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NEWTRAP:

Un photomaton pour tritons

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4. A case study
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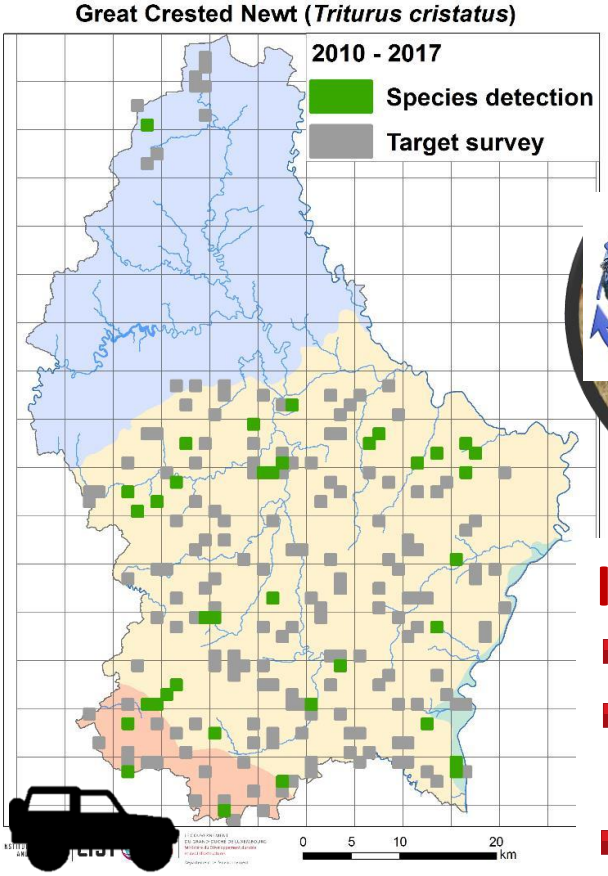
THE PROBLEMS



Current counting method

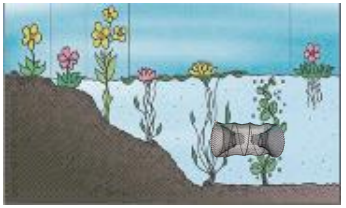
ISSUES :

- Time consuming and expansive
- Injuries to amphibians and habitat
- Low temporal resolution data

AMPHIBIAN OBSERVATION PROCESS

Automatisation

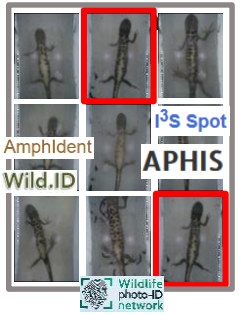
Field observations



PoC NewTrap

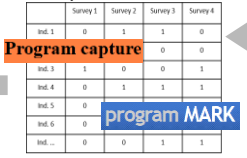
Media manager

Pictures



FNR POC

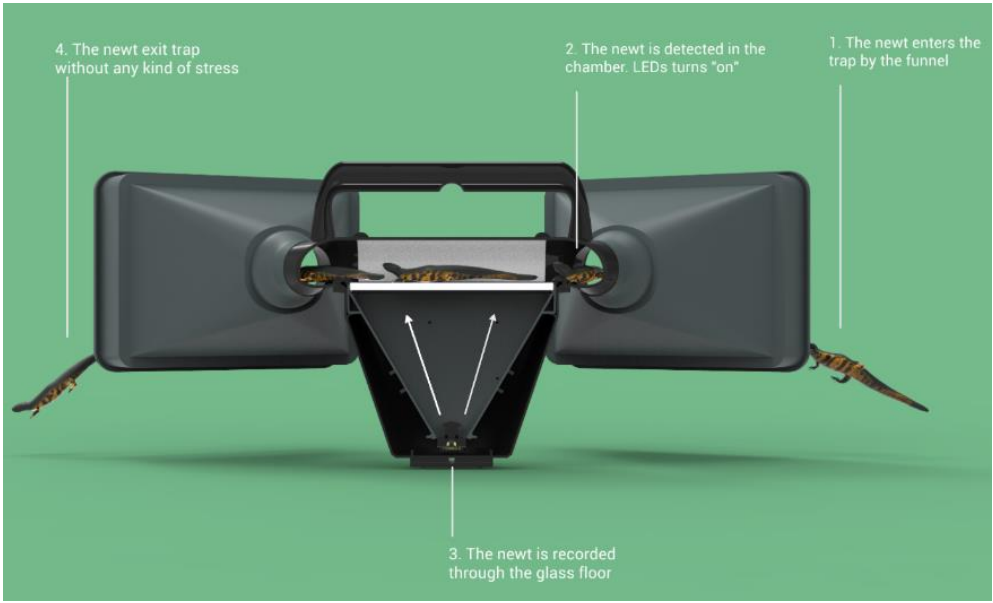
- species richness (not only newts)
- temporal activity
- biometrics
- population size
- population dynamics
- ethology



