

## Citizen science and biodiversity observations – EU BON best practice cases of initiatives, systems and tools.

### *Species Observation System in Norway*

#### **General description**

[The Species Observation System](#) (NBIC 2016) was started in 2008 by the Norwegian Biodiversity Information Centre (NBIC). It is an online species observation reporting system providing more than 60% of all available occurrence data in Norway. There are more than 15 million records, 400,000 with pictures in the system as of 2016, covering 19 800 species and coming from 9400 contributors. 87% of the observations are of birds.

#### **Integrating citizen scientists**

In order to effectively reach citizen scientists there are 6 nation-wide naturalist NGOs involved. Contracts of collaboration guarantee mutual interest to data provision and validation. The benefit for governmental institutions is access to big data, while the naturalists and their organisations get public awareness and sustainable data maintenance.

#### **Communication**

NBIC communicates with reporters via online user support on the webpage. Contracted NGOs communicate with their members through their own communication channels, as well as with the general public via publications, web pages etc.

#### **Data**

System management, data maintenance and system development is run by NBIC. Data is shared to national data portals and GBIF using Darwin Core (DwC) standard, but the native data format is even richer than DwC. The full resolution of sensitive data about species is hidden from general public and can be accessed only by validators or specialists with extended data access.

#### **Quality control**

Taxonomy, coordinates and all parameters are automatically validated upon reporting, reporters get a warning when species are out of geographical range or period. Anonymous reporting is not possible. Reporters are encouraged to provide reliable data. Identifications are discussed on a public forum, so that crowdsourced voluntary quality annotation is part of the procedures. Rare and endangered species are finally formally validated by one of more than 150 validators.

#### **Funding and dissemination**

Development is funded by the Norwegian (40 %) and Swedish Environmental Agencies (60 %). All data are disseminated to national portals and GBIF.

#### **Proven success factors for starting and maintaining citizen science projects/systems:**

1. Raise awareness of the potential of CS for biodiversity management within authorities/institutions, NGOs and scientific institutions
2. Connect naturalist NGOs to a persistent data management/data mobilizing/data sharing institution
3. Define the role and contribution of the interacting partners – create an organizational structure
4. Define and create a common agreement among the partners on the data licensing (CC BY 4.0) and data sharing protocols (Darwin Core Archive, EML for metadata)
5. Involve NGOs in the development and configuration of a CS reporting system
6. Estimate and develop a long time budget, funding agreement, and procedures for economic management
7. Define and administrate contracts with partners on the ambitions and level of user support and validation procedures
8. Define and develop communication procedures, routines, and responsibilities

9. Administer yearly reporting and payment procedures among the partners
10. Involve partners in further development and improvement of the CS reporting system, including cooperation with international partners

## *Israeli Butterfly Monitoring Scheme (BMS-IL)*

### **General description**

The Israeli Butterfly Systematic Monitoring Scheme (BMS-IL) was established in April 2009 and is run by the Israeli Lepidopterists Society. It builds on the long tradition and experience gained through over 30 years of systematic butterfly monitoring by thousands of volunteers across Europe, USA and other regions. Coordinated by Dr. Racheli Schwartz-Tzachor, Dr. Guy Pe'er and Dubi Benyamini, BMS-IL includes three elements: a) systematic observations along fixed transects ("Pollard walks"), b) collation of opportunistic sightings and c) targeted observations on rare species.

### **Integrating citizen scientists**

The main objective of the scheme is communicated to volunteers: to provide reliable data for assessing the status and trends in the abundance and phenology of Israel's butterflies, for both conservation and research purposes.

[GlueCAD](#) provides services to the Israeli Lepidopterists Society in designing, facilitating and organizing BMS-IL and the Israel Butterflies Observations portal starting in 2012, while the UFZ offers scientific guidances. GlueCAD is also working with EU BON partner [PPBio](#) in Brazil on a mobile application for monitoring Western Amazonian frogs using both photos and audio files for identification.

### **Communication**

The Israeli Lepidopterists Society shares information about BMS-IL and provides experts' review on data validations, identifications and confirmations.

### **Data**

GlueCAD provides data sharing tools and citizen-science based apps to facilitate data entry by volunteers. GlueCAD also performs system management, data maintenance and development of the Israel Butterflies Observations Portal, which enables volunteers to upload their data and facilitates data discovery: <http://www.gluecad-bio.com/hompage.asp?lng=eng>

Data is also published and shared in standardised DwC sampling-event format using the GBIF IPT: <http://cloud.gbif.org/eubon/resource?r=butterflies-monitoring-scheme-il#methods>. This standardised format faithfully stores the original data and allows it to be easily indexed into GBIF.org and integrated with other data sources.

