



Three examples of citizen-based observations and citizen science **SWITCH-ON / SMHI / Mellifica**

Citizen stream gauging,
Citizen habitat mapping,
Citizen nutrient footprint

Dr Esa Falkenroth, SMHI
Information Architect

Citizens GEOSS
St Petersburg
November 2016

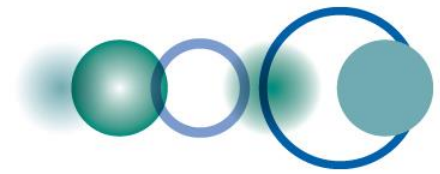


Follow us on twitter: [switchon_eu](https://twitter.com/switchon_eu)



water-switch-on.eu (Apps and virtual water-science lab)
Brings together 15 organizations from across Europe to search for new forms of scientific research and development of tools using Open Data for societal needs.

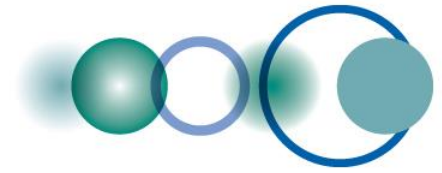
This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 603587.



Importance of connecting to existing communities

The collage features four overlapping website screenshots:

- EDGE (Evolutionarily Distinct & Globally Endangered):** A banner with a sloth and the text "EDGE EVOLUTIONARILY DISTINCT & GLOBALLY ENDANGERED" and "ZSL LET'S WORK FOR WILDLIFE". The navigation bar includes Home, About, Species, Conservation, Blog, Get Involved, and Donate. A "DONATE NOW" button is visible in the top right.
- WWF Global:** A screenshot of the WWF website showing the "Mammals" section with a "Giant Panda" focus. The navigation bar includes Home, WWF, What We Do, Our Earth, You Can Help, News & Stories, Images, GIFTS, and DONATE. A sidebar on the left lists "Fact Sheet BATS" and "BASIC Bats are th elongated".
- Map:** A screenshot of a map interface with the title "Map Help us put bats on the map!". It includes three buttons: "I've seen a bat", "I'd like to see a bat", and "I want to do more". The map shows various locations with bat icons.
- ASCOBANS:** A screenshot of the ASCOBANS website, showing the logo and the text "Agreement on the Conservation of Small Cetaceans in the".



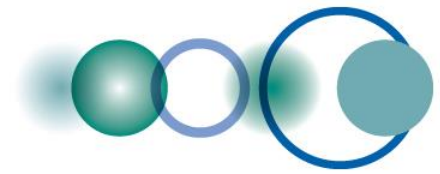
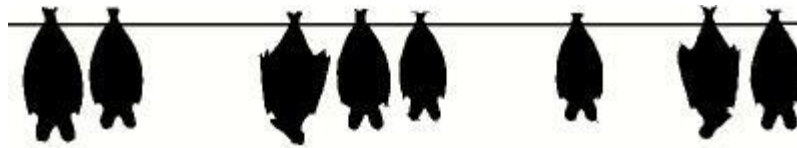
Example of a bio diversity community

<https://www.youtube.com/watch?v=zWSSk2xIIJs&feature=youtu.be&t=100>

Bat science is one of these active communities.

Bats use ultrasonic waves so you need special equipment to hear them.

Movie time..



Example 1: Where are the bats?

Bats use different habitats for feeding, roost and travel.

- [foraging habitats](#): bats hunt to find food
- [commuting habitats](#): travel between foraging habitats

Citizens (enthusiasts) are mapping bat habitats to better understand how the climate change is affecting bats

Goal is to better understand and protect the many different bat species.



Map

Help us put bats on the map!

View the Big Bat Map
Hints and Tips
Events

I've seen a bat

I'd like to see a bat

I want to do more

Help count bats ▶

About your bat sighting 1/3

Name

Email

When did you see your bat?0

07/11/2016

in the evening ▼

How many bats did you see?