OUR SOLUTION

Patent LU93388 filled in 2016
Design protection WIPO87166

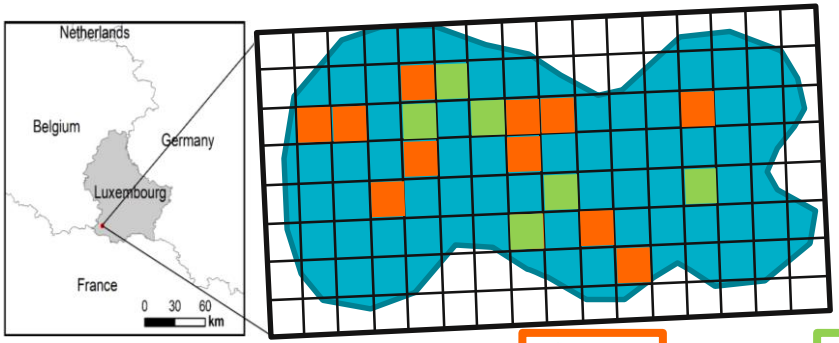
OUR SOLUTION



Battery (60A.h) + box on the bank

Recording of videos and Images (one picture by video)

A CASE STUDY



Capture-recapture study

1 pond followed in spring 2019:

Bascharage ~ 240m^2

Depth max: 100 cm

Target:

Comparison of 2 methods:

Units:

X 12 +

vs

X 6

Up to 20 “capture” sessions, from March to July

One session:

Random selection of squares for each session and method

VIDEOS FROM NEWTRAP

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NEWTFLIX

Palmate newt (male)

Smooth newt (courtship)

Great crested newt predating palmate newt

Alpine newt (foraging female)

Grass snake

Great crested newt and Leech

NEWTRAP MANAGER

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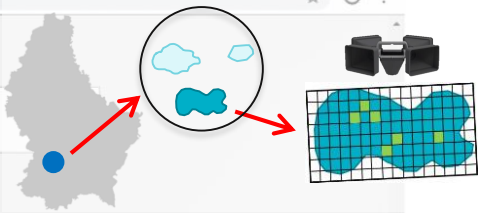
Encoding of conditions