### **Quality control**

Systematic butterfly monitoring is carried out in a strictly controlled manner according to the sampling protocol: the observation protocol requires volunteers to take a slow walk along a fixed transect, and report all butterflies observed within a "box" of 5x5x5 m' (van Swaay et al. 2015). Unrecognized individuals are reported as well, so that total abundance is known and the volunteers' recognition capacity can be evaluated. Every record uploaded by volunteers is flagged "for Approval" and the record status only changes to "Approved" after it has been reviewed by an expert. Furthermore, species out of season or distribution area are flagged for additional verification.

The Israeli Lepidopterists' Society waived all rights to the data and dedicated them to the Public Domain. The standardised data are publicly accessible via the [EU BON IPT](#) and have been indexed into GBIF.org facilitating integration with other data sources.

### **Proven success factors for starting and maintaining citizen science projects/systems:**

1. The data is shared openly with the philosophy that transparency and sharing are routes for rapid knowledge generation, cooperation, and capacity building.

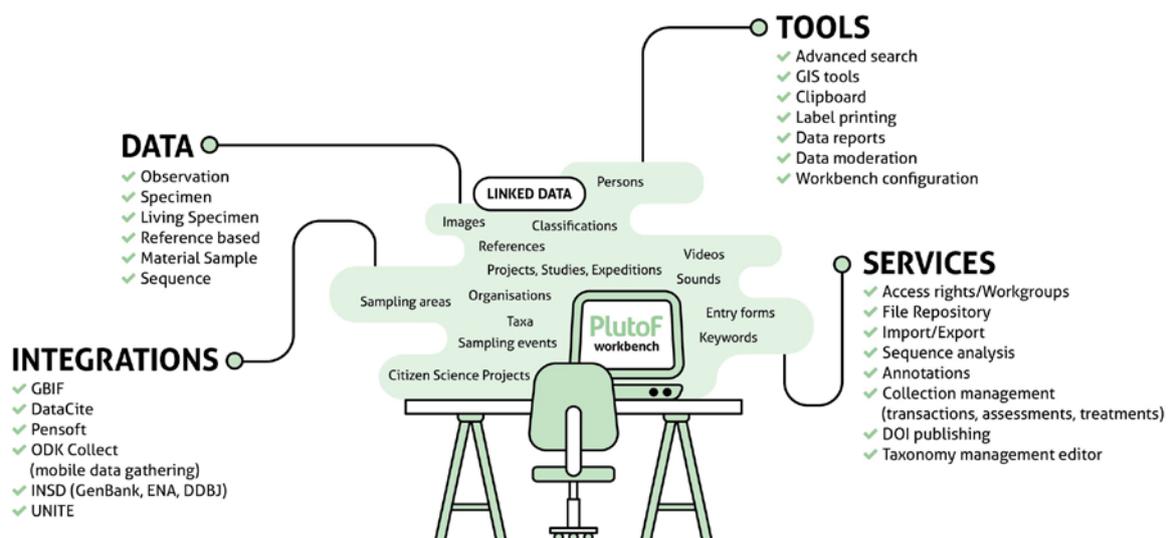
2. Involve experts for example in biodiversity data management to ensure the data is stored, standardised and shareable in the proper formats.
3. Ensure an expert is on site to help engage and guide first-time volunteers.

As an example for many other systematic monitoring schemes, the BMS-IL data has been linked with GBIF and intense discussion and development processes took place to ensure that GBIF can incorporate the meta-data which characterizes this scheme and others. Among others, it was important to identify how GBIF store and communicate information on...

- a) the attribution of observations to fixed sites and sections of a transect (a hierarchical structure which also occurs in other scheme types) - allowing data-users to know that data from a given site repeat over time
- b) the information that the abundance of all species in a given observation are being reported - allowing users to determine a “zero” for all other species not observed in a given date.
- c) the provision of information on observation method and sampling effort and area, allows data users to calculate butterfly density or to convert between units - thereby offering interoperability e.g. between different monitoring methods or taxa (e.g. plants are usually reported based on density). The use of sub-sections also enables one to calculate the species’ accumulation curve, in favour of estimating total species’ richness and the Species Area Relationship.
- d) the option to report on zero butterflies - seemingly a simple procedure from the butterfly perspective to ensure that all visits to a site are known even if no individuals are seen, but from a GBIF perspective required the creation of a “generic species zero”. With this small modification, a door is opened toward improved analyses e.g. of species’ phenology with “true zero” observations also in time

Through the work with BMS-IL, in cooperation with GlueCAD and the UFZ, GBIF could improve the means to accommodate systematic monitoring data, enhance tractability, identification and filtering of best data for analyses according to their suitability to address specific ecological questions.