1 ▼

Where was the bat?

garden ▼

What was the bat doing?

flying around ▼

flying around

coming out of a building

coming out of a tree

on the ground

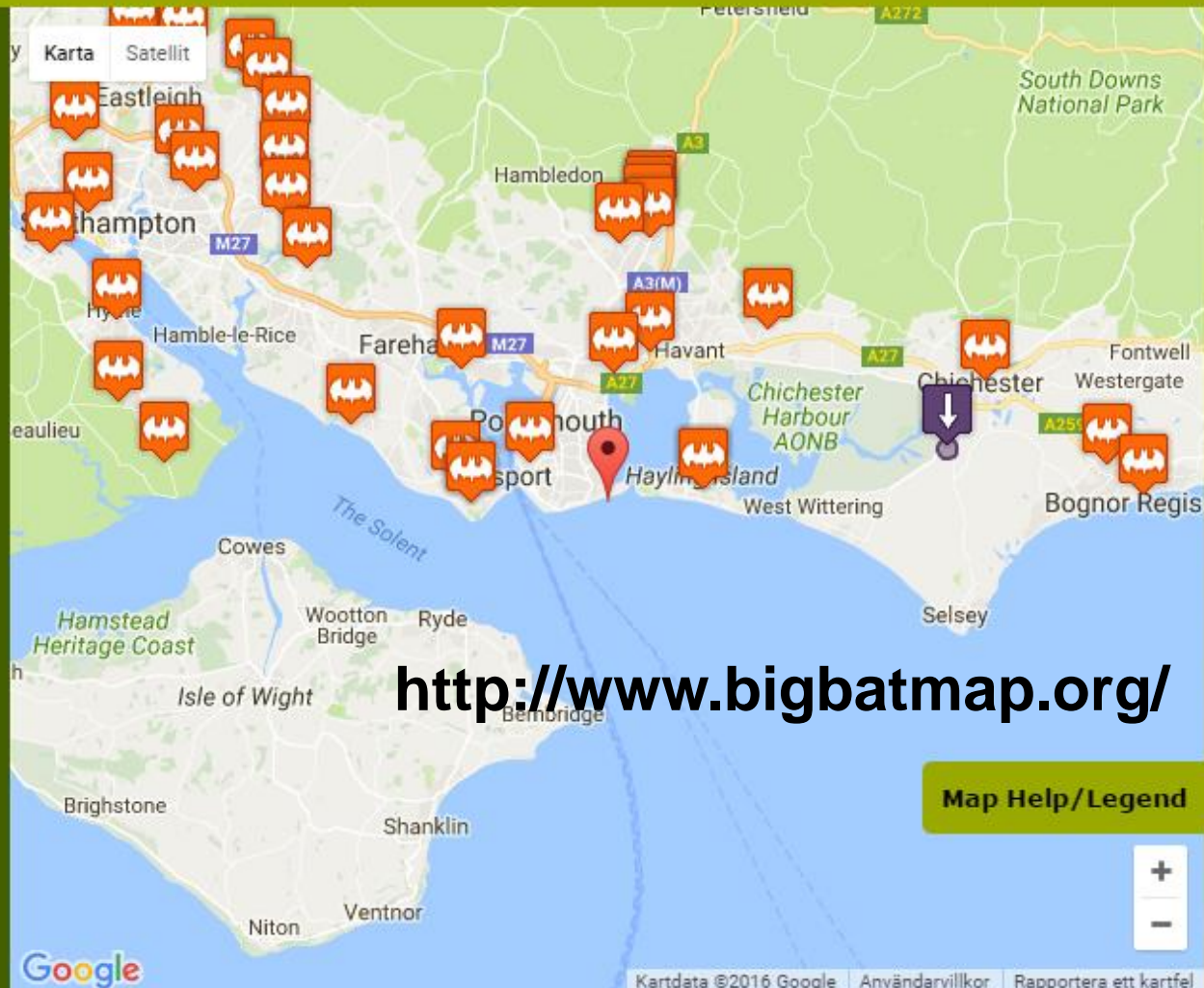
in my house

other

touch?

