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SETTING PATHS IN CITIZEN SCIENCE: BIODIVERSITY, NETWORKS, OPEN SCIENCE AND PLATFORMS

FIRST ITALIAN CITIZEN SCIENCE

CONFERENCE

ROMA 2017

**SETTING PATHS IN CITIZEN SCIENCE:
BIODIVERSITY, NETWORKS, OPEN SCIENCE AND PLATFORMS**

November 23-24, 2017

Conference Hall, National Research Council

November 25, 2017

Conference Hall, Civic Museum of Zoology

BOOK OF ABSTRACTS

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Con *citizen science* (scienza partecipata) si fa riferimento ad un nuovo modo di fare scienza, con una interazione a vari livelli tra società civile e comunità scientifica. Questa interazione può avvenire nei più disparati campi della ricerca, dalla biologia all'ecologia alla climatologia all'astronomia, dalle neuroscienze alla medicina e all'informatica. Diverse sono quindi le attività in cui i "cittadini" possono essere coinvolti: segnalare la presenza di specie animali o vegetali in un dato territorio, riportare osservazioni su specifici fenomeni, utilizzare apparecchiature per il rilevamento di parametri ambientali, mettere a disposizione risorse proprie per rilevazioni di varia natura, ecc. Ma il ruolo di collaboratori rappresenta solo il primo "livello" di coinvolgimento. Mano a mano che l'interazione tra le due "anime" della *citizen science* si fa più complessa il livello di coinvolgimento aumenta, arrivando ad includere, per esempio, la pianificazione delle attività sperimentali, l'elaborazione di dati, fino alla loro pubblicazione. La produzione di letteratura scientifica con il coinvolgimento diretto di ricercatori non professionisti è un fenomeno in crescita esponenziale a livello internazionale. Benché l'idea della partecipazione di "appassionati" alla ricerca non sia nuova (si può far risalire alla metà dell'800) oggi, grazie ai nuovi strumenti tecnologici multimediali – che semplificano comunicazione, scambio e validazione scientifica dei dati, oltre alla acquisizione, utilizzo e gestione delle informazioni – la *citizen science* si sta sempre di più affermando come un approccio in grado di fornire efficaci sistemi di monitoraggio e strumenti di ricerca sempre più importanti. Inoltre, non va sottovalutato il valore fondamentale che le iniziative di *citizen science* rivestono sul piano formativo e didattico. Il coinvolgimento della società civile nella ricerca consente un avvicinamento 'empirico' alle tematiche scientifiche, con il conseguente sviluppo di una maggiore consapevolezza dell'importanza della scienza, delle sue potenzialità, oltre che dei suoi limiti. Nel settore delle scienze ambientali, ad esempio, i progetti di *citizen science* possono avere ricadute importanti sul piano educativo che possono tradursi in cambiamenti significativi del comportamento dei cittadini nel rispetto dell'ambiente. In questo contesto, la *citizen science* può essere vista come una ulteriore evoluzione della educazione ambientale, dove il valore aggiunto risiede nel coinvolgimento attivo e diretto delle persone.

Lo sviluppo di progetti di *citizen science* è potenzialmente molto prezioso per i ricercatori: il numero di dati che si può ottenere con la partecipazione pubblica supera di gran lunga la capacità di lavoro del personale specializzato, permettendo in molti casi *monitoraggi su ampia scala spaziale e tempo-*

rale. Tuttavia, la partecipazione del grande pubblico alle attività di ricerca ha aperto anche molti problemi, su cui il mondo scientifico ha opinioni contrastanti. In particolare, la verifica della qualità dei dati è un punto particolarmente critico, che viene affrontato in modi diversi, dalla validazione diretta dei dati svolta da ricercatori esperti, alla formazione di validatori scelti tra i cittadini più attivi, a protocolli di consenso, e così via. Una solida verifica rende i dati utilizzabili sia in ambito di ricerca che di *decision making*, oltre ad avere l'innegabile effetto positivo di aumentare la fiducia dei ricercatori verso le attività di citizen science. Altri problemi possono essere il *bias* derivante da sovra- e sotto-campionamento di diverse aree, l'intercalibrazione degli osservatori, e non ultimo l'uso di piattaforme non necessariamente adatte per la organizzazione dei dati; si tratta di tematiche complesse, su cui vi è una intensa attività mirata a produrre risposte solide e condivise.

Per affrontare queste e altre tematiche di estremo interesse, nel febbraio 2015 si è svolta a San José, in California, la prima conferenza mondiale di Citizen Science organizzata dalla Citizen Science Association (CSA), mentre nel maggio 2016 Berlino ha ospitato la prima conferenza internazionale della European Citizen Science Association (ECSA). La *First Italian Citizen Science Conference* – la prima conferenza su tale argomento organizzata in Italia – illustra la nostra realtà mantenendo un taglio internazionale aperto alla acquisizione di buone pratiche e casi di studio europei. La Conferenza rappresenta un momento di sintesi importante per la comunità scientifica, ma si rivolge anche ai responsabili delle politiche ambientali e di ricerca nel nostro paese. In linea con quanto sta già accadendo in vari paesi europei, i dati e le elaborazioni prodotti dall'interfaccia tra scienza e società hanno un forte potenziale utile per sviluppare, ad esempio, nuove e più efficaci politiche ambientali.

La *First Italian Citizen Science Conference* e la tavola rotonda *Citizen Science e Comunicazione* sono promosse dall'Accademia Nazionale delle Scienze detta dei XL e dal CNR nell'ambito delle iniziative della infrastruttura Europea Life-Watch; in partnership con l'Associazione Nazionale Musei scientifici (ANMS), il Museo di Storia Naturale della Maremma, CSMON-Life, Rete L-TER Italia e la European Association of Citizen Science (ECSA); in collaborazione con il Museo Civico di Zoologia di Roma e il WWF Italia, con il patrocinio del Ministero dell'Ambiente e della Tutela del Territorio e del Mare, della Regione Lazio e dell'Assessorato alla Crescita Culturale di Roma Capitale. Le iniziative si svolgono sotto l'Alto Patronato della Presidenza della Repubblica Italiana.

Emilia Chiancone

Presidente

Accademia Nazionale delle Scienze detta dei XL

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CITIZEN SCIENCE: A NEW KNOWLEDGE POLITICS?

Knowledge politics, democracy, changing scientific practice

As this First Italian Citizen Science Conference demonstrates, the growth of world-wide activity in citizen science represents a significant social and scientific development. This is important both in terms of the sheer scale of activities but also with regard to the potential impact, influence and consequences of citizen science. As the European Citizen Science Association (ECSA) expresses its future vision: 'in 2020, citizens in Europe are valued and empowered as key actors in advancing knowledge and innovation and thus supporting sustainable development in our world.' This is not a small ambition – and it does raise larger questions about the relationship between the still-developing field of citizen science and more 'mainstream' scientific and institutional practices.

Put in binary terms, does citizen science represent an extension of science by other means or does it raise new questions concerning the nature of 'knowledge politics'? Does engagement with citizen science suggest a new form of citizen empowerment or does it simply reinforce existing boundaries around knowledge and democracy? As I hope to suggest, while some commentators might view citizen science as primarily a means of extended knowledge-gathering, it is important and timely to consider the larger implications of citizen science: as a way of developing new knowledge practices, shifting the institutional boundaries around science, and raising new questions and new perspectives.

* Department of Organization, Copenhagen Business School, Denmark.

SESSION I

BIOLOGICAL MONITORING THROUGH CITIZEN SCIENCE

ORAL PRESENTATIONS

CITIZEN SCIENCE IN EUROPE. A SNAPSHOT OF THE CURRENT SITUATION

European Citizen Science Association (ECSA), Cooperation on Science and Technology (COST), policy engagement, evaluation and impact, Open Science

Citizen Science is gaining attention – in the media, in the public, in science, but also in the political arena. A variety of projects emerges, and citizen science is practiced in a variety of disciplines (Pettibone *et al.* 2017). The citizen science community organizes itself globally in order to exchange ideas and experiences on best practices (Göbel *et al.* 2017). The European Citizen Science Association (ECSA; <https://ecsa.citizen-science.net/>) is growing and increasingly visible in European policy processes such as informing the Open Science Agenda (see also Vohland and Göbel 2017).

Citizen Science is linked to many promises: It should increase public participation, understanding and acceptance of science; it should increase scientific literacy and sustainable development; it should meet scientific quality criteria and enhance transparency of the scientific process. Within the framework of a Cooperation on Science and Technology (COST Action 15212; <https://www.cs-eu.net/>), a variety of researchers investigate under which conditions these promises are met or may become reality, and what are chances and limitations of the citizen science approach.

Göbel, C., Cappadonna, J. L., Newman, G. J., Zhang, J., Vohland, K. (2016) *More than Just Networking for Citizen Science: Examining Core Roles of Practitioner Organizations*. In Ceccarone, L. & Piera, J. (eds) *Analyzing the Role of Citizen Science in Modern Research*. Information Science Reference. <http://www.igi-global.com/chapter/more-than-just-net-working-for-citizen-science/170183>

Pettibone, L., Vohland, K., Ziegler, D. (2017) *Understanding the (inter)disciplinary and institutional diversity of citizen science: A survey of current practice in Germany and Austria*. *PLoS ONE* 12(6): e0178778. <https://doi.org/10.1371/journal.pone.0178778>

Vohland, K., Göbel, C. (2017) *Open Science und Citizen Science als symbiotische Beziehung? Eine Gegenüberstellung von Konzepten*. *TATuP – Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis* 26 (1/2) 18-24. <http://www.tatup.de/?journal=tatup&page=article&op=view&path%5B%5D=21>

* Museum für Naturkunde Berlin, Leibniz Institute for Evolution and Biodiversity Science (MfN) & European Citizen Science Association (ECSA).

CRISCUOLO L.* – OGGIONI A.* – CARRARA P.*
PUGNETTI A.** – BERGAMI C.**

INTEGRATING CS IN LONG TERM ECOLOGICAL RESEARCH: A CASE STUDY AND A CRITICAL INSIGHT

Ecology, Citizen Science, Long Term Ecological Research, Cammini LTER

Probably many citizens are ready to support Science in some tasks, but is Science ready to receive their help? Do researchers really trust in non-expert potential? Besides, scientific datasets and infrastructures are prepared to be enriched with volunteered data? And – finally – what can be done to carry on the integration among different structures and information paradigms?

Although Citizen Science (CS) has a long history behind it, and even if it is experiencing a “technological bloom” in recent years, there is still a lot to be done in order to achieve a full integration with traditional research activities. The mentioned integration regards indeed not only data and metadata schemas, but also methodologies, languages and aims.

