive relationship between FO_{survey} and PT



Summary of all available data sets (FS and PT studies):

- statistics (GLMM) calculated for scan sampling and transect count separately
- data set too small to include additional factors, therefore feeding guild and crop were included as random effects in GLMM
- clear correlation between FO_{survey} and PT
- too few data for scan samplings (9 data points) to be significant
- as mentioned before, transect counts lack differentiation of FO_{survey} values (indicated by the arrows above the graph)

WILL THE NEW APPROACH RESULT IN A COMPLETELY DIFFERENT LIST OF FOCAL SPECIES?



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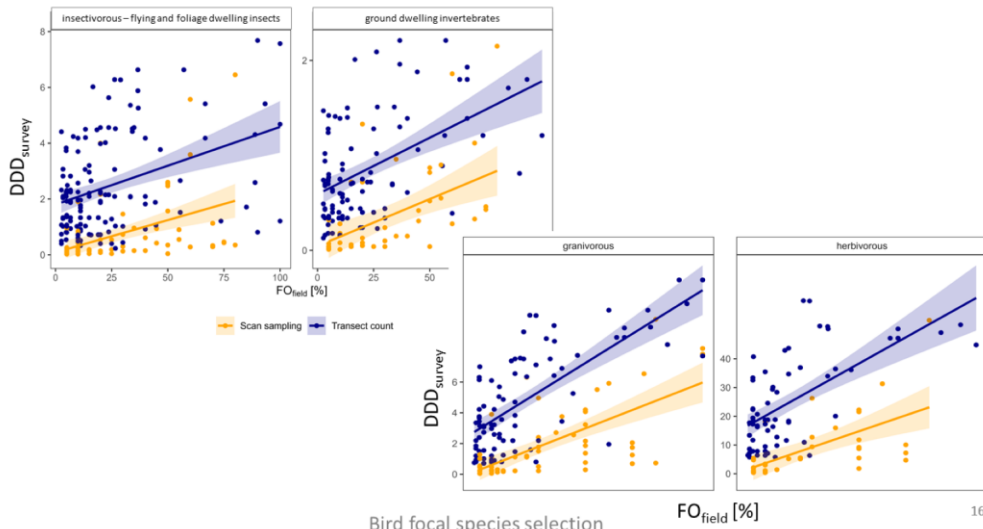
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Would this proposed approach (DDD_{survey}) lead to different results compared to the old approach based on FO_{field}?

The more similar DDD_{survey} and FO_{field} data, the less change the new approach will bring compared to the old one (green line).

In case a complete new list of species needs to be considered as FS, there would be no (yellow line) or a negative correlation between FO_{field} and DDD_{survey} (red line).

CORRELATION FO_{FIELD} AND DDD_{SURVEY} FOR DIFFERENT FEEDING GUILDS



The fear that completely new species will have to be considered as FS with the new guidance/approach is unfounded. This is obvious from a significant correlation between the former prevalence criteria FO_{field} and the calculated DDD_{survey} . Though, there is some scatter which indicates that some new species have to be considered (those in the upper left corner of each graph), while others might be less relevant (lower right corner of graphs).

GOODNESS OF FIT



⇒ **GOOD FIT:** species that are associated with a single study field
e.g. species with small home ranges during breeding season



⇒ **PROBLEMATIC:**

- species that alternate between several fields of same crop for foraging

⇒ **UNDERESTIMATION**

- flock of changing individuals

⇒ **OVERESTIMATION**



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bird pictures by Adobe Stock

The goodness of the approach depends also on the birds' ecology.

The approach has a good fit for species that are associated with just a few or even one field, due to a small home range. These are probably recorded during each survey and obtain a high FO_{survey} .

Other species have a lower fit:

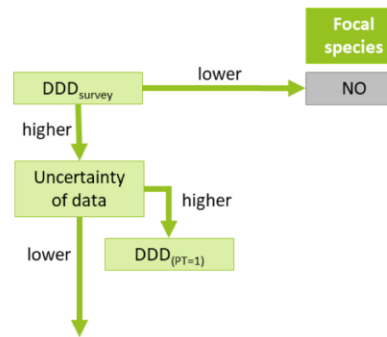
- Species that alternate between fields of the **same** crop for foraging; that have a large home range and likely use several fields. Their exposure will be underestimated by FO_{survey} .
- Species that form flocks on fields. Although the flock is observed frequently on the field, the composition of the individuals change. In FO_{survey} calculation it is assumed observed bird is always the same individual. Here, the exposure will be overestimated by FO_{survey} .

These and other traits have to be considered in final selection of FS species.

