Supplemental figures and tables for

‘Effects of Species Traits on the Catchability of Butterflies with Different Types of Malaise Traps and Implications for Total Catch Biomass’

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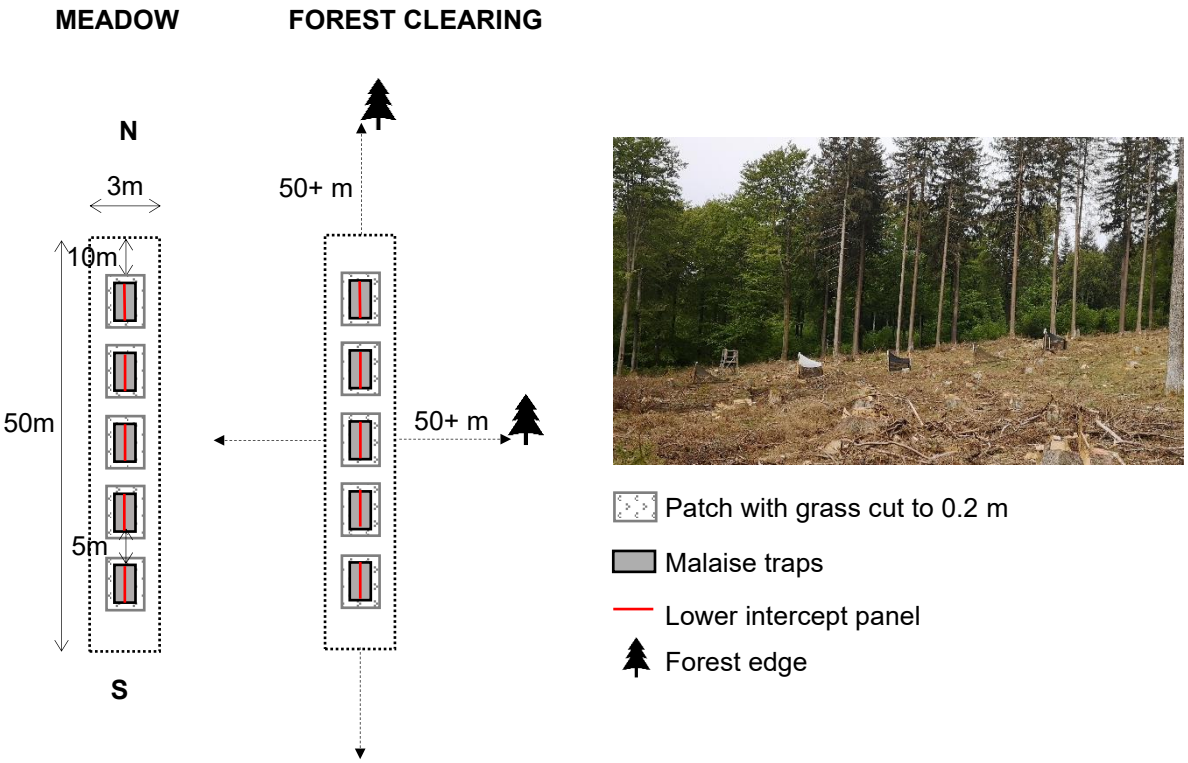

Fig. S1 Experimental setup (Uhler et al. 2022). Traps were placed in a row (distance between traps = 5 m) on a meadow and a forest clearing site each with the capture bottle facing South. Lower intercept panels (red) were opened to the east and the west. 10 m to nearby shrubs and trees were provided. For forest clearing sites, a minimum of 50 m was kept to the forest edge.