Not secure | newtrap:8080/survey/index



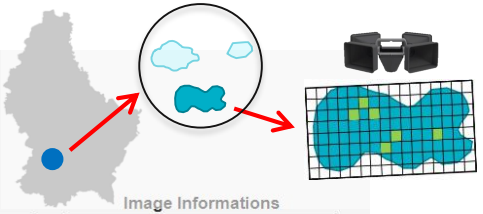
Recorder	L'Hoste Lionel
Comment	
Vegetation's Percentage	50 %
Water's Depth	0.4 m
Touching pond's bottom	☑
Start date of site visit	12 July 2019 17 : 20
End date of site visit	17 July 2019 08 : 15
Start working date of camera	12 July 2019 17 : 20
End working date of camera	17 July 2019 08 : 15
Device	laar_9 - NA Newtrap_2.0_1 - Pi_2.0_NoIR Newtrap_2.0_2 - Pi_2.0_NoIR Newtrap_2.0_3 - Pi_2.0_NoIR Newtrap_2.0_4 - Pi_2.0_NoIR
Scheduled working period	*Start time:* 00 *End time:* 00
Upload images	☑
Max seconds between pictures	120 s
Media linking (prefered method)	**Device 35** e.g. 2019_Bascharage\Session_06_finished\Bascha_P01_T01_K06

Save

Go back

NEWTRAP MANAGER

Encoding of pictures



Select Site: Bascharage rue du moulin

Select subsite: Bascha_P01

Select sampling location: C3

Select survey: Code K11 from 2019-05-15 15:00:00.0 to 2019-05-21 09:30:00.0

PlayList | Hide treated | Auto play | Extracted Images | Image Informations

Device	Name	Duration	Select
33	Bascha_P01_T01_K11_2019…		
33	Bascha_P01_T01_K11_2019…		
33	Bascha_P01_T01_K11_2019…		
33	Bascha_P01_T01_K11_2019…		

Play video and extract image

Validate

Image Informations

Species	Triturus cristatus
Sex	Female
Stage	Adult
Number	1
Number precision	Exact
Reliability of species identification	Certain
Behaviour	Standing

Remove from DB | Update infos

Duplicate last image infos

Video Speed : 1x | + | - | Capture | Delete

Go back

NEWTRAP MANAGER

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Image gallery

Not secure | newtrap:8080/manager/index

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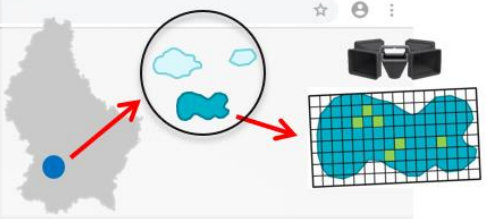

Select Site	Bascharage rue du moulin
Select subsite	Bascha_P01
Select sampling location	ALL
Select species	Anura
Select sex	ALL

Previous

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Go back | Export images

DEEP LEARNING

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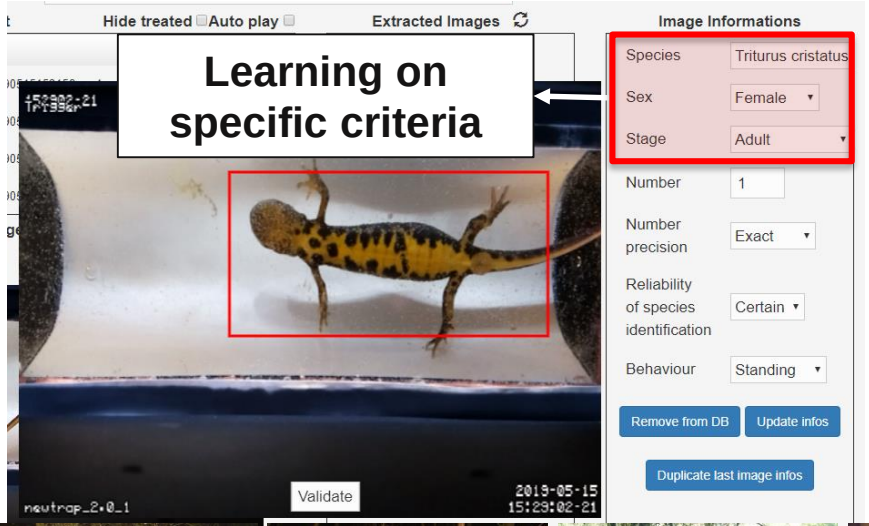
What is Deep Learning?