Cammini LTER (Long Term Ecological Research) has been a pioneering initiative in the Italian ecological research realm. It coordinates mixed groups of researchers and interested people, who travel together – mostly on foot – in a sort of pilgrimage through different ecosystems and ecological research sites. Since the first edition (2015) the Citizen Science has been introduced as both a tool for collecting observations and a method to keep people involved in the ongoing research activities.

The choice to blend traditional ecological research activities with CS arose some issues that needed to be faced. Firstly, it required to discuss with a panel of researchers, specialized in several different disciplines, the tasks to be outsourced to citizens and the methodology to be proposed. Secondly the best way to structure non-expert data had to be defined, in order to make them usable for long-term ecological researches. Lastly, various technological solutions had to be evaluated, aimed at satisfying both researchers' needs and usability requirements. The natural environment (high mountain, missing the internet connection) and the logistics of the trails (a number of ecosystems, different research objectives) added some complications that have been taken in account during the design phase.

The initiative was successful and has been re-launched in the following years.

Besides the material outcome – public participation, collected data, web/mobile applications, data elaborations, publications,... – it produced

* CNR IREA, Milan, Italy.

** CNR ISMAR, Venice, Italy.

some non-material results, that can be shortened in the impact of the experience on citizens, local communities and scientists themselves.

The integration effort involved – at the end – more than data structures: it went deeper into motivations, practices, habits and communication languages. Walking together helped in putting citizens in the shoes of ecologists, and ecologists in the shoes of the citizens.

In this contribution we briefly present the context of the initiative and motivate the technological and methodological choices. Then we propose a discussion on the lesson learnt in terms of Science preparedness and availability of infrastructures for CS. Finally we give our insights on how to proceed with CS integration in Scientific activities.

CITIZEN SCIENCE IN THE LIFE PROJECTS, THE EXPERIENCE OF MIPP “MONITORING INSECTS WITH PUBLIC PARTICIPATION”

LIFE projects, Insects, Species distribution, Habitats Directive

Are LIFE Projects a co-financing program suitable for citizen science projects?

The LIFE11 NAT/IT/000252 “Monitoring Insects with Public Participation” (MIPP) has been the first LIFE project in Italy where citizens are asked to gather occurrence data of protected insects. The project started in 2012 and has now entered in the “after-LIFE” phase.

Nine target species were selected (*Lucanus cervus*, *Osmoderma eremita*, *Cerambyx cerdo*, *Rosalia alpina*, *Morimus asper/funereus*, *Lopinga achine*, *Parnassius apollo*, *Zerynthia cassandra/polyxena* and *Saga pedo*), among them five are saproxylic beetles, three are butterflies and one is a grasshopper. The species have a conservation value, being listed in Annexes II and IV of the Habitats Directive, are large and relatively easy to identify, some of them being proper flagship species (e.g. the stag beetle).

In order to make efficient the citizen science approach, an architecture was created, that links citizens with scientists, with the implementation of multiple communication and information strategies: direct contact with public administrators and policy makers, dissemination of the aims of the projects with a number of products (leaflet, poster, brochures, gadgets, comic strips, news on website, newsletter), media relations, lessons at schools, seminars and workshops for technicians, public events. Moreover, a system of rewards for the best recorders was implemented.

The project portal and the app represent the core of the project. It was specifically built with the main objective of collecting the occurrence data in an easy way and managing the data with an improved back-end section. Data delivered by citizens includes geographic information, species identification and picture of the specimens. All the data are validated by experts.

Results of the project so far analyzed were higher than expected, if considering the ecology of the species and the probability of detection. The results have been used for multiple purposes: i) they provide an accurate picture of the species distribution at national level, which significantly differs from the distribution obtained by experts; ii) phenology and altitudinal range

* Centro Nazionale per lo Studio e la Conservazione della Biodiversità Forestale Carabinieri Bosco Fontana, Verona (Italy).

** Consiglio per la Ricerca in Agricoltura e l'analisi dell'economia agraria, Difesa e Certificazione, Firenze (Italy).

of the species have been studied in detail for the most recorded species, making more precise the information on the ecology of the species, which were often anecdotally; iii) lessons for future projects emerged, in terms of communication strategies, data acquisition, platforms, capacity of citizens for collecting data on elusive species, species identification issues ; iv) the project has given citizens a chance to be in contact with the “neglected biodiversity” and they have been educated on the importance and fragility of certain ecosystems.

MARTELLOS S.*

LIFE PROJECTS AND CITIZEN SCIENCE (CSMON-LIFE)

In the framework of the LIFE programme, the European Commission is funding several projects with at least a partial focus on citizen science activities. The Project CSMON-LIFE (<http://www.csmon-life.eu>) started in June 2014, with the aim of contributing to the dissemination of citizen science approaches in collecting biodiversity data in Italy. Citizen science approaches are well developed in Northern Europe, Northern America and Australia, and are becoming more and more common all over the world. In Europe especially, the Open Air Laboratories (OPAL) project in the British Isles, together with other relevant initiatives in other countries, demonstrated that citizen science activities can produce reliable biodiversity data, and led to the formation of the European Citizen Science Association (ECSA). CSMON-LIFE built on the experience of previous experiences in Italy and abroad to address several environmental problems by monitoring target species. The project aimed also at improving the knowledge base for biodiversity policy in Italy, namely the Italian National Biodiversity Network. Hence, CSMON-LIFE promoted an active collaboration among scientists, public administrations and citizens in discovering, monitoring and protecting biodiversity. Citizens have been involved both in data collection and validation, thus accelerating the progress towards the objectives of the European 2020 biodiversity strategy. While participating to project activities, citizens became more aware of the importance of conservation and management of biodiversity at local and global scale, and gained a better understanding of environmental policies. Furthermore, they become able to ask for new strategic approaches in environmental management, when and where necessary. Progresses in citizens' awareness and skills have been especially highlighted by some successful activities, which started "from below", when citizens asked for new, more focused (to their interest/area of influence) monitoring activities, after participating to the project's original monitoring campaigns.

* University of Trieste, Italy.

BARTUMEUS F.¹⁻²⁻³ – PALMER JBR.⁴ – OLTRA A.¹⁻² – ERITJA R.²⁻⁶
TORRES M.² – ESCOBAR A.² – GARRIGA J.¹⁻² – PIERA J.²⁻⁵

MOSQUITO ALERT: LESSONS AND RESULTS FROM THREE YEARS OF TIGER MOSQUITO MONITORING IN SPAIN

Mosquito monitoring, disease vectors, public health, citizen science, volunteering geographic information

From 2014 to 2016 we have been monitoring the Asian tiger mosquito (*Ae.albopictus*), a disease carrying mosquito in Spain with the citizen science program Mosquito Alert. Mosquito Alert is a multi-platform scalable citizen science system that provides accurate early warning information about the invasion process as well as vital information for public health action and mosquito population control in the territory. The data generated along these years has proved to be useful for modelling and generate risk prediction maps. Currently, Mosquito Alert is a reference and complements the information provided by national surveillance programs that use more traditional methods. The Mosquito Alert network includes citizen, managers (both entomologists and epidemiologists) public health administrators, modellers, educators, and journalists. These mutli-actor networks and citizen science engagement strategies are crucial to generate a tight loop between management, research and society, without which the scalability and massive potential of new technologies is lost. Citizen science is positioned to revolutionize the research, surveillance and management of mosquito-borne diseases at the global scale, upscaling up these systems and maintaining them at the long-term is now our challenge.

¹ Centre d'Estudis Avançats de Blanes (CEAB-CSIC). Girona, Spain.

² CREA. Barcelona, Spain.

³ Institut Català de Recerca i Estudis Avançats (ICREA). Barcelona Spain.

⁴ Universitat Pompeu Fabra (UPF). Barcelona, Spain.

⁵ Institut de Ciències del Mar (ICM-CSIC). Barcelona, Spain.

⁶ Servei de Control de Mosquits del Baix Llobregat. Barcelona, Spain.

CITIZEN SCIENCE: EXPERIENCES IN THE MARINE ENVIRONMENT

The European Union is addressing the issue of ocean literacy because it is becoming apparent that EU citizens are not aware of the importance of the oceans and the seas. We cannot protect what we do not perceive and it is important that citizens become aware of the importance of the marine environment. Citizen science is the perfect tool to improve ocean literacy, because the involvement of citizens in a scientific enterprise is conducive to their cultural development. Television programs on nature are blossoming since decades, and many are dedicated to the sea. But ocean literacy did not improve. Nature is the subject of shows, but not of educational programmes. Citizens are spectators with a passive role. With citizen science they become actors with an active role.

I will refer about my experience with a multiannual project on jellyfish in the Mediterranean Sea that involved thousands of citizens and led to relevant scientific discoveries. Jellyfish are difficult to see with scientific tools (from satellites to plankton nets) but are easily seen at least along the coast. Citizens, thus, became our sensors. The most important issue in developing a CS initiative is to make people know about it, and to attract their interest and willingness to participate. The use of the media and of visual arts is essential to both attract citizens when the campaign is launched and to reinforce their participation through the spread of the results of the campaign.

The Mediterranean jellyfish citizen science initiative is the most prominent example of CS in the marine environment at planetary level and is now paralleled with an initiative on marine litter.

* University of Salento, Italy.

ROBINSON L.D.*

SHARING BEST PRACTICE AND BUILDING CAPACITY FOR CITIZEN SCIENCE: THE ECSA EXPERIENCE

Best practice, Knowledge exchange, European Citizen Science Association

Citizen science is a flexible concept that has been adapted and applied within diverse situations and disciplines. The rapid expansion of citizen science programmes globally presents researchers and citizen science practitioners with incredible opportunities as well as a challenge: how to create cohesion and identify a common purpose globally, whilst also supporting and enhancing the further expansion, independence, creativity and bottom-up nature of citizen science?

The European Citizen Science Association (ECSA) was initiated in 2013 and exists to provide a welcoming, supportive environment for citizen science across Europe that promotes inclusion and strives for innovation and excellence. ECSA provides a forum for the exchange of knowledge and ideas, identification of shared goals, networking and developing best practice in order to build capacity for citizen science both within and beyond Europe.

In this presentation I introduce the core activities of the Association, in particular our working group on *sharing best practice and building capacity for citizen science*. A key output of this group is the Ten Principles of Citizen Science – a series of statements that set out our shared view of the characteristics that underpin high quality citizen science. Currently available in 26 languages, they provide a framework against which to assess new and existing initiatives with the aim of fostering excellence in all aspects of citizen science.