Yes ☐ No ☐

Next: Put your bat on the map! ▶



<http://www.bigbatmap.org/>

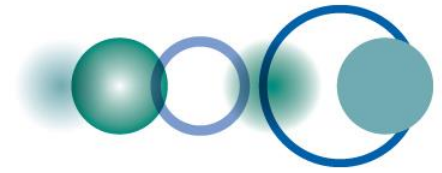
Map Help/Legend

+

-

Kartdata ©2016 Google | Användarvillkor | Rapportera ett kartfel

Donate ▶

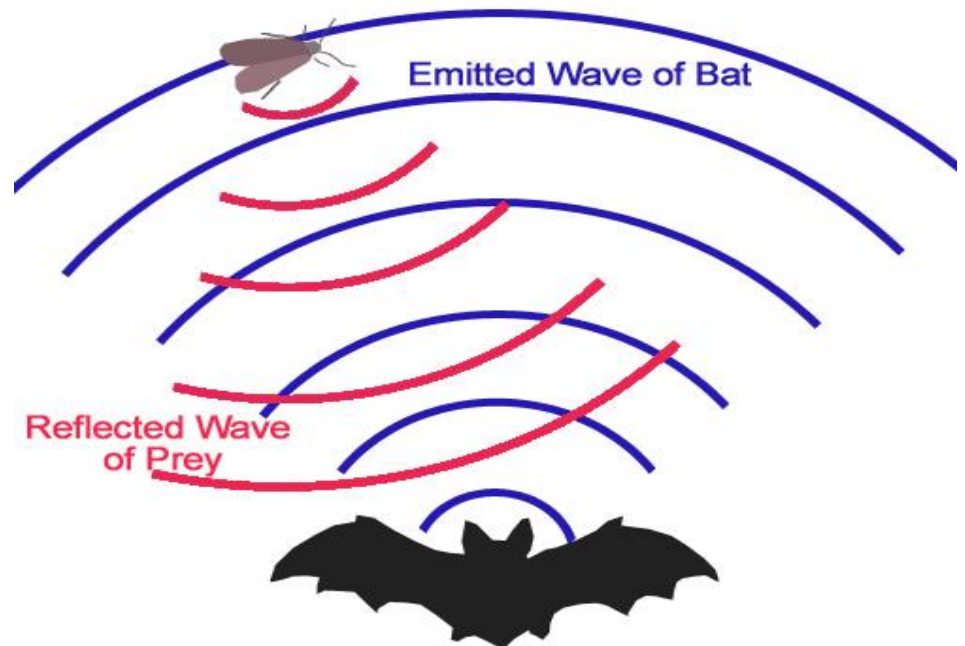


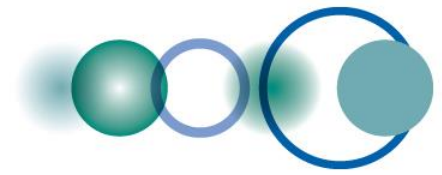
Another approach to collection

Bats use ultrasonic to hunt prey and travel between habitats along "corridors" .

Each species has a distinctive frequency pattern.

We can use the ultrasonic waves to locate and identify bats .

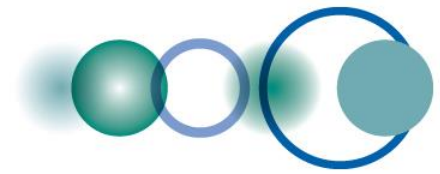




Citizen-financed IoT-approach to low-cost bat monitoring

- Raspberry PI (third gen with Bluetooth/Wifi)
- USB microphone [M500-384 \(384 kHz\)](#)
- Powerbank (2200 mAh)
- Velcro strap



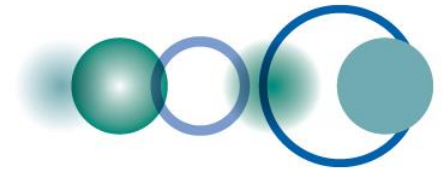


Open source and Open data

- Capture ultrasonic w mic
- Wireless upload
- Built-in webserver
- 2.7 GB/ hour recording
- Upload to cloud
- Open data shared (CC/BY)
- Open source (Arnold A)
- Plot frequency charts
- Active collection in Sweden, Australia, etc.

