

Moth monitoring in EU PoMS



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Importance of moths as pollinators

BIOLOGY
LETTERS

royalsocietyp

Research

Cite this
Bennion H
pollinators

Emerging
https://doi.org/10.1093/ee/een12174

Review

Nocturnal
services

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Conservation biology



Ecological Entomology (2014), DOI: 10.1111/een.12174

Ecological Entomology

scientific reports

OPEN

Addition of nocturnal pollinators modifies the structure of pollination networks

 Check for updates

Yedra García^{1,2}, Luis Giménez-Benavides¹, José M. Iriondo¹, Carlos Lara-Romero¹✉, Marcos Méndez¹, Javier Morente-López^{1,3} & Silvia Santamaría¹

Although the ecological network approach has substantially contributed to the study of plant-pollinator interactions, current understanding of their functional structure is biased towards diurnal pollinators. Nocturnal pollinators have been systematically ignored despite the publication of several studies that have tried to alleviate this diurnal bias. Here, we explored whether adding this neglected group of pollinators had a relevant effect on the overall architecture of three high mountain plant-pollinator networks. Including nocturnal moth pollinators modified network properties by decreasing total connectivity, connectance, nestedness and robustness to plant extinction; and increasing web asymmetry and modularity. Nocturnal moths were not preferentially connected to the most linked plants of the networks, and they were grouped into a specific "night" module in only one of the three

moths! pollen deposition rate of *Primula farinosa* L. agg.) is greater at night. LETTERS  WILEY

Nocturnal

Helen Hipperson² |

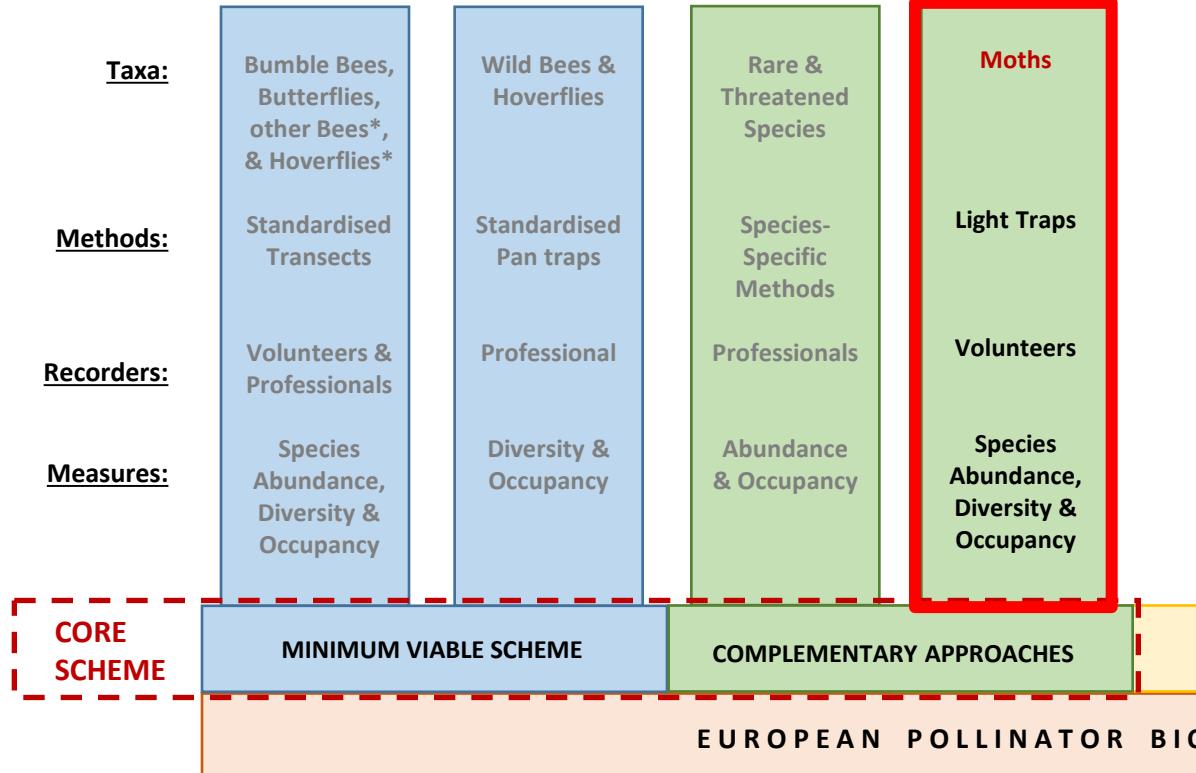
ected considerable changes and assessing the impact of climate change on plant-pollinator interactions. Our work has almost doubled the number of plant-pollinator networks described to date, and includes the first comparative study of plant-pollinator networks from three different biomes: high mountain, temperate forest and tropical rainforest.