At a time when citizen science is rapidly expanding but not yet mainstreamed within traditional research or policy processes, ECSA seeks to champion this approach and maximize the myriad benefits it can bring to science, the environment, communities and individuals.

* The Natural History Museum, London.

NATURAL HISTORY MUSEUMS AND CITIZEN SCIENCE IN EUROPE

Museum, citizen science, public engagement

Natural History Museums (NHMs) have a long history of collaboration with the amateur-expert naturalist community. Many museums were founded – and their scientific collections subsequently developed and maintained – with the invaluable support of enthusiastic, highly-skilled amateur naturalists. Similarly, long before citizen science became the widely known concept of today, NHMs, other academic organisations and amateur naturalists have worked together to help build understanding of the local and regional biodiversity.

A tradition of two-way knowledge sharing that continues today in most European museums. Over time, NHMs have renewed their functions within society and assumed a relevance not only for the conservation of collections, but also for engaging society in the generation of new scientific awareness.

During recent decades, many NHMs have undertaken a profound transformation of the solutions developed to deliver their core functions and the ways in which they interact with both visitors and local communities. Alongside their traditional roles of conserving and providing access to specimen collections, NHMs are increasingly looking to actively engage members of the public in projects that seek to build understanding of the natural world.

They have expanded and diversified their public-facing work to encompass the development of new educational approaches and tools that seek to engage broad sectors of society with the science of natural history. NHMs are currently delivering a wide range of field-based and online citizen science projects. Among others: the support to the development of amateur-expert naturalists, hosting taxon-specific biological recording schemes, the development of species monitoring projects, museum-led BioBlitzes and digital technology-mediated citizen science projects.

Natural History Museums are hence well-placed to both promote the field of citizen science and support capacity building within critical subject areas, such as taxonomy. Not least, NHMs have also taken a central role in establishing the European Citizen Science Association (ECSA).

* Maremma Natural History Museum.

SLAWSON D.*

CITIZEN SCIENCE THROUGH THE OPAL LENS

OPAL, led by Imperial College London, is a UK-wide partnership network of universities, conservation organisations, recording societies and museums dedicated to promoting citizen science and inspiring everyone from all walks of life to spend more time outdoors observing and recording nature. Our objectives span outreach (learning, engagement and stewardship) to research (supporting scientific enquiry) and place a strong emphasis on building active empowered communities driven to understand and protect the natural world. Through our nationwide network of local community scientists we have engaged with people through environmental surveys and activities on soil health, air quality, water quality, hedge quality, invertebrate biodiversity, climate, tree health, pollination and invasive species [<http://www.opalexplornature.org/>].

OPAL has delivered some major achievements: almost one million people have taken part in OPAL surveys since 2007, of which over 20% have been from disadvantaged communities; over 4,000 teachers have been trained to deliver outdoor learning in the last three years; over 60,000 sites have been surveyed and records submitted; and 44 academic papers have been published, 12 of which used data from OPAL surveys.

The field of citizen science could benefit from practitioners being open about the challenges as well as benefits so that hurdles can be overcome more effectively, and collectively we can advance the discipline. OPAL has gained useful insights on the difficulties and challenges of sustaining a long-running citizen science project. These include the constant need to secure funding to support core citizen science services such as websites and databases, maintenance of public interest when the lead scientist loses grant-funding or a change of political priority leads to a loss of support from a key policy customer. The need for citizen science to be better recognised by government and its agencies, 'mainstreaming' citizens' environmental observations as business as usual in beneficiary organisations e.g. to contribute towards official monitoring and allocation of commensurate funds from operations budgets (as opposed to short-term research grants), are proposed as radical solutions.

* Imperial College London, UK.

**RECREATIONAL CITIZEN SCIENCE:
UNITE RESEARCH WITH WHAT CITIZENS DO FOR FUN.
DIVERS IN MARINE BIODIVERSITY MONITORING**

SCUBA divers, recreational citizen science, biodiversity monitoring, volunteers in research

Institutes often lack funds and manpower to perform large-scale biodiversity monitoring. Citizens can be involved, contributing to the data collection, thus decreasing costs. Underwater research requires specialist skills and SCUBA certification, and it can be difficult to involve volunteers. Our studies, started in 1999, involve large numbers of recreational divers for collecting data on the status of marine biodiversity. The “recreational monitoring” approach used in our projects allowed volunteers to perform normal recreational activities, ensuring the reliability of data and a greater amount of divers involved. Using user-friendly questionnaires, volunteers report the presence of taxa encountered during their dives.

In these last 19 years recreational divers have been involved in 4 research projects: Mediterranean Hippocampus Mission (1999-2001), Divers for the Environment (2002-2005), STE: Scuba Tourism for the Environment (2007-2015) and Sea Sentinels – Divers United for the Environment (DUE project, 2017-2020). Mediterranean Hippocampus Mission was a census of two species of seahorses. Results showed that the greatest abundance of seahorses was reported in the northern Adriatic and central-southern Tyrrhenian seas and the distribution may be correlated with the degree of degradation of *Posidonia oceanica* meadows. Divers United for the Environment aimed to assess the marine biodiversity status along the Italian coasts. The results indicated a high significantly negative correlation between environmental quality and latitude (trend supported by surveys of the Italian Ministry of the Environment). The STE project investigated on the health of Red Sea coral reefs. The results revealed spatial trends across areas subjected to different protection strategies (higher biodiversity values in Sharm el-Sheikh, within protected Ras Mohammed National Park and Tiran Island, than in the less-regulated Hurghada area). Thanks to the collaboration with the Egyptian Ministry of Tourism, the results shall be integrated in the Egyptian coastlines management. Quality of volunteer-recorded data were validated comparing them with

* Laboratory of Fisheries and Marine Biology at Fano, Department of Biological, Geological and Environmental Sciences, University of Bologna, Fano (PU), Italy.

** Marine Science Group, Department of Biological, Geological and Environmental Sciences, University of Bologna, Bologna, Italy.

those collected by an experienced researcher. The results showed a sufficient level of the quality of data collected by volunteers. At last, the DUE project, started in March 2017, aims to verify the health status of the Mediterranean Sea after 12 years since the previous survey (Divers for the Environment). The greatest limitation with using volunteers to collect data was the uneven spatial distribution of samples. The benefits were the considerable amounts of data collected over short time periods and at low costs.

ENHANCING PUBLIC AWARENESS AND ADVOCACY FOR NATURE CONSERVATION: MONITORING BROWN BEARS IN THE ABRUZZO LAZIO AND MOLISE NATIONAL PARK

Apennine brown bear, ecological consciousness, protected areas, public awareness, science-based management

Over the past 12 years, we conducted annual counts of female bears (*Ursus arctos marsicanus*) with cubs (FWC) to provide a practical index to monitor the long-term reproductive potential of the highly endangered Apennine brown bear population in the Abruzzo, Lazio and Molise National Park (PNALM). Initiated in 2006, as part of a scientific effort to enhance the conservation status of this isolated and relict bear population, these surveys proved a practical means to integrate population monitoring and participatory scientific learning. The technique is founded on ground based surveys from several vantage points amply dispersed throughout the PNALM and adjacent area, for a total of about 1,300 km². Because simultaneity of sightings is needed to ensure reliable distinction of different family groups, these surveys involved 3-7 seasonal replicates of simultaneous sessions each year, with up to 78 observers concurrently scanning open areas from 46-105 cumulative vantage points. Additionally, a team of 1-10 trained observers repetitively scanned areas with high probability of occurrence of bear family groups, or verified sightings reported by third parties. Research scientists, PNALM and Forest Service officers coordinated the program each year, enrolling 50-65 volunteers, including students, private citizens, and activists from environmental and recreational groups. To promote reliability of the data collected and to facilitate ecological learning, each year we trained volunteers through preliminary workshops, and we successively shared with them results obtained and their conservation implications. The program represented a unique opportunity for volunteers to experience a protected area well beyond landscape sceneries generally associated with recreational activities such as hiking or biking. By being allowed in remote areas of the park, citizens that participated to the program had a unique opportunity to connect with nature while participating in a coordinated network meant to enhance science-based conservation of our natural heritage, therefore allowing a thorough emotional and intellectual experience. Remarkably, the direct participation of local volunteers in the FWC surveys enhanced their deeper apprecia-

* Department of Biology and Biotechnologies "Charles Darwin", University of Rome La Sapienza, Rome, Italy.

** Scientific Service, Abruzzo, Lazio and Molise National Park, Pescasseroli, Italy.

tion of science-based conservation, their active participation in the park's management policies, and their sense of responsibility over the landscape. The challenges we faced were mostly related to organizational issues (i.e., networking opportunities, relationships with external parties, skills assessment and logistical aspects of training activities, volunteers turn over, funding and administrative issues), communal sharing of sensitive data (e.g., role and impact of web social networks), educational content and evaluation. Nevertheless, by integrating public outreach and scientific data collection in a well-known National Park, the program has proved an enduring success over these years to improve monitoring performance and efficiency; most importantly, it fostered social change and awareness toward science-based management and conservation of natural resources, possibly leading to increased public responsibility and advocacy for nature conservation.

FRANCESCONI F.* – CAMBRIA E.V.* – DE SANCTIS M.*
MARTELOS S.** – VALENTI R.* – VITALE M.* – ATTORRE A.*

MODELLING THE SPATIAL DISTRIBUTION OF ALIEN INVASIVE SPECIES FROM CITIZEN SCIENCE DATA: LIMITS AND ADVANTAGES

Alien invasive species, citizen science, biodiversity, data reliability, volunteer monitoring

Decision-makers and governmental organizations are increasing the use of citizen volunteers to enhance the capacity to monitor species occurrence and distribution around the world and to investigate major aspects of global change impacts on biodiversity. For citizens the motivation is to contribute to “real” science, public information and conservation. For scientists, citizen science offers a way to collect information that would otherwise be not affordable.

CSMON-LIFE (Citizen Science MONitoring) is one of the first Italian projects which focuses on using a citizen science approach on biodiversity. It is funded by the European Commission under the LIFE+ programme. CSMON has come to its latest year with more than 4000 registered users and over 20000 validated reports focused on several environmental issues, such as: the loss of biodiversity because of the presence of alien species; the effects of climate change; the conservation of rare species; the impact of human activities on the environment. The data validated feed the National Biodiversity Network established by the Italian Ministry for the Environment in order to make freely available biodiversity data.