"A set of automatic learning methods composed of algorithms and reproducing the functioning of a human neural network"



Requires:

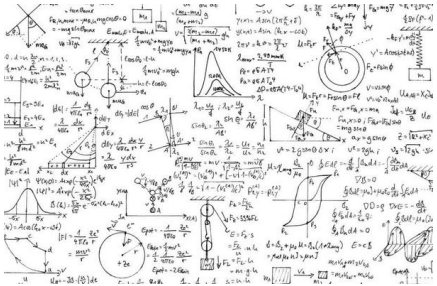
⇒ **Learning phase**

⇒ **Enough data to train on**

⇒ **A good CPU**

Background and **lighting under control with NEWTRAP!!**

DEEP LEARNING



3 models are running on NEWTRAP manager, using CNN transfer learning method

1st model:

⇒ Determine the species

⇒ learned on approximatively 200 *T. cristatus*, 200 *L. helveticus*, 200 *L. vulgaris* and 200 other species

⇒ Classification accuracy: 90%

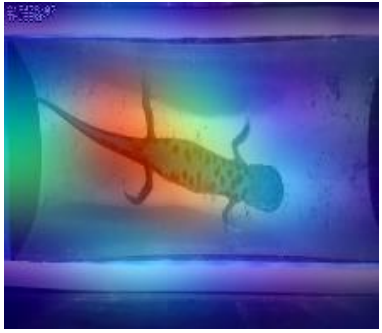
2nd model:

⇒ Determine the sex of any *T. cristatus* (adult)

⇒ learned on 1000 females and 2000 males

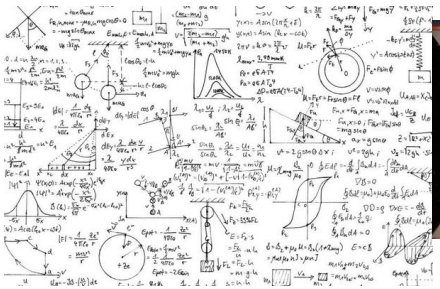
⇒ Classification accuracy: 99%

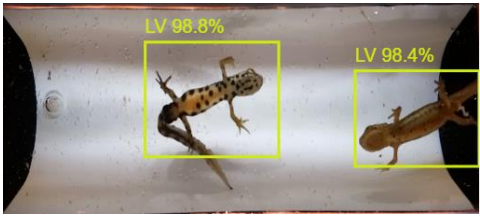
⇒ Discriminate regions by using Class Activation Map methodology

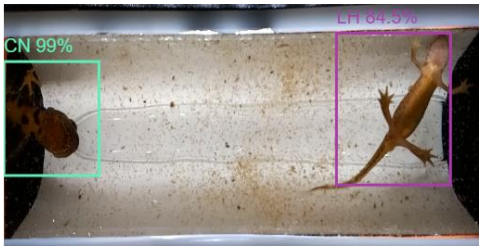


The tail is relevant to determine the sex

DEEP LEARNING







3rd model:

⇒ Determine simultaneously the species and the region in which the individual is located in the picture (bounding box)

⇒ Learned on approximatively 200 *T. cristatus*, 200 *L. helveticus*, 200 *L. vulgaris and* 200 other species + the bounding box coordinates