github.com/cloudedbats/cloudedbats

```
20
21 @cloudedbats_core.singleton
22 class SoundRecorder(object):
23     """ Note: Singleton class to avoid some concurrency problem
24     def __init__(self):
25         """ """
26
27     def setup(self, in_sampling_rate_hz = 44100, # Default: 44.
28               in_adc_resolution_bits = 16, # Default: 16
29               in_channels = 2, # Default: 2 = stereo.
30               in_device_index = 0, # Default: First recog
31               in_device_name = '', # Use name lookup to g
32               audio_target = None,
33               ):
34         """ """
35         #
36         self.in_sampling_rate_hz = in_sampling_rate_hz
37         self.in_adc_resolution_bits = in_adc_resolution_bits
38         self.in_width = self.in_adc_resolution_bits / 8
39         self.in_channels = in_channels
40         self.audio_target = audio_target
41         if in_device_name:
42             self.in_device_index = AudioSource().get_device_ir
43         else:
44             self.in_device_index = in_device_index
45         #
46         self._pyaudio = None
```



Example 2:

Encouraging citizens to report water-levels

- Data for water-level is required to calibrate and verify EHYPE hydrological model.
- Hydrological models produce data for flooding warnings, forecasts, water quality information, etc.
- Use in hydrological core-service for forecasting/warnings
- Approach: "Build system and see how it works out"

Example 2: WRAP (web rapporteringssystemet) Citizens measure water-level from bridges

- National monitoring network consists of 130 stations
- Additional 130 monitoring station run by private companies
- Over 30.000 waterbodies in Sweden so citizens help with measurements to improve accuracy of data
- Idea is to allow citizens to measure water-level from bridges
- No community exists so we actively contacted citizens (mostly farmers) to help out with measurements.





**Penguins here? How
to eliminate outliers**



Quality assurance of water-level measures (not so easy)

- Many ways of measuring from bridges.