We used data collected by citizen volunteers for four alien plant species: *Ailanthus altissima*, *Robinia pseudoacacia*, *Carpobrotus edulis* and *Opuntia ficus-indica* to model their ecological niche using MaxEnt (Maximum Entropy) software. As environmental factors we used the WorldClim bioclimatic variables with a spatial resolution of 1 km², as well as soil, land use and topography parameters.

We set aside 25% of the samples for testing and the rest used for niche modelling training. The analyses used a threshold to make a binary prediction, with conditions above the threshold as suitable and those below as unsuitable. To identify variables that are most important for the species being modelled the jackknife test we used, and a set of response curves elaborated to interpret if there are strong correlations between variables. Finally, it was necessary to include in MaxEnt’s run a bias file to represent sampling effort to reduce the sampling bias performed during volunteer monitoring due to the

* Environmental Sciences Department, Sapienza University of Rome, Rome, Italy.

** Life Sciences Department, University of Trieste, Trieste, Italy.

different accessibility of the sites explored and the different amount of time dedicated to these operations.

Despite these limitations data coming from the activity of citizen volunteers significantly increased the knowledge on the spatial distribution of target species. Based on these results, the establishment of permanent biodiversity observatories formed by citizen volunteers is envisaged.

MALEK R.*-*** – TATTONI C.** – CIOLLI M.** – CORRADINI S.*
ANDREIS D.* – DALLAGO G.* – IORIATTI C.*
MAZZONI V.* – ANFORA G.*-***

**BUGMAP, A CITIZEN SCIENCE APPROACH TO MONITOR
THE INVASIVE BROWN MARMORATED STINK BUG *HALYOMORPHA
HALYS* (HEMIPTERA: PENTATOMIDAE)**

Mobile application, hitchhiking pest, scientific popularisation, distribution mapping

The Brown Marmorated Stink bug, *Halyomorpha halys*, is a polyphagous multi-voltine insect, with a capacity of long distance dissemination causing enormous agricultural damages. A promotion to a public nuisance pest is also due to its tendency to overwinter in man-made structures, which prompted volunteering citizens to help track the invasion. The presence of *H. halys* in the Province of Trento (North-eastern Italy) was first reported in 2016. Therefore, we designed BugMap, a free mobile application, that allows the gathering of a large amount of data on the presence of this bug. Hence, involving citizens in the scientific inquiry and permitting a faster understanding and reaction to its invasion. Thus, spatial analysis and distribution modeling are employed to better comprehend the invasion dynamics of this pest.

BugMap reports are received as a citizen filled form on the number of specimens, detection site (building, means of transport, garden or agricultural cultivation), along with photographs that allow the validation of the sightings. These reports were coupled with data from traps deployed in various locations in Trento Province, to account for presence and absence of *H. halys* (<http://appmeteo.fmach.it/bugMap/>). Environmental features with potential effect on *H. halys* distribution were selected i.e. Digital Elevation Model, land-use, hydrography and forest tracks. From the Digital Terrain Model (DTM), the slope was derived using GRASS GIS version 7. All data have been re-sampled at 100 meters resolution to increase the speed of calculation in Maxent using the jackknife test for assessing variable contribution. Plotting in R was also done to test for correlation among the above-mentioned GIS layers and other variables, including finding method (visual or trap), distance from railways, lakes, rivers and main streets, as well as the detection location in buildings or gardens.

The variables that contributed the most to the distribution of this species

* Department of Sustainable Ecosystems and Bioresources, Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige, Italy.

** Department of Civil Mechanical and Environmental engineering, University of Trento, Trento, Italy.

*** Center of Agriculture Food and Environment, University of Trento, San Michele all'Adige, Italy.

were elevation and distance from houses, accounting for 49.29% and 42% respectively. These results illustrate the suitability of Trento for hosting *H. halys*, particularly in terms of altitude, ranging from 190-300 meters above sea level. Additionally, there is a strong association with urban development, whereby this bug finds numerous overwintering sites and green refuge areas surrounding houses and buildings, further facilitating population build-up. Moreover, plotting the distance from main streets and rivers with respect to the finding frequency, displayed that most sightings were reported at a distance usually not exceeding 200 meters. This could be elucidated by the “hitchhiking” behavior exhibited by *H. halys*, which may well be enhancing the colonization process. Although still young and in its early stages, BugMap has proven to be a resourceful tool, capable of involving citizens in the scientific process. Furthermore, it allows the gathering of a large amount of data in a cost and time effective manner, which is readily helping scientists understand and better react to this alien invasion.

CASTRACANI C.* – SPOTTI F.A.* – ZUCHELLI M.**
GRASSO D.A.* – MORI A.*

THE SCHOOL OF ANTS: A BRIDGE BETWEEN RESEARCH AND THE ITALIAN SCHOOLS

Citizen Science, Urbanization, Ants, Scientific Citizenship, Science Education

The aware citizen needs a basic scientific knowledge in order to understand science, its technological applications and its purposes. This will lead to the acquisition of a “Scientific Citizenship” for the correct evaluation of the social use of science and the comprehension of the political decisions that affect our lives and our community. The Italian society is facing a clear lack of Scientific Citizenship. The Italian school is following a model of science education that is still too conceptual and insufficiently laboratory. On the other hand, scientific institutes are too slowly recognizing the big communicative gap between researchers and the rest of the society. The Italian version of the “School of Ants” is a Citizen Science project that was initially born to answer a scientific question, but very quickly developed in an interesting example of inquiry-based science education developing a direct link among researchers, teachers and students. Can ants be a useful model to study how human impact is shaping biodiversity in urban ecosystems? Studying Italian ants using citizen scientists was thus a promising approach to address this scientific question. Initially, we ran a pilot project that saw the collaboration of the Myrmecology Lab. of Parma University, the Cariparma Foundation and the Parmigianino Educational Institute. During one year, students collected the ants of their schoolyard using a specific ant collecting kit and a standardized protocol. At the same time, teachers and researchers developed a multidisciplinary learning path that used the “hands on” experience to understand many different concepts. The promising results and feedbacks led to the current second phase with the aim to raise the project from local to national level. A web-site is under construction (www.schoolofants.it) and the collaboration with the Science Museum of Trento (MUSE – www.muse.it) led to the production of the “Ant Box”: a scientific and didactic package that teachers can use to let the students directly participate to the scientific project and to manage independently a formative course during one school year. The Ant Box was tested by 16 teachers with their classes (students age: 9-16) and preliminary results are shown in this presentation. The checklist of Italian urban ant species was implemented and the project helped the students to improve their scientific skills and their interest toward science.

* Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Parma, Italy.

** Educational Services, Science Museum of Trento (MUSE), Corso del Lavoro e della Scienza 3, 38122 Trento, Italy.

SPINA F.*

**CITIZENS ALLOWING LONG-TERM AND LARGE-SCALE
MONITORING OF THE ROLE OF ITALY AS A BRIDGE
BETWEEN EUROPE AND AFRICA FOR EUROPEAN BIRDS:
THE ITALIAN RINGING CENTRE AT ISPRA**

Birds, ringing, long-term bird monitoring, large-scale bird monitoring, EU Birds Directive, data validation, centralized datasets

Monitoring migratory animals is particularly challenging due to the need for international coordination in data collection protocols, data exchange beyond languages, large-scale and longterm coverage of a wide array of habitats, sites and species. Birds are the best known taxonomic group of migratory animals. Italy is a natural bridge between Europe and Africa for billions of birds regularly crossing the Mediterranean on their annual migratory movements. The key role of Italy as country of origin, passage and destination of migratory birds calls for monitoring activities across the whole annual cycle. Ringing is the most widely used method for individual marking of birds; subsequent encounters of individually marked birds allow following their life histories and quantitatively describing their movements as well as demographic parameters like survival, natal and breeding dispersal, recruitment. In Europe bird ringing is organized through National Ringing Centres co-ordinated by the European Union for Bird Ringing EURING, www.euring.org. The first ringed bird in Italy was marked in August 1939. Since then, ISPRA (formerly INFS) coordinates all ringing activities in our country through its Area Avifauna Migratrice BIO-AVM. Italian ringers are passionate amateur ornithologists, as well as scientists, university students and PhD, staff of Natural History Museums who follow a specific period of field training before passing 3 different exams in order to access the existing 3 levels of ringing licenses issued by local Authorities. The presentation describes key aspects of this unique example at the Italian level of a long-term, large-scale and multi-species monitoring offering a collection of data of high applied value. Examples from ongoing projects coordinated by ISPRA (e.g. Progetto Piccole Isole, 30 years of activity, Progetto Alpi, 21 years, Progetto MonTRing, freshly launched) will confirm the importance of scientific results gathered through the networks of Italian ringers for understanding the role of Italy for European birds and the conservation effects of the implementation of international environmental legal instruments (e.g., EU Wild Birds Directive) through the contribution of data gathered by Italian ringers. The annual average 25,000 man/days in the field by hundreds of Italian ringers have allowed building a

* ISPRA, Area Avifauna Migratrice, Ozzano Emilia (BO), Italy.

centralized data repository system (EPE, EURING Protocol Engine) at ISPRA, now hosting 7million data from over 450 bird taxa since 1906. The applied value of covariates collected by Italian ringers based on strictly standardized protocols (e.g. morphometrics, physical conditions) will be described through specific examples. In a period of fast increase in the involvement of citizens in the collection of environmental data, the key importance of a process ensuring data validation before data entering in national or international datasets will be discussed.

POSTER PRESENTATIONS

BIOBLITZ: ECSA AND DITOS NETWORKING AND CAPACITY BUILDING FOR BIODIVERSITY CONSERVATION

BioBlitz, citizen science, biodiversity, networks

Since 2016, the European Citizen Science Association (ECSA) started its involvement in 'Doing It Together Science' (DITOs). This pan-European project, funded within the Horizon 2020 framework, aims at communicating Citizen Science (CS) and Do-It-Yourself science approaches to the public and policy makers in order to enhance public participation in science. ECSA has an important role in expanding the outreach of DITOs, facilitating networking and capacity building activities among the wide network of ECSA members and CS practitioners in Europe and beyond.

Special efforts are made with BioBlitzes, one of the tools available in environmental CS that has the potential to make a valuable contribution to public engagement, science, and environmental management, addressing issues of interest at EU level related to biodiversity conservation. A BioBlitz is an event during which members of the public, scientists and voluntary naturalists work together to record as many species as possible within a geographical area and defined time period.

Participants are involved in a process whereby the knowledge gained creates sustained awareness and lead to change in attitudes and behavior towards conservation of biodiversity. Citizens are engaged with hand-on activities and learn about the importance of monitoring biodiversity, while also generating species records. Data collected during a BioBlitz can be used to update species lists of an area, to inform decision-making processes and to support monitoring and reporting of environmental legislations.