ss and climate change, and cities are particularly vulnerable. The impacts of climate change on plant-pollinator interactions remain poorly understood, and comparative studies of taxa with divergent niches and life histories are lacking. Here, for the first time, we simultaneously compare nocturnal moth and diurnal bee pollination networks using DNA metabarcoding and ask how pollination networks change in response to climate change.

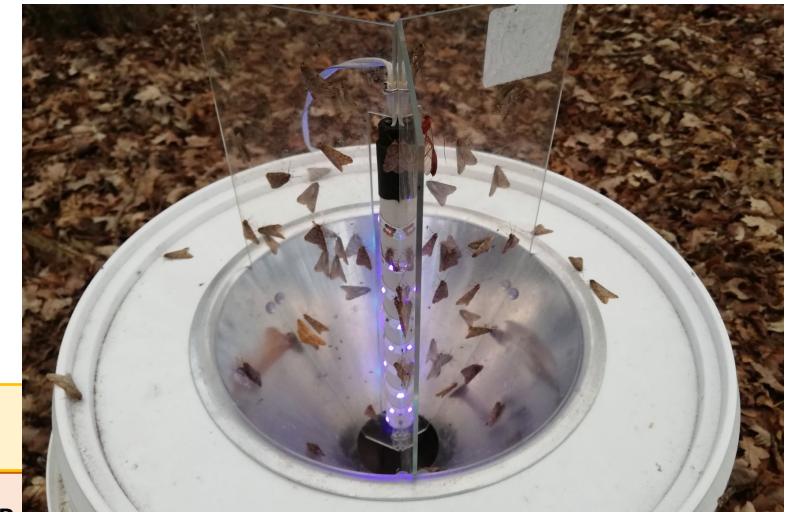
is, Denmark

Moth monitoring: light traps

Agreed methodology: tested under SPRING project



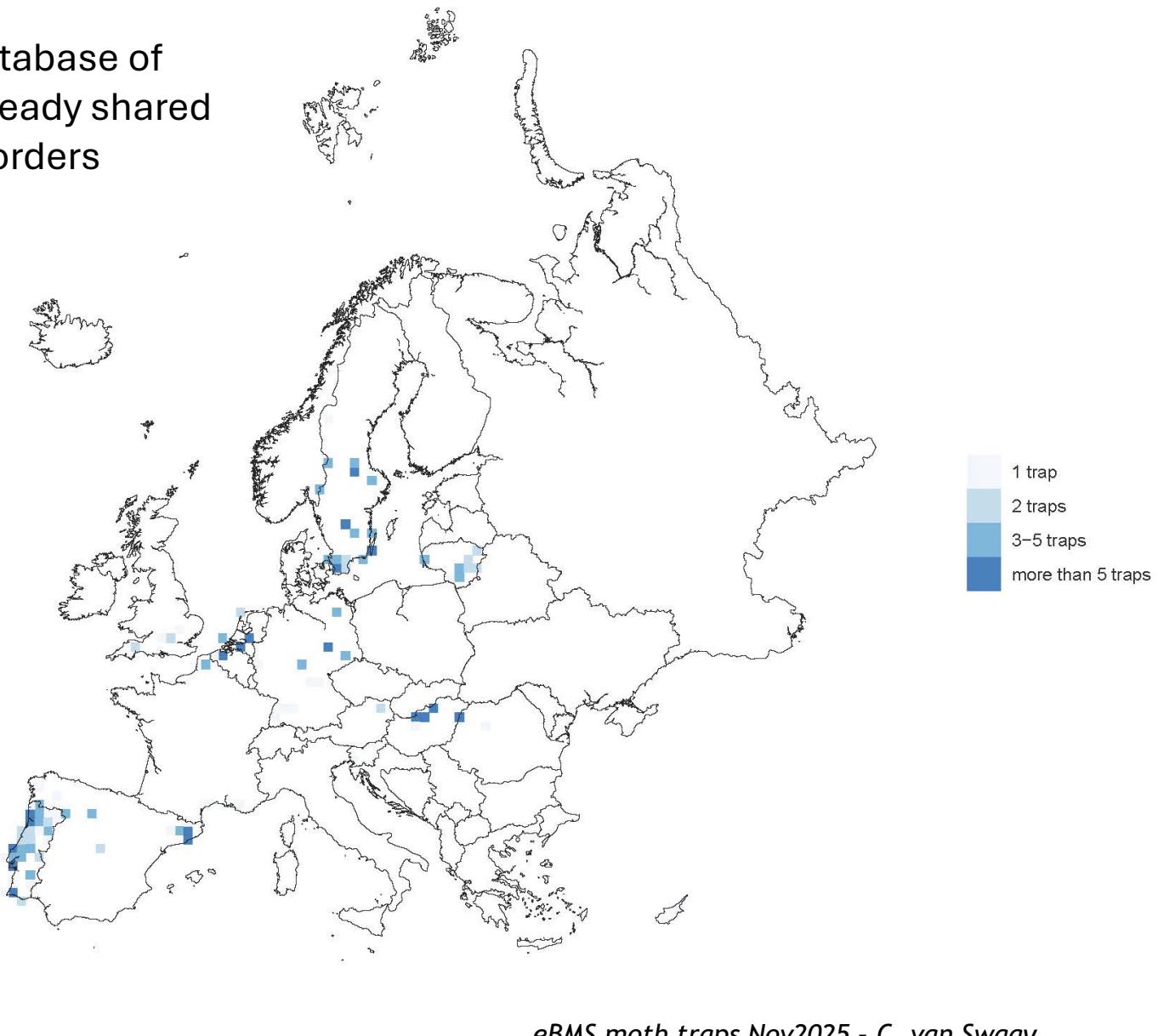
Climate	Country	Partner
Continental	Germany	UFZ
Mediterranean	Spain	CREAF
Pannonian	Hungary	Centre for Ecological Research
Boreal	Sweden	Lund
Atlantic	NL	De Vlinderstichting



Extrapolate to other countries; **citizens** can participate AI + validation; calculate trends (small country) min. **25 traps** set at least **12 times a year**

Sampling locations moth monitoring (Moth-traps)

eBMS holds a database of moth records already shared by volunteer recorders



Spring countries:
NL, Spain,
Sweden, Hungary,
Germany
+
Portugal
Lithuania
Belgium
Austria
France
UK

LED-trap tested

- Cheap, not very powerful → attracts local moths
- Sensor and powerbank → automatically switched on all night
→ no need to stay all night up
- Not very notable → low risk of stolen (*site selection*)
- Moths photographed → feed into AI algorythm



Involving amateurs
scientists



eBMS capabilities

Manuals with instructions, database, app and website



Self-made bucket traps by the Dutch Butterfly Conservation

In 2017 the Dutch Butterfly Conservation invented a new trap with LED to boost the number of locations for the monitoring scheme. To stimulate other monitoring schemes as well we want to make available the specifications of the parts we have used. We use a 15.000 mAh power bank, on which the LED strip burns all night long. Thereby egg boxes are needed which we placed inside the bucket.

A simple bucket. We used a 27-litre bucket. Make a round hole in the lid so the funnel fits. Be aware that they are very light, so on windy places you have to attach them to the ground.