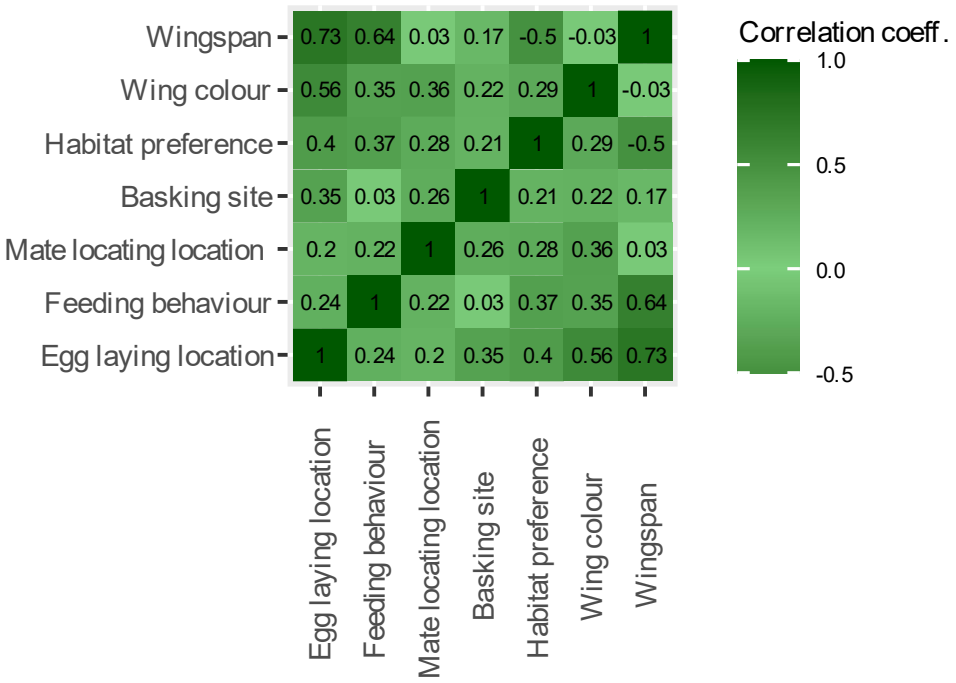

Fig. S2 Correlation coefficients resulting from the check for pairwise correlations between butterfly species traits

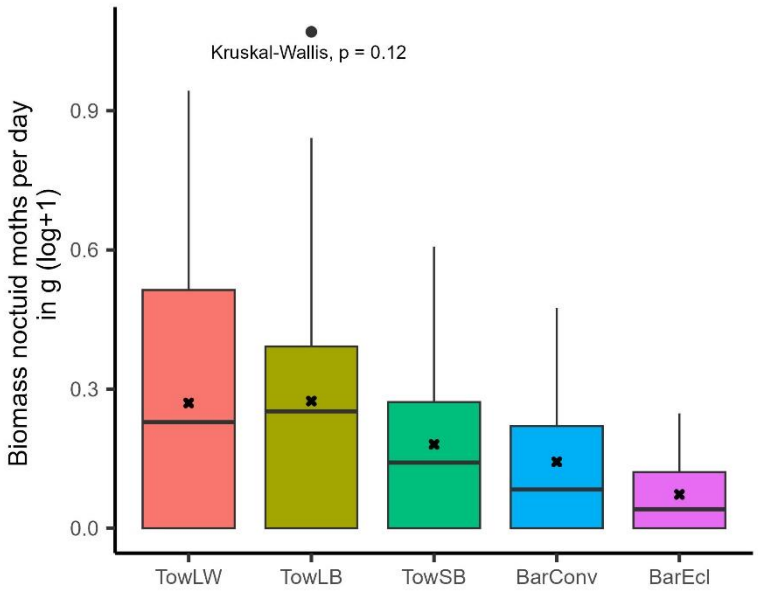

Fig. S3 Malaise trap types and their noctuid moth biomass. There is no significant difference in the noctuid moth biomass between the trap types. For the comparison, the Kruskal-Wallis rank sum test was used. TowLW = Large Townes trap with white roof, TowLB = large Townes trap with black roof, TowSB = small Townes trap with black roof, BarConv = Bartak trap with conventional capture bottle, BarEcl = Bartak trap with eclector bottle

Supplemental Tables

Table S1 Size classes of noctuid moths noted while screening the samples. Compared with butterflies, noctuid moths were only assigned to size classes based on their forewing length without further determination to species level. There were five size classes identified.

Size class	Forewing length (cm)
2	< 1.0
3	1.0 - 1.5
4	1.5 - 2.0
5	2.0 - 2.5
6	> 2.5

Table S2 Butterfly species and their functional species traits. Trait data was extracted from Settele et al. (2015), Middleton-Welling et al. (2020) and Popović et al. (2022). Wing colour brightness level was assigned depending on whether the upper side of the wing appeared more pale (1) or dark (6) following Bladon et al. (2020).

Butterfly	**Wingspan (mm)**	**Egg laying location**	**Feeding behaviour**	**Mate locating location**	**Basking site**	**Habitat preference**	**Wing colour brightness level**
Nymphalis polychloros	62	woody plant	tree-feeder	never locating in grass	never grass basking	forest	4
Argynnis paphia	62	woody plant	tree-feeder	never locating in grass	grass basking	forest	4
Limenitis camilla	56	woody plant	tree-feeder	never locating in grass	grass basking	forest	6
Celastrina argiolus	27	herb	tree-feeder	never locating in grass	never grass basking	habitat generalist	3
Fabriciana adippe	53.5	herb	tree-feeder	locating in grass	grass basking	habitat generalist	4
Pararge aegeria	38	grass	tree-feeder	locating in grass	grass basking	forest	5
Maniola jurtina	41.5	grass	tree-feeder	locating in grass	grass basking	open habitat	5
Gonepteryx rhamni	58	woody plant	tree-feeder	never locating in grass	grass basking	habitat generalist	2
Aphantopus hyperantus	38.5	grass	tree-feeder	locating in grass	grass basking	habitat generalist	5
Pieris brassicae	57	herb	tree-feeder	never locating in grass	never grass basking	open habitat	1