With BioBlitz becoming more and more popular in Europe it is crucial enhancing applicability of this approach in different context and further developing its potential with regards to citizens, scientists and policy makers priorities. Within this framework, ECSA promotes and coordinates the establishment of a Europe-wide network of BioBlitz practitioners with the aim to increase cross-boundary exchange of knowledge and foster inter-disciplinary collaboration in biodiversity conservation.

The policy brief "BioBlitz: Promoting cross border Research and Collaborative Practices for Biodiversity Conservation", resulted from a collaborative process engaging members of the BioBlitz Task & Finish group at ECSA. The aims are to inform on the potential of this methodology to achieve a number of local and national biodiversity targets and to highlight a series of recommendations to increase impact of BioBlitz. Further reading:

<https://ecsa.citizen-science.net/blog/ditos-launches-first-bioblitz-policy-brief>

* European Citizen Science Association, Berlin, Germany.

ARMIRAGLIO S.¹ – PISANO N.² – ALBERTINI J.³ – LIPRERI E.³
VASTA L.³ – MARTELLOS S.⁴

MUSEUMS, CITIZEN SCIENCE AND TERRITORY: GERT PROJECT IN BRESCIA

Biodiversity, volunteer monitoring, environment management

The GE.R.T. (Generare Reti Territoriali) project has been promoted by the Municipality of Brescia to involve citizens into territorial naturalistic surveys for studying and monitoring local biodiversity. The project is hosted by CSMON-LIFE (<http://www.csmo-life.eu/>), Citizen Science project LIFE13 ENV / IT / 842, which provides a software platform and a dedicated app. Data submitted by the citizens converge into the National Network on Biodiversity (NNB) of the Ministry of Environment. The GE.R.T. project is managed by the Natural Science Museum and by the Municipality Sustainability Department. It involves town's scientific associations, whose volunteers analyze and validate data sent by the citizens. The aims of this work are: make a first project synthesis after a year of activity; demonstrate the utility of the data collected by the citizen scientists for environment management. The project officially began on May, 2016. At the end of April, 2017, 1786 georeferenced data have been collected, which have been submitted by 89 citizen scientists, even though 75% of data have been collected by 10% of the participant citizens. Data submitted by citizens have been identified at species or genus rank for 85% of the total observations. Those data are divided into four macro-categories: vascular flora, vertebrate fauna, invertebrate fauna and fungi & lichens. Most observations are located in the Province of Brescia (93%), especially from the Municipality of Brescia territory (63%). Some of them are located in the southeast of Brescia, where the Municipality wants to establish a local protected area. In this area, among 263 determined species, some of them (35) result to be under law protection (Habitats Directive 92/43/CEE, Birds Directive 79/409/CEE, L.R. 10/2008). The qualitative and quantitative presence of the protected species has the same importance in the area (13% ca). Unfortunately, a small number of species (*Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle, *Helianthus tuberosus* L., *Robinia pseudoacacia* L., *Trachemys scripta*, *Schoepff*) are invasive and alien species (Black list of L.R. 10/2008, Commission Implementing Regulation EU 2016/1141).

¹ Natural Science Museum in Brescia, Environmental Sustainability and Natural Science Department, Municipality of Brescia, Brescia, Italy.

² Environmental Sustainability and Natural Science Department, Municipality of Brescia, Brescia, Italy.

³ Servizio Civile Nazionale 2016/2017, "Biodiversità al Museo", Natural Science Museum in Brescia, Environmental Sustainability and Natural Science Department, Municipality of Brescia, Brescia, Italy.

⁴ Life Sciences Department, University of Trieste, Trieste, Italy.

BIOBLITZ LOMBARDIA, A CITIZEN SCIENCE INITIATIVE IN THE PROTECTED AREAS OF LOMBARDY: A COMPARISON BETWEEN THE TWO EDITIONS (2016 AND 2017)

Bioblitz, protected area, Lombardy, iNaturalist, people's participation

Bioblitz events are spreading out as ways of approaching inexperienced people to the natural world, mainly to the biodiversity monitoring system. They are events placed between scientific divulgation and data collection. In 2016 (Cecere et al., 2016) and in 2017, in Lombardy, two editions of the Bioblitz event took place in protected areas, thanks to the initiative of Area Parchi, Parco Regionale Oglio Sud, Riserva Naturale Le Bine, Parco Regionale Nord Milano together with the DG Ambiente of Lombardy.

	2016	2017
Number of protected areas	15	29
Number of observations	1.521	3.495
Number of species	633	933
Naturalists/guides involved	50	114
Participants	2.500	2.655
Volunteers involved	150	73

All the data have been uploaded on the platform iNaturalist – www.inaturalist.org – which has been chosen for several reasons: the possibility to add observations of any taxa, to create a specific project (e.g. “Bioblitz Lombardia”), as well as the user friendliness and the free access.

Both in 2016 and in 2017, plants and birds represent more than 60% of the observations and of the species too. In both years, the 10 most observed species belong to the avifauna, and there are no less than 8 species in common. In 2016, the first species not belonging to the avifauna can be found in the thirteenth place (*Tarassacum officinalis*), while in 2017 it is a butterfly (*Coenonympha pamphilus*) found in the twelfth place. Anyway, species included

¹ Riserva naturale e fattoria didattica Le Bine, Acquanegra sul Chiese (MN), Italy.

² Parco Regionale Oglio Sud, Calvatone (CR), Italy.

³ Parco Regionale Nord Milano, Milan, Italy.

⁴ Area Parchi, Milan, Italy.

⁵ Regione Lombardia, Milan, Italy.

in Dir. UE 79/409 have been observed, e.g. *Ruscus aculeatus*, *Lycaena dispar*, *Morimus asper*.

It is important to highlight the increasing number of parks and reserves taking part in the Bioblitz event in 2017, compared to 2016. This is due to the fact that, for a scientific activity, the importance of being on-site on the same day has been grasped. Bioblitz was addressed mainly to inexperienced people, but an important role has been played also by the naturalists, the volunteers and the common people involved. On the contrary, the number of people, who took part as individual subjects during the guided tours and in the subsequent use of the platform, has been below expectations.

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BARONI D.* – BALESTRIERI R.* – BALESTRIERI V.*
BONIFACINO M.* – FERRARO S.*

AN INTEGRATED APPROACH COMBINING NON-SPECIALIST VOLUNTEERS DATA ACQUISITION AND SPECIALIST ENTOMOLOGISTS SURVEYS: THE EXAMPLE OF THE ORTHOPTERA IN CAMPANIA

Orthoptera, Campania, photographic identification, georeferenced, distribution maps

We developed a “verified citizen science program” to improve knowledge on the Orthoptera fauna in Campania, an undersampled region of South Italy. Orthoptera, commonly called grasshoppers and crickets, is an order of insects characterized by relatively big average body sizes and colorful patterns, which render them appreciated by a large pool of potential volunteers. Moreover, photographic identification can be done for a substantial number of species and the ability of the observer to identify species actually is not required. Otherwise, when we were not able to reach a species-level identification from the volunteer’s pictures, we carried out specific surveys to collect the insects and confirm the identifications. Therefore, volunteer’s data acquisition proves to be a crucial step to better address the specialist entomologists’ fieldwork.

67 species have been sampled during the first two years of the project, corresponding to 61.5% of the 109 previously known Orthoptera species in Campania. Moreover, 4 species were new for the study area: *Eupholidoptera chabrieri brunneri* (Targioni-Tozzetti, 1881), *Bicolorana bicolor bicolor* (Philippi, 1830), *Oecanthus dulcisonans* Gorochoy, 1993, *Stauroderus scalaris scalaris* (Fischer von Waldheim, 1846). Two of these species have been discovered by non-specialist volunteers, determined by photographic identification and subsequently collected to prove the data. Regional distribution data have been substantially increased, with about 600 data collected in 2015-2016. All these data, together with 590 bibliographic data, have been integrated in the project “The Orthoptera of Campania” developed on the platform www.ornitho.it. All the 1200 data loaded on this platform are georeferenced and directly available for analysis, e.g. up-to-date distribution maps.

Our results show that “verified citizen science programs” are an integrated method which may improve significantly the efficiency of entomological surveys carried out by specialists in wide and less known areas.

¹ Associazione per la Ricerca, la Divulgazione e l'Educazione Ambientale (ARDEA).

BEDINI G.¹ – BAGELLA S.² – FILIGHEDDU R.² – PECCENINI S.³
BARBERIS P.³ – LONGO D.³ – DOMINA G.⁴ – BACARO G.⁵
MARTELOS S.⁵ – PERUZZI L.¹

WIKIPLANTBASE, A PLATFORM WHERE ACADEMIC AND AMATEUR BOTANISTS MEET AND HAVE FUN

Floristic records, regional floras, georeferenced databases, online data entry, freely available data

The Wikiplantbase project, started in 2013, provides a framework where georeferenced floristic records from Italian administrative regions can be stored, updated and accessed through the Internet. The online software platform was designed to encourage data entry by non-academic collaborators: pull-down menus and auto-complete fields reduce the amount of typing required and the chances of typographical errors alike; geographic localities can be entered by point-and-click on a map. All records entered are checked by regional coordinators, who can validate, modify or reject them before making them accessible online. Both academic and amateur botanists have joined the projects which counts 114 collaborators – mostly non academic – from four Italian regions (Tuscany, Sardinia, Liguria and Sicily) as of 28 June 2017. As a result, the database now stores 211693 floristic records, 188657 georeferenced toponyms, 18273 taxonomic records, and 3910 bibliographical references. A fifth region, Friuli Venezia Giulia, is currently completing the steps to become a member of the project, with the collaboration of the regional Group for Floristic Research and Exploration (GREF). Besides data, within days of Wikiplantbase online launch, collaborators have started to provide an active feedback on issues arising from data entry, searching, and missing options. Their feedback spurred a progressive refinement of the software platform. The version 2.0 was launched in 2015, and contains several improvements suggested by the Wikiplantbase community. As regards communication and dissemination, Wikiplantbase community members has participated in the organisation of both traditional scientific meetings and social events, like Piant@Là – a science café organised in Sassari in 2015 – and Wikifestival, a meeting held in Pisa in 2017 where scientific communications mingled with quiz games, and participants received official Wikifestival

¹ Biology Department, University of Pisa, Pisa, Italy.

² Department of of Science for Nature and Environmental Resources, University of Sassari, Sassari, Italy.

³ Department of Earth, Environment and Life Sciences, University of Genoa, Genoa, Italy.