- [We ordered here](#)



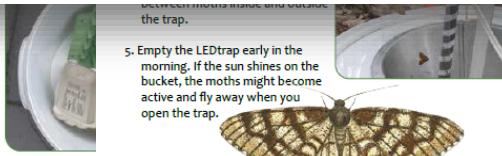
on the inside of the funnel.
Moths like to sit in the deepest recesses of the egg boxes.

remove the egg boxes from the bucket. The moths often like the deepest recesses of the egg box. When you can't view properly, first try photographing all the other moths, and then try to remove the moth by gently tapping the egg box against a and then take your photograph.

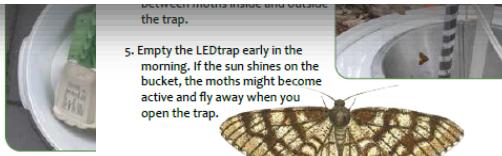
inside of the bucket and make photos of all moths present.
store the LEDtrap and charge the powerbank immediately, so to use on your next trapping night.



1. Put the two egg cartons upright in the LEDtrap. The butterflies can hide under these boxes when they land in the bucket.



2. Connect the power bank and place it upright in the bucket. When properly connected, a light will flash near the light sensor.



Note: There are two different USB connections. The one with one lighting bolt on it consumes much less power than the one with two, so it's recommended to use this connector.

3. Put the lid on the bucket, but do not click it into place. Otherwise there will be such a shock to the bucket when you try to empty it that the moths will become active and possibly fly away.



This is the screw for the light sensor.



The light sensor is attached to the screw.

4. There is a screw on the side of the bucket to which the light sensor can be attached.



5. If necessary, pull the cord at the top of the LED strip a little tighter, so that the tube with the LED strip stands upright between the three Plexiglas plates.



6. Place the LEDtrap at the same location each time.



eBMS Website

Moth traps registration and samples



Moth trap type:

- LED funnel trap
- Other funnel trap
- Trap with 2 sheets
- Other trap

Types of lamp in trap:

In the table below, list all the lamps in the trap. Add a row for each lamp type.

Lamp type	Additional description of lamp	How many of this lamp
LED->Ledstrip->395-405 SMD 2835	2 watt	2
<Please select> LED->Ledstrip->395-405 SMD 2835 LED->Ledstrip->395-405 SMD 5050 LED->PowerLED->Please describe LED->LepiLed->Mini LED->LepiLed->Standard LED->LepiLed->Maxi LED->LepiLed->Maxi switch LED->Other->Please describe TL->Actinic->6W TL->Actinic->8W TL->Blacklight->18W TL->Other->Please describe E27->Mercury vapour - ML->160W E27->Mercury vapour - ML->250W E27->Mercury vapour - ML->500W E27->Mercury vapour - HPL->125W E27->Mercury vapour - HPL->400W E27->Mercury vapour - Blacklight->160W E27->Mercury vapour - Blacklight->400W		



UK Centre for
Ecology & Hydrology

Moth trap details

Weergeven Vertalen

Please provide the spatial reference of the location. You can enter the reference directly, or search for a place then click on the map to set it.

Land:

Netherlands

Location Name:

13220



eBMS Website

Verification by experts

Verification

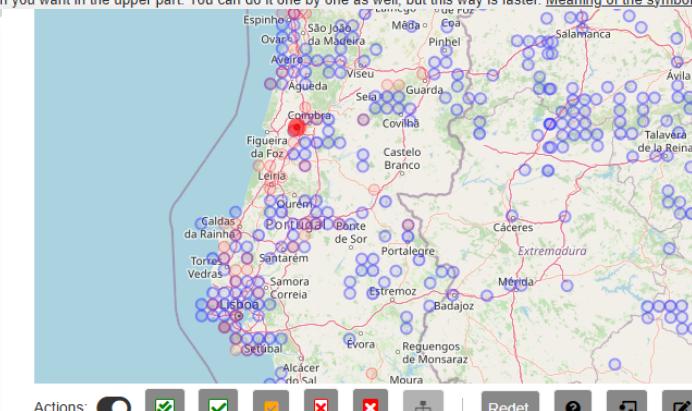
The most important functions inside the verification system are explained below. For more information read the [iRecord manual](#). This page shows all the records registered based on the filter applied (country, species group, survey...) to your account.