⇒ Classification accuracy: 97%

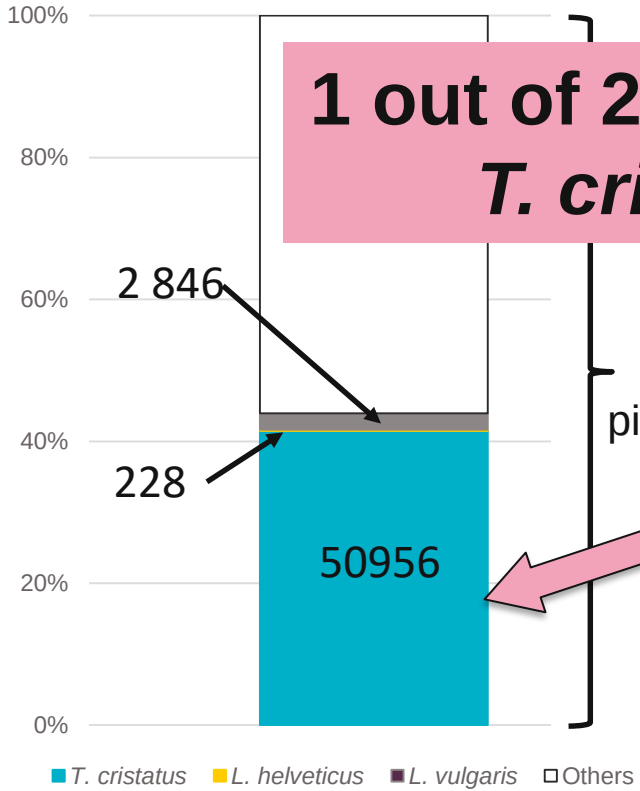
FIRST OUTCOMES

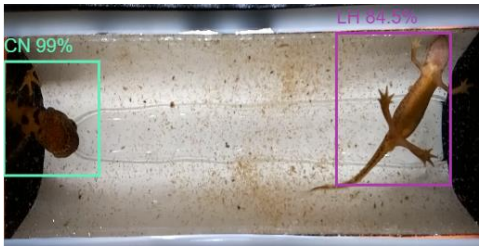
Raw results from modelling (without individualisation)

Based on the 3rd model

1 out of 2 pictures is *T. cristatus*

98 052 pictures





FIRST OUTCOMES

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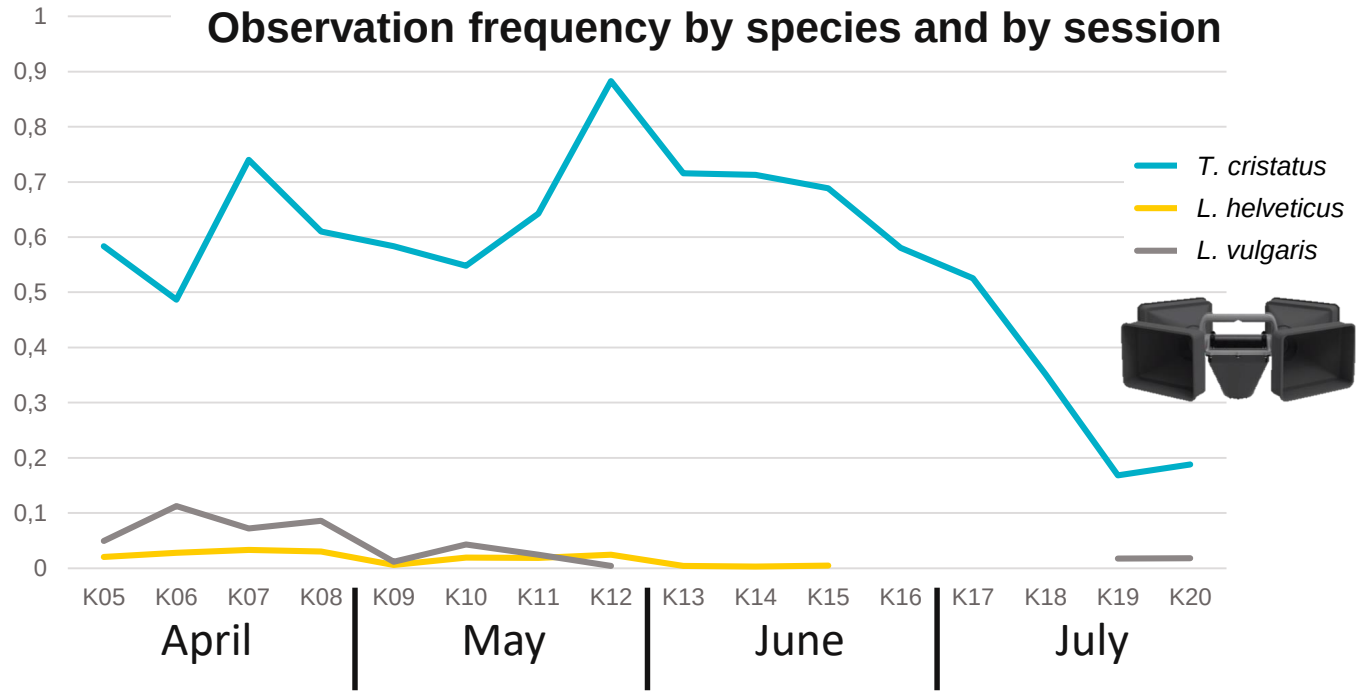
Results from modelling (without individualisation)