⁴ Department of Agrarian, Food, and Forestry Sciences, University of Palermo, Palermo, Italy.

⁵ Department of Life Sciences, University of Trieste, Trieste, Italy.

t-shirts. Furthermore, each regional coordinator has created a Facebook page. Data from Wikiplantbase have been used to draft a paper on phylogenetic diversity of pteridophytes in Tuscany, which has been accepted for publication on a scientific journal. To benefit the wider scientific community, the Wikiplantbase dataset is being connected to data aggregator platforms like the Italian National Biodiversity Network, and the GBIF, by using the BIOCASE protocol. The online platform Wikiplantbase is ready to be replicated in other contexts, thus providing support to a network of regional floristic databases, suited to exploit the involvement – still largely untapped – of non-academic collaborators, as advocated by citizen science.

DE FELICI S.¹⁻² – MAZZEI P.³ – DINOLFO T.³ – GIOLI F.³
LABRIOLA C.³ – SBORDONI V.¹⁻⁴ – CESARONI D.¹

NATURALISTIC FORUMS AS MEGASTORES OF BIODIVERSITY DATA

Social networks, Lepidoptera, data validation, georeferenced data

The World Wide Web provides a wide array of opportunities for citizens to share and publish data of their own observations. As far as biodiversity is concerned, forums and social networks store a big deal of steadily increasing “naturalistic” data. Are these data potentially useful to be part of the rapid growth of the biodiversity big data system? In most cases, biodiversity data obtainable from generic social networks do not have any kind of validation neither by expert amateurs nor professional taxonomists. As a consequence, these data require an expert reconsideration before being used, otherwise they lose any scientific value. On the other hand, in forums specifically dedicated to natural sciences, discussions are managed by moderators, often skilled taxonomists, who help inexperienced users in species identification. These data are potentially useful and ready to be included in biodiversity databases after a quick check. In such a case, the naturalistic forums are important containers of validated data. Unfortunately, these data can only be extracted through textual searches, for the most part.

The aim of our contribution was the development of a pilot database of georeferenced data on Lepidoptera based on photographs and information published on two widely known websites: “Natura Mediterraneo Forum” and “Forum Entomologi Italiani”. Both amateur citizens (forum users) and forum moderators are involved. A careful examination of discussions, where amateurs posted their observations, allowed us to assemble an introductory dataset consisting of about 5000 records. Starting from textual sites descriptions and photos, we verified the correctness of the original validation, georeferenced the collecting localities and systematized spatial and temporal data from the photos taxonomically validated by moderators. The dataset was limited to butterflies (Lepidoptera Rhopalocera) and, interestingly, included several species listed in the Habitats Directive (92/43/EEC). The georeferenced data have then been used to analyze the geographical location of observations, including their associated relevant features (e.g. elevation, protected areas, and land use).

¹ Department of Biology, University of Rome “Tor Vergata”, Italy.

² LifeWatch-ITA, Collections Thematic Center; CNR-IBAF, UOS Montelibretti (Rome), Italy.

³ Natura Mediterraneo Forum.

⁴ Italian National Academy of Sciences, called of the XL, Roma, Italy.

Results of this exploratory study confirmed the utility of assembling biodiversity data from the web, particularly for those taxa like butterflies where validation by expert taxonomists via photographic image is affordable. However, this attempt also revealed some limits and bias typically associated to the lack of a sampling design. These data analyses will also represent the starting point to convert naturalistic forums, maintaining their essence, into efficient and captivating platforms of Citizen Science.

SETTING A FRAME FOR CITIZEN'S PARTICIPATION IN BIODIVERSITY AND ECOLOGICAL SURVEYS

Biodiversity, ecological barriers, monitoring, citizens involvement, collections, data-bases

The Natural History Museum of Ferrara (Italy), after the national meeting “Biodiversity for All: the citizen science projects for the study and the conservation of nature” held in Ferrara in 2015, officially launched at the end 2016 its own main projects that couple both the direct monitoring of some entities of the landscape and the collections of geo-referenced observations by citizens.

The first project is CosMos, “Collecting Snails, Monitoring Snails”, that was inspired by an important Molluscan collection owned by the Museum: people can post observations of a few easily identifiable species adopted as indicators of the biodiversity conservation status, or ask for the identification by experts.

The other project is “Delta Road Kill”, a monitoring scheme of Vertebrates road mortality in the three provinces (Ferrara, Ravenna, Rovigo) touched by the last part of Po River before it reaches the Adriatic sea.

The projects rest on different online platforms. CosMos is hosted by the CS-MON Life website: observations can be uploaded if and only if a photograph of the animal observed is available. Delta Road Kill, due to the particular kind of observations it requires, is based on the iNaturalist platform by the California Academy of Science: when observations are uploaded, even if photographs of the observed animals are strongly recommended in the purpose of the scientific validation of data, it is not mandatory to attach an image, because taking a photograph could be too dangerous for the citizens.

However, at least five different web platforms were analyzed before making the choice.

To engage people in the projects, the Museum adopted a communication strategy combining web advertising (website, newsletter, social networks), press releases and the organizations of meeting with citizens: the researchers of the Museum go outside, to reach people where they meet as members of no-profit associations and in schools, taking advantage of formal and informal encountering opportunities. The social networking of iNaturalist allows one to invite people posting their observations to join the project of the Museum, to become active and aware collaborators of the projects and not only a passive source of data.

* Natural History Museum, Municipality of Ferrara, Italy.

While proposing the two main projects, it spontaneously happened to extend the collection of data to other, less targeted projects: thus, “Biodiversità del Delta del Po” collects observations of plants and animals in the province of Ferrara, Ravenna and Rovigo, and “Dune costiere dell’Emilia-Romagna” collects observations from the coastal ecosystems of our region: both are important research areas for the Museum.

All the activities are supported by the National Civil Service, that recognized the social value of the citizen science approach.

20 YEARS OF SEA-TIZEN SCIENCE IN THE MEDITERRANEAN SEA

Marine science, citizen science, Mediterranean sea, elasmobranch, photo-identification

Osservatorio Mediterraneo is an on-going project that involves marine enthusiasts and professionals in reporting sightings and photographs of mainly rare or protected marine species, participate in tagging and photo-identification projects and collect various samples or data. This network of marine enthusiasts includes divers, yachtsmen, anglers, professional fishermen, Coast Guard, Navy, Marine Protected Areas personnel. It was established in 1996 and is constantly maintained through direct training activities, conferences, seminars in trade shows, social media activities and media articles. Sightings are also increasingly being reported and collected through social media and via news aggregators such as Google Alert. To be included in the database, reports must be accompanied by photos or video, and confirmed by specialists. Sightings and samples are often shared with other projects or researchers (e.g. MED-LEM, Occhio alla Medusa, Tethys and others).

Since 1996 Osservatorio Mediterraneo has recorded over 2,000 records of the presence, behaviour, phenology and ecology of rare, unusual or alien species spanning from elasmobranchs (reflecting MedSharks' main interest) to marine mammals, marine turtles, molluscs, gorgonians, jellyfish and several species of fish. In particular:

- ✓ over a dozen papers were published based on data collected within Osservatorio Mediterraneo
- ✓ two research projects were launched: "Operazione Squalo Elefante" targeting basking sharks and "Progetto Stellaris" on the nursehound shark
- ✓ three new species of Molluscs were described, from detritus samples collected by divers
- ✓ tissue samples were collected opportunistically by members of the public on dead specimens of several species of sharks for genetic and toxicology analysis
- ✓ specific community-created photo-banks were established for photo-identification, providing non-invasive information on migration and habitat use of rare and endangered species: such as previously unknown seasonal patterns of basking sharks (*Cetorhinus maximus*), and critical habitats of the sandbar (*Carcharhinus plumbeus*) and nursehound (*Scyliorhinus stellaris*) sharks.

* MedSharks, Rome, Italy.

This community has also provided data for geological and climatological studies. There is clearly great potential in using citizen science to advance knowledge in the marine environment. Although constant effort is needed to validate data and avoid mis-reporting and mis-identification, volunteers can contribute valuable information with direct observations and generate high quality data, especially on clear and easy targets.

The challenges lie in the effort needed to engage the public and retain its interest.

DI GRAZIA F.* – GUMIERO B.* – FABBRI S.*
THORNHILL I.** – LOISELLE S.**

FRESHWATER QUALITY MONITORING IN ITALY WITHIN THE FRESHWATER WATCH NETWORK

Scientific accuracy, environmental stewardship, freshwater, environmental education

Citizen science has the potential to make a significant contribution to scientific understanding and research. The number of data obtained through public participation can far exceed the working capacity of a single researcher, thus allowing a wider geographic and temporal scale. Since 2012, FreshWater Watch (FWW) has been working with citizens scientists, gathering data on the quality of freshwaters in more than 30 cities around the world and provides a platform to empower local communities to be stewards of their local freshwater resources.

Using FWW, the Citizen Science Italian Observatory will embark upon a pilot period, collaborating with regional and national park and environmental authorities to create a bridge between authorities and citizens. Across the parks we will seek to engage members of the local community who have vested interests in the park and study both ecological and sociological aspects pertaining to the project.

We expect that through carrying out monitoring of Italian rivers, the participants will have a higher level environmental awareness and be more willing to take action to improve their local area. We aim to simplify the relationship between citizen and research and through aggregation into working groups develop a sense of belonging. By doing this, we hope to move the individual from the position of spectator to being part of the solution to environmental concerns.

To capture this we will administer a periodic questionnaire regarding people's perceptions of their environment. In so doing, we will test whether or not the citizen has acquired greater sensitivity and understanding of the environmental mechanisms and whether they have acquired a greater sense of responsibility and membership. Data collected through volunteer involvement will also allow us to understand further the quality of Italian water bodies such as seasonal trends in nutrient concentrations and turbidity levels and support the management of the parks.

The Citizen Science Osservatorio is supported by Fondazione Flaminia (Ravenna-Italy).

* Department of Biological Geological and Environmental Science (BiGeA), Bologna University, Bologna, Italy.

** FreshWater Watch, Earthwatch Institute, Oxford, United Kingdom.

A CITIZEN SCIENCE INITIATIVE IN THE MARINE PROTECTED AREA OF “REGNO DI NETTUNO” (ISCHIA, PROCIDA AND VIVARA ISLANDS, GULF OF NAPLES)

Marine Protected Areas, local community, educational institutions, scientific information system

Among the functions and objectives of any Marine Protected Areas in the Italian context is the organization of extended knowledge of the local marine life, finalized to its conservation, and the promotion of a synergistic network of private and public subjects, including NOG and no-profit organizations present in the AMP territory, to increase knowledge and awareness of the local conditions of the marine habitat and species.