- There is an automatic check of all the butterfly records based on the flight period and distribution of species, so you see green or red thumbs showing the result of this automatic check. If you hover the mouse over the red thumb symbol it explains why it was rejected.

You can use the different functions of the verification menu to find better records. For example, you can click on the white arrows of each column to order it, like the "Check" column to see the rejected records. You can search directly by species, survey method, location, recorder, etc., or use the filters on the top for filter by picture or record status. As other eBMS tables on the website, you can change what you see on this table using the tool symbol on the top right.

- **How to correct records.** First, select one of the records you want to edit, it will highlight the whole row in blue. Then buttons on the right appear to use for correcting a record. The most common one is the label button, to redetermine a record, changing the species name. You can click on the first symbol for all records waiting for a review. To change that you can select several records at once and apply the review action. First, click on the first symbol on the top right, then a column of tick squares will be available. You can click, selecting the first square and then, you can select the action you want in the upper part. You can do it one by one as well, but this way is faster. Meaning of the symbols: First double green tick marks for records with pictures; one green tick for records considered correct (green)
- **Validate the Records.** On the first column appears a *clock symbol* for all records waiting for a review. To change that you can select several records at once and apply the review action. First, click on the first symbol on the top right, then a column of tick squares will be available. You can click, selecting the first square and then, you can select the action you want in the upper part. You can do it one by one as well, but this way is faster. Meaning of the symbols: First double green tick marks for records with pictures; one green tick for records considered correct (green)

Click, selecting the first square and then, you can select the other squares to mark the specimen as valid or invalid.						
47514811	118 681	<i>Xanthorhoe fluctuata</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514810	118 681	<i>Pachynemia hippocastanaria</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514809	118 681	<i>Mythimna unipuncta</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514808	118 681	<i>Colotois pennaria</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514807	118 681	<i>Athetis hospes</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514806	118 681	<i>Allophyses alfaroi</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514805	118 681	<i>Agrochola lychnidis</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 
47514804	118 681	<i>Agrochola helvola</i>	Estação Paul de Arzila	2025-12-03	Quadros Tenreiro, Paulo Jorge	 1 