Up to 24 per day

$$= \frac{\sum \text{nb of hours with detection per session}}{\sum \text{nb of operating hours per session}}$$

Based on the 3rd model



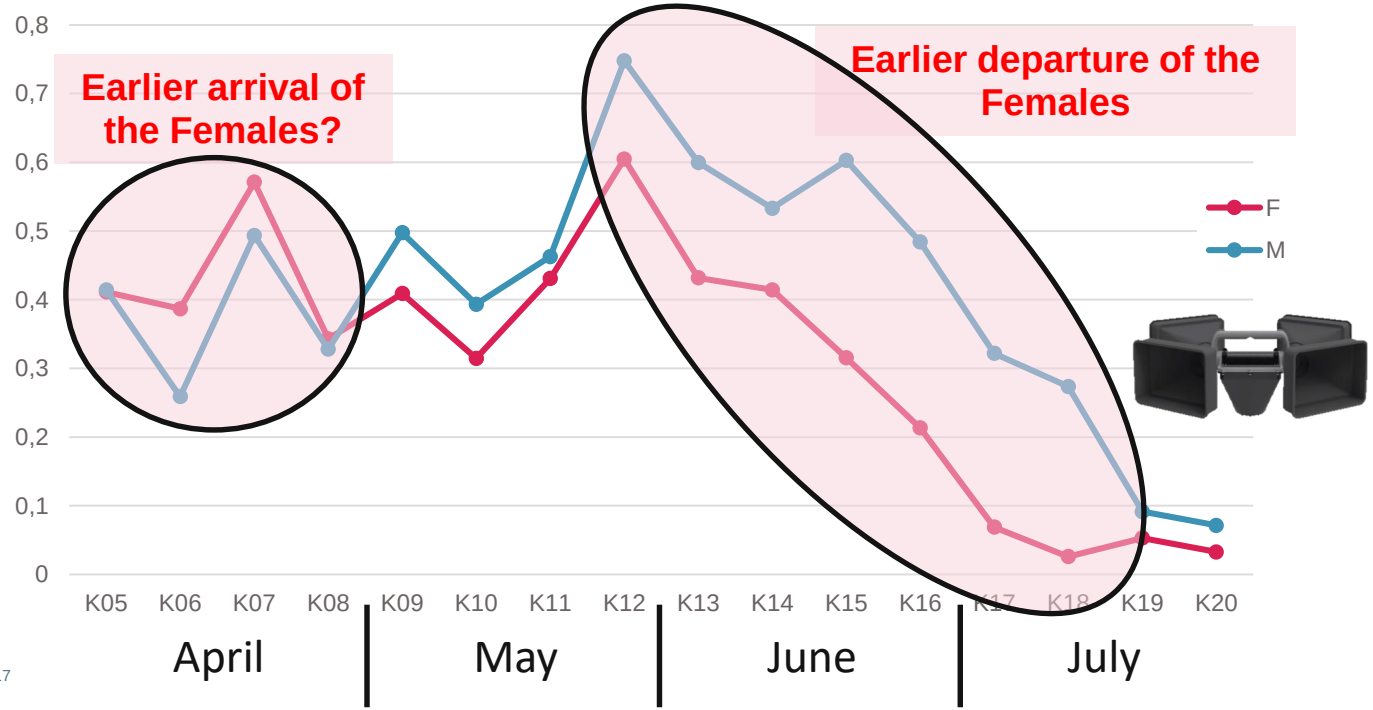
FIRST OUTCOMES

Results from modelling (without individualisation)