The AMP “Regno di Nettuno” includes the three Phlaegrean islands of Ischia, Procida and Vivara (Gulf of Naples) and has been instituted in April 2008.

In the island of Ischia, in particular, a marine research Institution is present, the Stazione Zoologica Anton Dohrn (Naples), which has in Ischia Porto the Villa Dohrn-Benthic Ecology Center active since 1970, and whose staff performed also the pilot study for the AMP institution back in 1999-2001.

In the past years many documented cases of citizen science have been reported to the Villa Dohrn Center staff by many private citizens, as well as NGO and no-profit organizations, private cooperatives and diving operators. Among the phenomena reported we can list, the presence of alien taxa, the records of mass mortality events due to heat-waves, the flowering and seedlings of the seagrass *Posidonia oceanica*, the occurrence of underwater gas (CO₂) emissions, the loss of fishing net and other fishing gear, the mucilage or jellyfish blooms, and also the spill of pollutants.

In the effort to face the marine conservation challenge, the engagement of society is of essential relevance, and in recent years many examples of extensive citizen science initiatives are available at local and National levels.

The objective of this proposal is to build effective cooperation between science, AMP and society, to organize a web-site/web platform dedicated to reporting various phenomena, species and events relevant to estimate possible threats and changes of the local marine habitat, communities and species, due to natural, climate- or human-mediated effects; and to increase local knowl-

* Stazione Zoologica Anton Dohrn, Villa Dohrn-Benthic Ecology Center, Ischia (Napoli, Italy).

** Marina di Sant’Anna s.r.l., Ischia (Napoli, Italy).

*** Marine Protected Area “Regno di Nettuno”, Ischia (Napoli, Italy).

edge, social awareness and responsibility to the marine life and its conservation efforts within the AMP.

The web site/platform is intended to be open to all citizens and private and public subjects, with a list of possible phenomena and species that everyone can contribute to report in a simple way with the compilation of simple sheets and upload of photos.

The Stazione Zoologica staff and the AMP experts will give a scientific feed-back to all reports, involving also other colleague scientists to verify the consistency of every input received.

Periodic demonstration of the various events reported the web site, will be organized in public meetings and in synthetic overview reports.

THE ITALIAN SOCIETY FOR THE STUDY AND THE CONSERVATION OF DRAGONFLIES AND THE COLLECTION OF FAUNISTIC DATA IN THE LAST 10 YEARS

Odonata.it, dragonflies, atlas, faunistic records, citizen science

The Italian society for the study and the conservation of dragonflies (Odonata.it) has been collecting faunistic data since its foundation in 2007. In the year 2014 all data collected in the past, mainly using spreadsheets and e-mail, were analyzed to produce a provisional atlas of the Italian dragonflies. These data had been collected by more than one hundred enthusiasts and experts. From 2014 onwards, the society changed the approach of data collection and focused on the platform Ornitho.it and the related mobile app Naturalist. The costs of the dragonfly section of the platform Ornitho.it are covered by the society Odonata.it. Currently, a team of fourteen expert odonatologists validates the records transmitted by non-professional scientists on the basis of photographs. In the years 2015 and 2016, a total of 37.149 faunistic records from 417 contributors were collected, many of those who provided data are not members of the society Odonata.it. Importantly, numerous records of 1) rare and/or threatened species and 2) species listed in the annexes of the Habitats Directive have been transmitted and some of these were from populations previously not known. So far the platform Ornitho.it has allowed to collected data for 89 species.

* Società italiana per lo Studio e la Conservazione delle Libellule – ODONATA.IT

LANFREDI F.¹ – LEANDRI F.² – CECERE F.³ – ROSSETTI G.⁴

BIOSAFARI I.C. MARCONI CASALMAGGIORE - DISCOVERING THE TERRITORY AND ITS BIODIVERSITY THANKS TO THE NEW TECHNOLOGIES

Communication, check, compare, share, biodiversity

Citizen Science is a powerful tool for communicating, educating and empowering citizenship. The Istituto Comprensivo Marconi (Casalmaggiore, CR) used the iNaturalist.org platform as a useful tool to develop European competences and disciplinary competences. In particular: to talk with other people in the right and defined way, to improve self-esteem, to collaborate and participate, to use digital tools, to develop expertise in geography and naturalistic aspects of territory. The project's phases and analysis of the collected data are presented.

¹ Istituto. Comprensivo G. Marconi , Casalmaggiore (CR), Scuola secondaria di primo grado Don Primo Mazzolari, Rivarolo del Re (CR), Italy.

² Vicolo Chiuso 2/A, San Giovanni in Croce (CR), Italy.

³ Riserva Naturale e fattoria didattica Le Bine, Acquanegra sul Chiese (MN), Italy.

⁴ Parco Regionale Oglio Sud, Calvatone (CR), Italy.

THE CHALLENGE OF SAVING CITIZEN SCIENCE DATA: WILL THEY SURVIVE TO THE SPREADING ON SOCIAL PLATFORMS?

Naturalistic forums, database optimisation

Naturalistic forums have developed in Italy in the early 2000s. These are virtual places where professional and amateur users share their experiences and skills by exchanging information on animals, plants and fungi. Natura Mediterraneo Forum (NMF) and Entomologi Italiani Forum (EIF) are two of the most important Italian naturalistic forums. To date, NMF has about 10,000 active users and stores about one million messages in 128 forum sections in which also occurrences of taxa new for Italy or for Europe are reported. EIF is somehow complementary to NMF: it is limited to Arthropods and stores about 400,000 messages from 5,000 users. As is normally the case in the most qualified naturalistic forums, both in NMF and EIF, moderators are skilled taxonomists who frequently help and encourage the beginner users in identifying taxa. In this way, over time, the regular users can increase their skills on their favorite topics.

In recent years, we noted that the number of messages in these forums is decreasing because of the competition of social networks such as Facebook or Instagram. These platforms have some fascinating features for amateurs, such as the very simple use in creating new thematic groups and rapid data exchange by smartphone; hence the number of small nature-based groups founded on these technologies is rapidly growing. However, by definition, these groups lack moderators, and rarely someone is able to provide adequate scientific knowledge or is able to actually train the participants. In addition, on these platforms, unstructured data are hard to find and, in fact, disappear after short periods after their release. Therefore, the use of these media causes irremediable dispersion of data.

As far as Citizen Science is concerned, forums are important containers of naturalistic data collected by citizen scientists. Many data already validated by moderators can be recovered through textual searches. Furthermore, these containers can be improved by re-engineering their database. Database optimization, including using DwC concepts for occurrence data, can provide the basis for efficient data retrieval and enhance forums to compete with modern social networks, in terms of mobile usability, feedback, and sharing.

* *Natura Mediterraneo Forum.*

** LifeWatch-ITA, Collections Thematic Center; CNR-IBAF, UOS Montelibretti (Rome), Italy.

MERLINO S.¹ – ABBATE M.² – GIOVACCHINI A.³
LOCITANI M.⁴ – STROOBANT M.⁵

MONITORING MACRO AND MICRO PLASTIC IN PELAGOS SANCTUARY: A CITIZEN SCIENCE SUCCESSFUL APPROACH

Citizen science, coastal monitoring, marine litter, marine protected areas, network

SEACleanerII is the follow up of SEACleaner project, a citizenscience project implemented, from 2014 to 2016, by CNR-ISMAR, in collaboration with other Research and Organisation Centers (DLTM, INGV), 5 Regional/National Parks in South Liguria and North Tuscany/Tuscan Archipelago, and many Association of Volunteers and local School Institutions. In SEACleaner project the aim was to collect data on the distribution, abundance and type of macro “Anthropogenic Marine Debris” (AMDs) on several beaches in a vast area belonging to the Pelagos Mammals Sanctuary, with particular attention to the marine protected areas (MPAs) included. The problem of AMDs accumulation at sea and along coastline is becoming increasingly important within the Marine Strategy Framework Directive (MSFD), but there is still not enough data regarding macrodebris, microdebris and the principal pollution sources of them along our coasts. These data are instead important, in order to establish the degree of Environmental Status of Italian coastal areas and to make comparison with bio-indicators of coastal flora and fauna and their biodiversity index. For this reason, SEACleaner has undertaken collaboration and synergies with other citizenscience projects focused on biological surveys, through Reef Check Protocol MAC-e, in the same selected area (as *BluePaths Project* of Istituto Comprensivo Statale “2 Giugno”, La Spezia, Italy). Results of the first three years of activities were made public by means of publications (both specialistic and for generic public), a master thesis (Giovacchini A.: *Monitoring and Analysis of Beached Marine in some coastal zone surrounding the International Marine Protected Area of the Sanctuary of Cetaceans* - Corso di Laurea Magistrale in Biologia Marina, 2016, Pisa University), and on the net, especially through a short documentary realized by ISMAR, DLTM and CNR WEB TV for the 10th of Researchers Night in Bruxell in 2015, and projected in 2016 in occasion of various national and international Environmental Film Festival (*MARINE RUBBISH. A challenge to share*. Distributed by CNR-WEB TV). From

¹ CNR – Istituto Scienze Marine (ISMAR), sede di La Spezia c/o Forte Santa Teresa – Pozzuolo di Lerici, La Spezia, Italy.

² ENEA – UTMAR, Forte Santa Teresa – Pozzuolo di Lerici, La Spezia, Italy.

³ Università di Pisa – Dip. di Biologia, Pisa, Italy.

⁴ Istituto Nazionale geofisica e vulcanologia (INGV), sede distaccata Villa Pezzino, Portovenere, La Spezia, Italy.

⁵ Distretto Ligure delle Tecnologie Marine (DLTM), La Spezia, Italy.

2016, thanks to SEACleanerII project, the network has been extended to ENEA-UTMAR of La Spezia. The new project continued to collect data through citizenscience, focusing now on microplastics which represent a major problem for marine mammals in the considered area. SEACleanerII provides data collected during repeated campaigns at the same georeferenced stations, with seasonal time lapse. Compared to the previous SEACleaner project, the surveyed area in SEACleanerII is restricted to specific MPAs with high protection degree. (Pianosa Island in Tuscan archipelago; San Rossore Park, near Pisa) and to some neighboring urban beaches, in order to compare situations that differ for parameters as anthropization, tourist exploitation, cleaning beach actions etc. Here we present some preliminary results of the last year of microplastic collection and a brief review of past SEACleaner results. Moreover, we would like to stress the role of networks as essential instruments to pursue better goals.