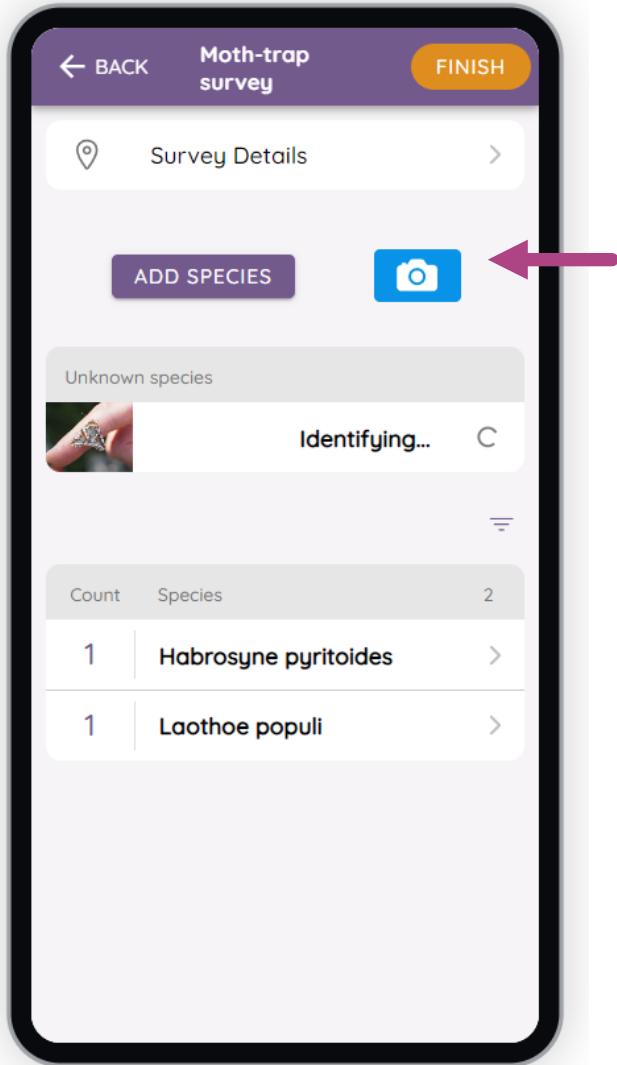


Details	Comments	Recorder experience
ID status checks	47514809  	
Accepted name (as entered)	<i>Mythimna unipuncta</i> (HAWORTH, [1809])	
Common name	vandrarrgräsfly	
Location	Estação Paul de Arzila	
Vice County	-	
LRC Boundary	-	
Grid ref	40.18258N 8.55424W	
Date seen	03/12/2025	
Recorder	Quadros Tenreiro, Paulo Jorge	
Determiner	Quadros Tenreiro, Paulo Jorge	
Dataset	EBMS :: EBMS fixed moth trap	
Sample comment	-	
Occurrence comment	-	



ButterflyCount

Butterfly Count App has capability to record moths with photo based automatic image recognition for identification of Atlantic zone moths (improving algorithm)



Adding a photo will start image recognition AI algorithm and will add species and counts

correct identification of 95% of moths in North-Western Europe

reliable moth monitoring by citizens

AI needs improvement:
add more areas (remote) + specialists

coordinators for moth monitoring are needed

Moth monitoring EUPoMS: methodology

COMMISSION DELEGATED REGULATION(EU) 2025/2188: Article 6 “Data Collection protocol for night-active moths”

- ...collect data on night-active moths at each monitoring site by using light traps.
- The light traps shall be active for **one night a month** during the observation period, with a minimum time interval ... of three weeks (*exception: bad weather conditions*).
- The light traps **placed more frequently**... where the observation period is shorter than six months. In this case, the minimum time interval shall be less than three weeks.



Moth monitoring EUPoMS: methodology

COMMISSION DELEGATED REGULATION(EU) 2025/2188: Article 6 “Data Collection protocol for night-active moths”

- **Record environmental parameters**: temp (in °C); cloud cover (in oktas); wind speed (in m/s); principal moon phase; fog and precipitation (presence/absence)
- **Two light traps** shall be placed at each monitoring site, with a distance of at least 50 m between them.
- **Use an identical light trap design and an identical light source** type at all monitoring sites. The light trap design and the light source type shall not be changed in the course of an assessment period.



The light source has a high output in the ultra-violet and blue light range (350-550 nm)

Moth monitoring eBMS: weaknesses

- We need to **expand the image recognition** capabilities of the App to cover more moths, particularly those occurring outside Western Europe
- At BCE and DVS we know a lot of (mainly **unconnected**) moth **experts** around Europe and joining them up in a network would foster progress in establishing an effective citizen science based moth Monitoring scheme
- **Ensure standard moth trap production** (or key components for self assembly) is scaled up and accessible traps available in all MSs soonish → Dutch production (Vivara 2026)
- We need **financial support** to really develop effectively and fast



Summary

- Scientific evidence: equally **important pollinators** as bees and hoverflies.
- We have a **tested method** to monitor them -> can easily be enrolled to other countries/regions.
- Easy identification by AI -> **citizens** can participate (volunteers, farmers, etc.)
- To detect a significant trend in the total number of moths in a small country or region, around **25 traps** are needed which are set at least **12 times a year** (from SPRING)
- There is a **website** and an **app** to enter all data into the eBMS **database**.
- **Trends** can be calculated using the same methods as for butterflies.
- These trends can be combined to **indicators**, just as we already do for butterflies.



Main messages

Monitoring of moths is ready to be used on a European level

- Now is the time to make a significant step in **organising a coordinated moth monitoring network** across Europe.
- We can learn from establishing the eBMS network and from work on the moth Red List to make good progress on a voluntary basis network
- We have a growing network of moth experts
- We need **financial support** to really develop effectively and fast

Everything is ready to start monitoring moths
at a European scale now





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EMBRACE Project: EC-ENV/2024/NP/0040: Grassland
butterfly indicator and European Butterfly
Monitoring Scheme update (2021-2026)

Acknowledgements
Volunteers
Coordinators
Assistants
Rangers
Institutions
Experts
European Commission
MEPs
DG Environment