Based on the 3rd model

T. cristatus

Observation frequency by sex and by session

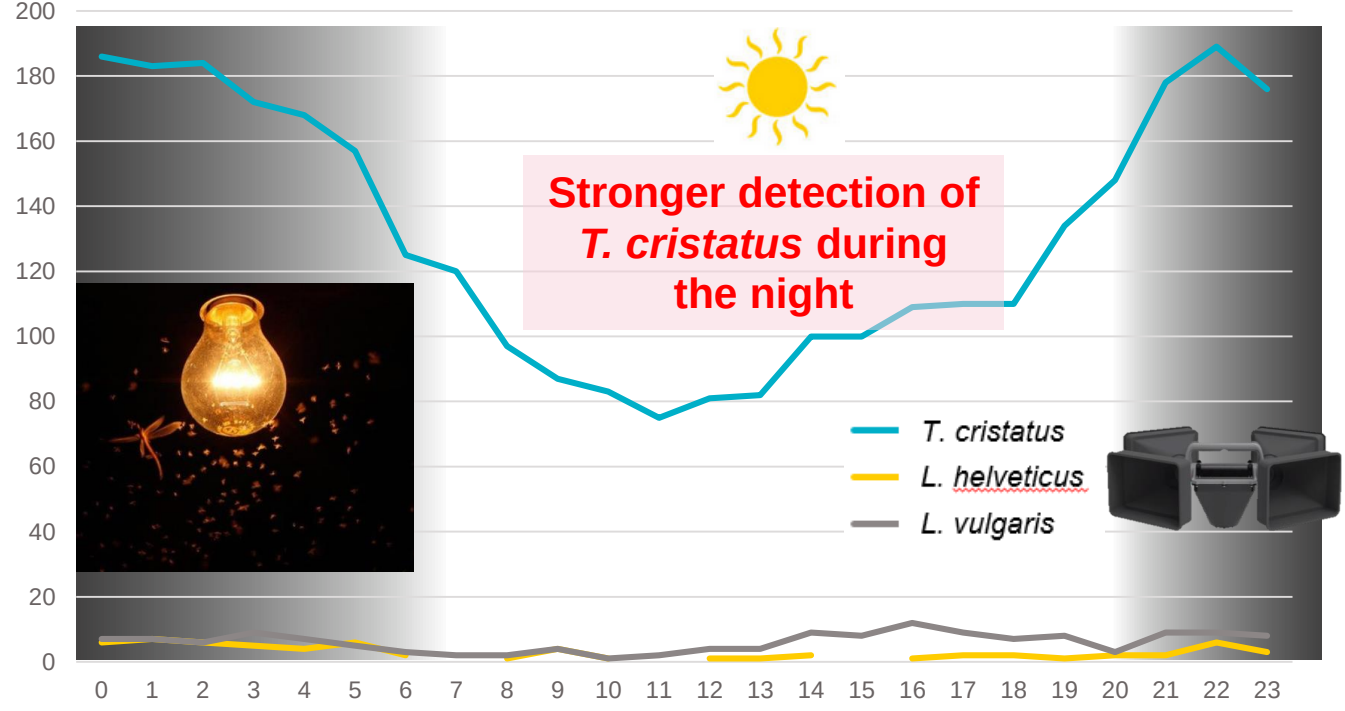


FIRST OUTCOMES

Results from modelling (without individualisation)