Pieris napi	40	herb	tree-feeder	locating in grass	grass basking	habitat generalist	1
Aglais io	53.5	herb	tree-feeder	never locating in grass	grass basking	habitat generalist	4
Vanessa atalanta	59.5	herb	tree-feeder	never locating in grass	grass basking	habitat generalist	6
Aglais urticae	48	herb	tree-feeder	never locating in grass	grass basking	habitat generalist	4
Polygonia calbum	46	herb	tree-feeder	never locating in grass	grass basking	forest	4
Coenonympha arcania	37	grass	tree-feeder	never locating in grass	grass basking	open habitat	4
Melanargia galathea	47.5	air (ref. to as grass)	non tree-feeder	locating in grass	grass basking	habitat generalist	3.5
Pieris rapae	44.5	herb	non tree-feeder	locating in grass	grass basking	habitat generalist	1
Pieris mannii	43	herb	non tree-feeder	never locating in grass	grass basking	open habitat	1
Ochlodes sylvanus	30	grass	non tree-feeder	locating in grass	grass basking	open habitat	4
Argynnis aglaia	51.5	herb	non tree-feeder	never locating in grass	never grass basking	habitat generalist	4
Phengaris teleius	34	herb	non tree-feeder	locating in grass	never grass basking	open habitat	4
Carcharodus alceae	30	herb	non tree-feeder	NA	grass basking	open habitat	6
Lycaena tityrus	30	herb	non tree-feeder	NA	grass basking	habitat generalist	5
Cyaniris semiargus	29	grass	non tree-feeder	NA	grass basking	open habitat	4
Brenthis ino	37	herb	tree-feeder	NA	never grass basking	open habitat	4

Araschnia levana	33.5	herb	tree-feeder	locating in grass	grass basking	habitat generalist	4
lasiommata_megera	42.5	grass	tree-feeder	locating in grass	grass basking	open habitat	4
Lycaena phlaeas	26.5	herb	tree-feeder	locating in grass	grass basking	open habitat	4
Leptidea sinapis	38	herb	non tree-feeder	locating in grass	grass basking	habitat generalist	1
Phengaris nausithous	35	herb	non tree-feeder	never locating in grass	never grass basking	open habitat	5
Thymelicus lineola	25.5	grass	non tree-feeder	never locating in grass	grass basking	habitat generalist	3
Thymelicus sylvestris	26.5	grass	non tree-feeder	never locating in grass	grass basking	habitat generalist	3
Polyommatus icarus	28.5	herb	non tree-feeder	locating in grass	grass basking	open habitat	4
Hesperia comma	31	grass	non tree-feeder	never locating in grass	grass basking	habitat generalist	4
Coenonympha pamphilus	28	grass	non tree-feeder	locating in grass	grass basking	open habitat	3
Carterocephalus palaemon	27	grass	non tree-feeder	never locating in grass	grass basking	habitat generalist	6

Table S3 Classification of wingspans. Wingspans of butterflies were classified into five categories. Close to equal species numbers for each wingspan category were ensured.

Wingspan category	**Wingspan (mm)**
Smallest sized	(20;30]
Small sized	(30;40]
Middle sized	(40;50]
Large sized	(50;60]
Largest sized	(60;70]

Table S4 Classification of wing colour brightness levels for PCA. Wing colour brightness levels (see Table S2) were assigned to three wing colour categories. For different levels of wing colour brightness, see Bladon et al. (2020).

Wing colour category	**Wing colour brightness level**
pale	(1;2]
Partly dark	(3;4]
dark	(5;6]

Table S5 Number of individuals per species/species group in the five different Malaise trap types: TowLW = Large Townes trap with white roof, TowLB = large Townes trap with black roof, TowSB = small Townes trap with black roof (), BarConv = Bartak trap with conventional capture bottle, BarEcl = Bartak trap with eclector bottle