Top of rail

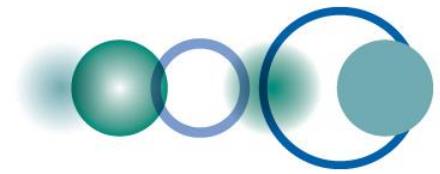
Road level

Start of rail

Start of bridge

Surface to bottom

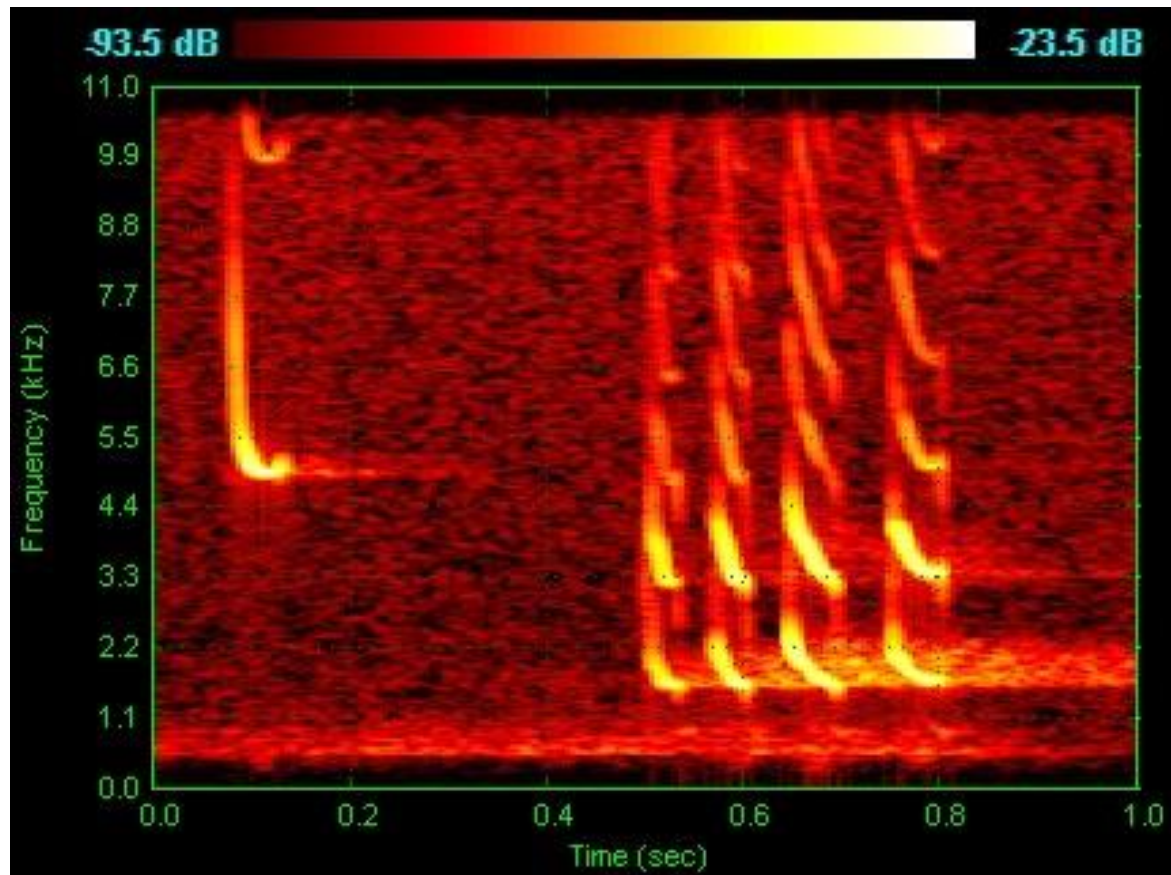
Outlier elimination is difficult

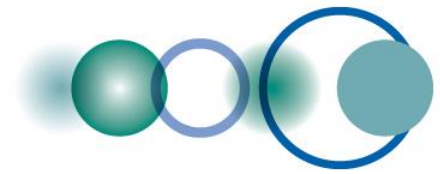


Quality assurance of bat recordings is easier

Each species have a distinct signal that can be identified:

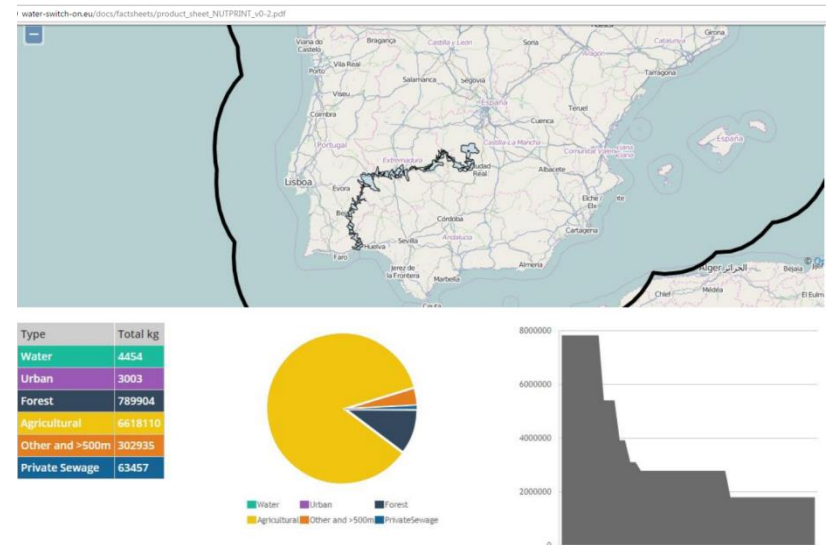
- frequency ranges
- signal duration
- peak energy freq
- frequency patterns
- neighbour reports



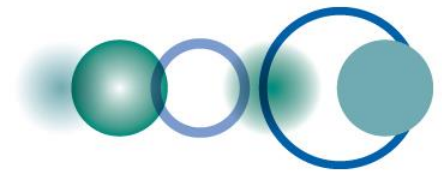


Example 3: NUTPRINT: your footprint

- NUTPRINT aims to visualize the nutrient footprint on European coastal waters from anywhere within the European continent.