Based on the 3rd model

Number of hours with detection per time of day

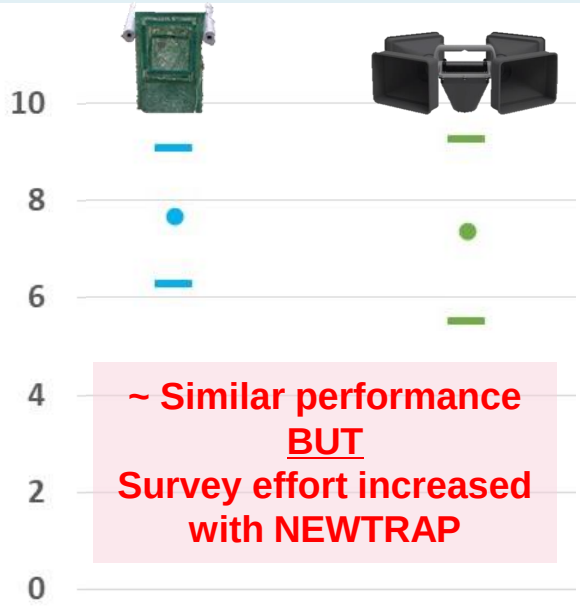


FIRST OUTCOMES

Results from individualisation on *T. cristatus*

Mean number of unique individuals caught per trap and per day

Partial analysis done on **10 sessions** from mid April to end of June



~ Similar performance
BUT
Survey effort increased with NEWTRAP

Assessment of the population size

Partial analysis done on **15 sessions** from March to end of June

Partial analysis done on **10 sessions** from mid April to end of June

~ Consistent assessment of the population size between methods
BUT
NOT based on the same dataset

FIRST OUTCOMES

Technical and financial aspects

Cost: **~ 750€ /** prototype (without considering labour costs)

Robustness: **Limited** (distortion with heat during the season)

Operating time: **2,86 days** (with a 60 A.h battery and based on 10 sessions)

Size: **60 x 40 x 30 cm** with funnels (L x l x h)

CONCLUSIONS & PERSPECTIVES

NEWTRAP - Apparatus:

=> NEWTRAP produces high temporal resolution data

- **Detection of presence**
- **Population estimates**

=> New tool ⟷ A protocol has to be defined

=> Technical issues are identified

=> Looking for a company to go further

CONCLUSIONS & PERSPECTIVES

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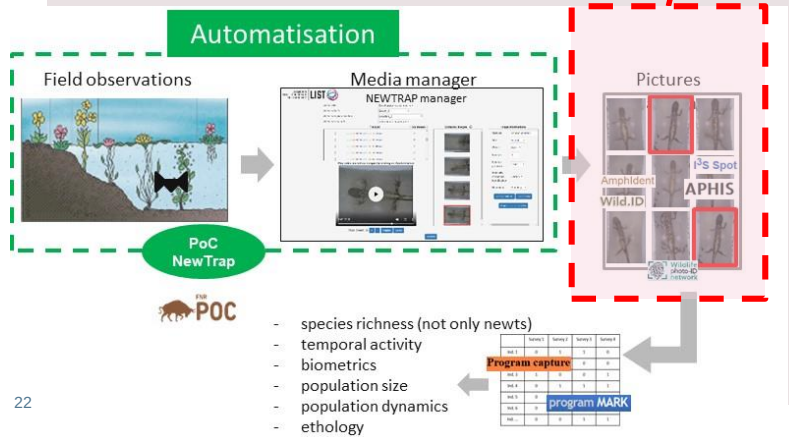
NEWTRAP Manager and the predict tools:

⇒ Very helpful to manage and pre-treat datasets

⇒ Development of an appropriate and working pattern comparison software

⇒ Improve and extend algorithm to other species



⇒ **Other ponds to enhance the library**

⇒ **Tests in other conditions**

⇒ **Other species, Larva**

CONCLUSIONS & PERSPECTIVES

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NEWTRAP opens new doors for amphibian field ecology

Thank you for your attention!

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