AND BEYOND – AN EXAMPLE HOW TO INTERPRET A FS-LIST

Mock example: Scan sampling, granivorous birds, BBCH 00-09, winter cereals

Species name	FO _{survey}	DDD _{survey}	DDD _(PT=1)	Focal species
Skylark	95	10.7	11.22	
Linnet	35	4.7	13.31	
Chaffinch	30	3.9	12.85	
Tree Sparrow	20	2.6	12.93	
Wood Pigeon	75	2.3	3.00	
House Sparrow	10	1.2	11.98	N
Wood Lark	10	1.2	11.95	N
Grey Partridge	30	1.1	3.65	N
Goldfinch	5	0.7	14.03	N
Greenfinch	5	0.6	11.98	N
Mallard	3	0.1	2.10	N



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Step 2: consideration of ecological information/traits of the ranked species to come to a final selection of FS

Procedure is shown on a fictive mock example.

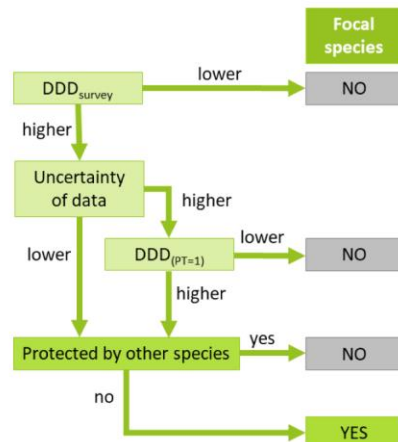
There is no defined threshold, how many species have to be considered. We recommend to use a decision tree:

- for each species, decide whether DDD_{survey} is higher in relation to other observed species
- It is also necessary to consider the uncertainty of data in terms on how much effort was put in the FS study (e.g. number of study fields and surveys, is chosen method suitable for crop and growth stage. A high effort during conducting the FS study pays off here in confidence in the data. The higher the uncertainty, the more conservative the selection has to be, because the ranking could re-order with a change in FO_{survey}-value.
 - high uncertainty: To get an idea what is highest DDD possible for certain species if PT would be 1, the DDD for PT =1 is calculated ($DDD_{(PT=Q_1)}$). Is it possible that lower ranked species change rank with higher ranked species?
If DDD_{PT1} is low, the species needs no further consideration (here: exclusion of wood pigeon, but tree sparrow included)

AND BEYOND – AN EXAMPLE HOW TO INTERPRET A FS-LIST

Mock example: Scan sampling, granivorous birds, BBCH 00-09, winter cereals

Species name	FO _{survey}	DDD _{survey}	DDD _(PT=1)	Focal species
Skylark	95	10.7	11.22	Y
Linnet	35	4.7	13.31	Y
Chaffinch	30	3.9	12.85	Y
Tree Sparrow	20	2.6	12.93	N
Wood Pigeon	75	2.3	3.00	N
House Sparrow	10	1.2	11.98	N
Wood Lark	10	1.2	11.95	N
Grey Partridge	30	1.1	3.65	N
Goldfinch	5	0.7	14.03	N
Greenfinch	5	0.6	11.98	N
Mallard	3	0.1	2.10	N



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- b. here, also known aspects of feeding ecology/flocking behavior that causes under-/overestimation of FO_{survey} should be taken into account (overestimation of linnet FO_{survey})
3. Would species be covered by other/ more protective species? This would be the case here for tree sparrow which is covered by the chaffinch. Hence, final selection in this example would be to consider skylark, linnet and chaffinch as FS.

CONCLUSION

- ⇒ FO_{survey} is a measure for ranking the DDD, **NOT** a substitute for the PT.
- ⇒ Available data of focal species studies are still of value.
- ⇒ Focal species studies with few transect counts seem to be less suitable for this approach.
- ⇒ Focal species studies with many scan samplings (or transect counts) seem to be promising.
- ⇒ **DDD approach based on FO_{SURVEY} can be used to rank potential FS according to exposure/vulnerability to select FS.**

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- FO_{survey} is a measure to rank DDD, it is NOT a substitute for the PT
- Available data of (old) FS studies are not wrong, but still of value if they were conducted appropriately. Not everything has to be done again under the new guidance, but they maybe need to be re-evaluated based on this approach and may come to slightly different conclusions in terms of the FS selection.
- Focal species studies with few transect counts seem to be less suitable for this approach.
- Focal species studies with many scan samplings (or transect counts) seem to be promising.
- DDD approach based on FO_{survey} can be used to rank potential FS according to exposure/vulnerability to select FS for further consideration.