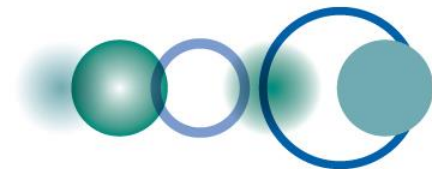


- NUTPRINT is a tool that could be used in education, public consultation to raise awareness for eutrophication problems in coastal waters. It can be used by schools/universities, environmental and management organisations



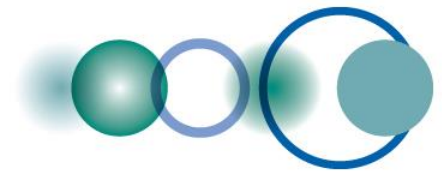
Nutrient loads and retention calculated based on

- Precipitation/snow: WFDEI, GlobSnow, Former Soviet Union Hydrological Snow surveys
- Discharge: EWA, Baltex Hydrological Data Centre
- Evapotranspiration: MODIS
- Routing and lakes: Hydrosheds, Hydro1K, GGLWD
- Landuse: GLC2000 and CORINE
- Crops/soil: CAPRI, MIRCA2000, FAO-56, GRDC, DSMW, Euroland Soil Sealing
- Irrigation/nutrients EIM, GMIA, Siebert, FAO-56, GEMS,...
- Waste water: Hyde, EEA



DEMO

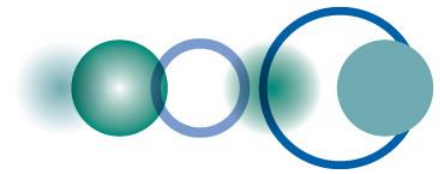
<http://water-switch-on.eu/>



Three examples of citizen-based observation techniques and/or citizens science

- Three types of communities: biodiversity/farmers/students
- Three approaches to motivate people to participate
- Four uses: science, core-services, community, education
- Two approaches to collection: web-based and automated
- Two approaches to quality assurance



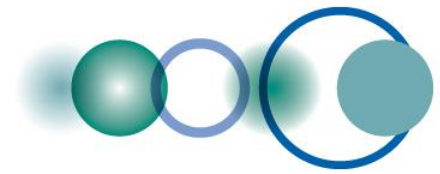


Bat experience

- Existing enthusiastic bat community to build on
- Clear community goal for the data collection
- Hardware replaces boring recording task
- Low-cost hardware and cloud-solution
- Easy to get started
- Quality assurance possible (freq and time domain)
- No penguins

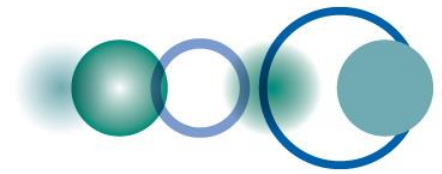
WRAP Experience

- Try to encouraging citizens to contribute water-level data
- General purpose collection: warnings/science
- Manual measurement that take time
- Low-cost hardware (cell phone)
- Stringent measurement protocol needed (hard to do it correct)
- Quality assurance very hard
- Risk for penguins



A few things to consider when working with citizen-based observations/science

- Connecting to existing citizen communities (able and willing to collect) is easier than building new communities
- Existing communities are also a shortcut to marketing (without marketing nobody will know about your system)
- Feedback/visibility to observing citizens is appreciated/necessary
- “Cultural issues”... Efforts required to overcome resistance of non-traditional solutions in education/core services.
- Citizen observations are easier to accept if you use graphical presentation (rather than plugging in the data-stream directly into critical core-services).
- Cleaning required for data acceptance. Some data are relatively easy to clean and assess quality whereas other data are very hard to check.
- Early work on business canvas to find sustainability



Devices are getting cheaper



Thank you !

Esa Falkenroth
SMHI/ SWITCH-ON Project