## PlutoF citizen science module



**Figure 7:** Components of the PlutoF workbench and database

### General description

PlutoF is a web-based workbench (**Fig. 7**) and database solution for biodiversity research (<http://plutof.ut.ee>). It is developed and maintained by University of Tartu Natural History Museum (UTNHM). PlutoF database follows international biodiversity standards as Darwin Core. There are many institutional users who manage their biological data but private users can also freely access all the services and store their observation and sample data. PlutoF provides data collecting and sharing services for Estonian Ornithological Society, one of the major CS organizations in Estonia, PlutoF occurrence data are published on national biodiversity portal <http://elurikkus.ut.ee>. The PlutoF citizen science module for managing biodiversity projects was launched in 2015 and aosp qualified occurrence datasets could be exported to the GBIF database. The CS module is only one module out of many tools incorporated in the PlutoF system that can be also be used for collection management, DNA sequence analysis and other purposes.

### **Integrating citizen scientists**

PlutoF is a tool which can be used by all persons who want to collect, manage and share species occurrence data. Citizen science organizations encourage their members to use PlutoF for reporting and the collected observation data can later be published on portals which are built on database by using a specific API. It is also possible to use mobile applications to upload occurrence data in PlutoF and users can directly ask the PlutoF helpdesk for assistance.

### **Communication**

Citizen science organizations who run PlutoF-based data projects manage the communication with their contributors themselves, but the PlutoF team offers courses and email support for the workbench users. There are video tutorials and user guides available that show the effective use of the PlutoF workbench. For project managers the PlutoF-based internal communication channel assists to discuss accepted or rejected occurrences, and supports the feedback to and from citizen scientists.

### **Data**

Occurrence data follow Darwin Core standards. Datasets from various projects that comply with quality requirements will be published to GBIF via a locally installed IPT. For countries without a local GBIF node and IPT it could help to publish their data through the PlutoF system. Users can access their data after the submission and can add additional information about sampling area, interactions with other taxa (parasite, host), multimedia files, keywords and can manage identifications etc. For the legacy data the users have an option of importing csv format tables.

### **Quality control**

Projects that use PlutoF tools for citizen science data collection can use an observation moderation service. In that case appointed users will check the data coherence and likelihood of the taxon to be observed at that time or place. In case of doubt the moderators can ask additional information from observers to verify the occurrences. For specific project datasets the project managers or managing institutions have to take the responsibility for data quality. After they have proved their capability of assuring the quality, data will be published to GBIF.

### **Funding and dissemination**

PlutoF is funded by Estonian research networks and the University of Tartu. Some module developments are project-based.

## *Citizens' Network for the Observation of Marine Biodiversity*



Credit: Thanos Dailianis, HCMR

### **General description**

COMBER (Citizens' Network for the Observation of Marine BiodivERsity; <http://www.comber.hcmr.gr/?q=news>) was a pilot citizen science project initiated under the EU project ViBRANT. It was designed and implemented as a pilot project for divers and snorkelers who are interested in participating in marine biodiversity citizen science projects, in the framework of the ViBRANT e-Infrastructure Project. It demonstrates the necessity of engaging the broader community in marine biodiversity monitoring and research projects, networks and initiatives. It analyses the stakeholders, the industry and the relevant markets involved in diving activities and their potential to sustain these activities.

### **Integrating citizen scientists**

Scientists from the HCMR (Hellenic Centre for Marine Research, Heraklion) were working with local diving and sailing clubs and offered short theoretical seminars for divers and snorkelers that are interested in participating in the project. During these seminars, divers get an overview of the local fish fauna and how to identify the different species. Afterwards, specially trained guides accompany the participants on their dive or snorkeling trip to help observing and recording fish.

### **Communication**

Under the supervision of scientists and assistance of instructors, a simple protocol elaborated was implemented. This included professional lectures on coastal biodiversity and instruction on data recording and up-loading, questionnaires and safety provisions. In addition, a blog has been developed to assist the communication between all members of the pilot project.

### **Data**

After the dive, participants enter their observation into the COMBER database. The data will be used in the future to assess the marine biodiversity along the local coasts. Sensitive data about species is hidden from general public and can be accessed only by specialists. Data are open and available for further use and harvest by the large aggregators. After short seminars, divers are able to recognize and record the fish fauna of the Mediterranean by using the BIOWATCH underwater fishcard. They are familiar with the recording software and can therefore independently contribute with observations during future dives. Data are also thoroughly checked by the scientists at regular intervals.

### **Funding and dissemination**

COMBER operated under the ViBRANT project funded by the EU under the e-Infrastructures instrument (7th RTD Framework Programme). It is continued as a self-sustained project.