Butterfly species	TowLW	TowLB	TowSB	BarConv	BarEcl
Aglais io	0	1	0	0	0
Aglais urticae	0	2	2	1	0
Aphantopus hyperantus	8	9	5	2	1
Araschnia levana	5	0	3	0	0
Argynnis aglaia	11	3	8	0	1
Argynnis paphia	66	16	24	0	4
Brenthis ino	25	8	23	8	3
Carcharodus alceae	6	4	6	3	1
Carterocephalus palaemon	0	0	1	0	0
Celastrina argiolus	1	4	0	0	0
Coenonympha arcania	3	1	4	5	3
Coenonympha pamphilus	66	37	40	37	34
Cyaniris semiargus	2	1	0	0	1
Fabriciana adippe	3	3	0	0	0
Gonepteryx rhamni	0	0	0	0	1
Hesperia comma	0	1	1	0	1
Lasiommata megera	14	4	4	1	2
Leptidea sinapis	3	1	1	1	0
Limenitis camilla	1	0	0	0	0
Lycaena phlaeas	10	3	1	2	1
Lycaena tityrus	4	8	6	1	0
Maniola jurtina	97	42	50	22	13
Melanargia galathea	15	4	6	0	1
Nymphalis polychloros	2	3	0	0	0
Ochlodes sylvanus	15	6	5	1	2
Pararge aegeria	3	0	0	0	0
Phengaris nausithous	1	0	1	0	0
Phengaris teleius	1	1	0	0	0
Pieris brassicae	2	0	0	0	0
Pieris mannii	1	0	0	0	0
Pieris napi	145	42	31	8	4
Pieris rapae	60	7	4	4	0
Polygonia c-album	20	2	2	0	0

Polyommatus icarus	7	2	0	2	0
Thymelicus lineola	71	34	26	23	16
Thymelicus sylvestris	39	14	7	15	14
Vanessa atalanta	12	2	0	0	1
Argynnini sp.	0	0	1	0	0
Lycaenidae sp.	0	2	0	0	1
Pieris sp. (napi/rapae/mannii)	55	13	15	3	16
Thymelicus sp. (lineola/sylvestris)	4	0	0	0	0
Lepidoptera (maniola jurtina/aphantopus hyperatus, pieris rapae, pieris napi)	9	4	1	1	11

Table S6 Number of individuals per noctuid moth size class in the five different Malaise trap types: TowLW = Large Townes trap with white roof, TowLB = large Townes trap with black roof, TowSB = small Townes trap with black roof (), BarConv = Bartak trap with conventional capture bottle, BarEcl = Bartak trap with eclector bottle

Noctuid moth size class	TowLW	TowLB	TowSB	BarConv	BarEcl
2	3	9	9	11	0
3	197	202	130	88	36
4	182	204	99	65	38
5	86	80	54	49	22
6	4	4	2	1	0

Table S7 Relative abundances of butterfly individuals with a certain trait in five different Malaise trap types

Trait category	Trait	TowLW	TowLB	TowSB	BarConv	BarEcl
Basking site	grass basking	49.05 %	17.83 %	16.59 %	9.32 %	7.21 %
Basking site	never grass basking	40.57 %	17.92 %	30.19 %	7.55 %	3.77 %
Egg laying location	grass	39.65 %	18.58 %	17.71 %	13.22 %	10.85 %
Egg laying location	herb	58.85 %	17.13 %	16.39 %	5.59 %	2.05 %
Egg laying location	Woody plant	58.87 %	16.31 %	21.28 %	0.00 %	3.55 %
Habitat preference	forest	64.08 %	14.79 %	18.31 %	0.00 %	2.82 %
Habitat preference	Habitat generalist	53.48 %	19.01 %	14.18 %	7.80 %	5.53 %
Habitat preference	Open habitat	39.34 %	17.22 %	21.17 %	12.80 %	9.48 %
Mate locating location	grass mating	50.17 %	17.87 %	16.65 %	8.88 %	6.44 %
Mate locating location	never grass mating	48.61 %	17.48 %	15.99 %	9.38 %	8.53 %
Feeding behaviour	non tree-feeder	43.43 %	17.75 %	16.02 %	12.55 %	10.25 %
Feeding behaviour	tree-feeder	52.86 %	17.92 %	18.93 %	6.23 %	4.07 %
Wing colour	dark	42.53 %	21.10 %	22.08 %	9.09 %	5.19 %
Wing colour	pale	67.09 %	15.97 %	11.50 %	4.15 %	1.28 %
Wing colour	partly dark	43.77 %	17.35 %	18.16 %	11.06 %	9.66 %
Wingspan	large sized	59.63 %	16.77 %	19.88 %	0.00 %	3.73 %
Wingspan	middle sized	54.35 %	16.09 %	17.94 %	7.39 %	4.22 %
Wingspan	small sized	53.59 %	17.40 %	19.06 %	6.63 %	3.31 %

Wingspan	smallest sized	38.24 %	19.55 %	15.74 %	14.53 %	11.94 %

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