“BLUE PATHS”: 5 YEARS MOTIVATING CITIZEN PARTECIPATION IN RESEARCH ACTIVITIES FOR BENTHOS COASTAL MONITORING

Citizen science, coastal monitoring, benthic species, snorkeling, bio indicators

“Blue Paths” (“Percorsi nel Blu”) is a long lasting Citizen Science Project carried on by a United School District in La Spezia (North Italy – Liguria), i.e. Istituto Comprensivo Statale ISA 2 “2 Giugno”, with the aim to promote, during a continuous school-training period (from Kindergarten to Secondary School) a series of innovative didactic techniques for teaching Marine Biology and for building a Global Citizenship consciousness in students, but also in parents and volunteers, by expanding the target audience. Implementation of Citizen Science activities are aimed to raise awareness on marine environmental issues, starting with knowledge of scientific monitoring techniques used to record distribution data on marine biodiversity within coastal areas located in the Ligurian and Tyrrhenian Sea and surrounding the “Pelagos” Mammals’ Sanctuary. Thanks to the synergy of a Partnership between School Institutions, Marine Parks, local authorities, Research and Organisation Centers, Associations of volunteers, Blue Paths is not limited to enrich the students’ curricula, but is also finalized to represent an intergenerational resource for an active citizenship in which each member has the opportunity to learn the scientific method that characterizes the work of the Researcher and can operatively feel part of a Research Project in coastal monitoring surveys, by contributing to increase the data collection in order to find information on coastal habitats and suggest suitable strategies for their safeguarding. The loss of biodiversity registered in these coastal zones is a problem often related to the increased pollution of marine litter along our coasts. Concerning this topic, for instance, the effect that fragmentation of marine litter can have on the coastal ecosystem or on benthic bioindicators (such as filter feeding Molluscs or Briozoans) can help us to evaluate the impact on the food chain by observing their distribution on the sea bottom or their accumulation rate on the beach. For this reason the Blue Paths project has selected a restricted group of young citizens (excellent students) able to apply the monitoring techniques of beached and underwater benthic communities in the supra- littoral, intertidal and upper infra- littoral areas. The project provides data collection during repeated monitoring cam-

¹ Istituto Comprensivo Statale n° 2 - Complesso “2 Giugno”, La Spezia, Italy.

² Distretto Ligure delle Tecnologie Marine (DLTM), La Spezia, Italy.

³ Consiglio Nazionale delle Ricerche - Istituto Scienze Marine U.O.S. di Pozzuolo di Lerici, La Spezia, Italy.

⁴ Istituto Comprensivo Statale n°4, Scuola Secondaria “U. Mazzini”- P.zza G. Verdi 13, La Spezia, Italy.

paigns at the same georeferenced monitoring stations, by months' time laps, to estimate the qualitative and quantitative presence of beached benthic samples or of anthropogenic marine litter (in accordance with the Reef Check Protocol MAC-e and SeaCleaner Project) and to deduce information about the benthic distribution on rocky bottoms with no-invasive methods (linear transect and sampling squares). Preliminary observations about the distribution of benthic conspicuous, alien, bio indicators of coastal flora and fauna and their biodiversity index, arise from the use of an experimental Bio-Watching Protocol specific for the involvement of Citizens in Visual Census monitoring techniques in Snorkeling or in Scuba diving, up to ten meters in depth. This study presents some preliminary results of five years of data collection carried out in Pianosa Island within the Tuscan Archipelago.

CITIZEN SCIENCE AS TOOL FOR THE MONITORING OF THE MARINE ALIEN SPECIES

Mediterranean Sea, NIS, smartphone, Apulian

CSMON-LIFE aims at a new approach to involve citizens in expanding and improving scientific knowledge about biodiversity management and protection. A section is dedicated to the evaluation of marine alien species recorded along the Italian coasts, with special focus on the Adriatic and Ionian basin.

The marine alien species represent an indicator of changing environmental characteristics and marine biodiversity, therefore the biological monitoring is fundamental to assess the pattern of distribution and ecological impacts, as also confirmed by their inclusion in the programs of the MSFD (2008/56/EC).

The project was launched in 2014, it is still ongoing (project closure foreseen for November 2017) and makes use of a free CSMON-app for sending 'alerts' consisting of a photo, the date of discovery and the geographical position mainly by fishermen, divers and the general public.

At the beginning, critical issues related to the use of the app were noticed, because of the stakeholders' low technology mastery, showing serious difficulties for the alerts sent via the project app, also confirmed by the low number of alerts received. In order to achieve wider and more shared response, it has been decided to integrate less innovative and technological tools that certainly reached the stakeholders while maintaining the minimum characteristics that each alert must have (photo, date and location): e-mail, a Facebook account and a WhatsApp number. These tools, together with the app, gave the possibility to receive a higher response.

Up to June 2017, 43 meetings and seminars were organized, 21 protocols were signed with the main fisheries cooperatives and environmental associations, 154 posts on Facebook account were published, 15 articles on local and national websites, journals and newspapers were published, a continuous support to all the interested stakeholders has been provided and almost 400 people got in touch with the project.

Actually, almost the foreseen number of alerts have been collected (128 alerts) that were also identified, mapped and categorized: 17% alien species, 6% rare species, 77% common species. The alien species were grouped in 4 taxa. The highest numbers of alien species were Crustacea (50%), followed by Mollusca (18%), Fish (14%), Ctenophora (9%), and other Invertebrates (9%). Specifically, the most recorded species were the Crus-

* CIHEAM Bari, Italy.

taceans *C. sapidus* and *P. gibbesi*, both shows the widest distributions in the areas investigated.

These preliminary results demonstrate (i) the need to set the alerts collection tools according to the target groups, (ii) the lack of knowledge about marine alien species, often confused with the common/rare ones and (iii) the potentiality of the areas as sink (and source) for the biological invasions.

Long-term investigation coupled with the awareness of the role played by the citizen scientists will improve the knowledge on the spatial and temporal distribution of marine alien species, representing the first early warning system for the detection of new arrivals.

PINZARI M.* – CIAMBOTTA M.* – MARTELLOS S.**
MATTOCCIA M.* – SBORDONI V.*-*** – CESARONI D.*

“ASK THE EXPERT”, AN INITIATIVE OF PROJECT CSMON-LIFE

Citizen Science MONitoring, Biodiversity, Observer quality, Validation

CSMON-LIFE (Citizen Science MONitoring) aims at involving citizens in monitoring Italian biodiversity by a citizen science approach. Novel IT tools for mobile devices have been developed in the framework of the project, providing citizens with a platform for collecting and sharing geo-referenced data of target species. CSMON-LIFE also offered another option to participants, the “Ask the expert” campaign, which aims at encouraging citizens to satisfy their curiosity, by trying to identify and reporting other organisms other than the project’s target species, and having experts verifying their identification.

This report analyses the data of taxa collected in the “Ask the expert” campaign, in order to evaluate the degree of citizen’s participation and engagement, the quality of observations, the distribution of observations, as well as the most intriguing taxa to citizens.

The data analysed were: 1) amount of sightings, entrants and mean number of sightings per entrant; 2) temporal and spatial distribution of observations; 3) estimates of the correct identifications; 4) which taxa have been reported by citizens.

During two years, more than 500 citizen scientists reported ca. 3000 observations, with a linear growth over time, and a certain degree of heterogeneity in temporal distribution, with evident seasonal peaks. Since the project started in Lazio, observations came mainly from this region. However, a high number of sightings were collected in other regions (Lombardia and Emilia-Romagna, especially). The whole dataset of observations included several taxonomic groups from plants to animals.

As far as animal taxa are concerned, the greatest number of observations was about invertebrates, which triggered curiosity in most people, like spiders and insects (especially species of the orders Lepidoptera and Coleoptera). As far as vertebrates are concerned, most observations were collected on birds, mammals and reptiles. Citizens also provided new data on the occurrence of some alien animal species in Italy.

Finally, these results enable us to make assumptions about which taxonomic groups could be best taken into account in future biodiversity projects aiming at involving citizens.

* Dept. of Biology, University of Rome “Tor Vergata”, Italy.

** Dept. of Life Sciences, University of Trieste, Italy.

*** Italian National Academy of Sciences called of the XL, Rome, Italy.

“ADOPT A TRIESTE TIGER”, A PROJECT OF CITIZEN SCIENCE AT SCHOOL

Science communication, school, environmental education, health education, evaluation, invasive species, tiger mosquito

Infectious diseases transmitted by mosquitoes are a very topical issue which has strongly re-emerged after the latest global health emergency declared in February 2016 by the World Health Organization (WHO), for the virus Zika. People involvement is crucial to monitor and contrast the spreading of mosquito species and, to that aim, several Citizen Science projects have been implemented, such as Mosquito Alert (Spain), Mosquito Atlas (Germany) and ZanzaMapp (Italy). These projects provide for a qualitative (and not quantitative) monitoring of the mosquitoes; moreover, to date, their effectiveness has never been assessed.

The Citizen Science project “Adopt a Trieste Tiger” has involved “non-experts”, specifically high school students, in the Tiger mosquito (*Aedes albopictus*) quantitative monitoring on the Trieste municipality territory. This project has undergone an important evaluation phase to understand its effectiveness in terms of scientific topic learning, perception of science, perception of the non-experts role in the scientific process and their involvement in the research activity.

This project has been built and assessed using the method proposed by Cornell Lab of Ornithology (Cornell University, Ithaca, NY) “Evaluating learning outcomes from citizen science”. It has been built in three phases: the first phase provided for *theoretical and practical* classroom speeches to introduce the mosquito’s characteristics; the second phase entailed the students to implement the quantitative monitoring of the species through the egg-traps placed in their home gardens; the third phase provided for another classroom intervention; in a final event the experience and the results obtained were shared. The project effectiveness evaluation has been made through entry and exit tests (mixed approach: quantitative and qualitative) in order to assess the learning level and the changes in perception of science, perception of the non-experts role in the scientific process before and after the project. Moreover the evaluation method analysed some involvement and participation indicators.

Overall, 57 students from 3 classes have participated in this project. Classroom interventions have been supported by a blog and a closed Facebook group dedicated to the project. 29 students offered to participate in the

* Master’s course in Science Communications “Franco Prattico” (MCS), International School for Advanced Studies (SISSA), Trieste, Italy.

summer monitoring and 10 of them volunteered for the microscopic reading of the eggs. 57 entry and exit tests have been administered; 34 students joined the Facebook group.

Citizen Science proves to be an adequate instrument to involve and recruit “non-expert” volunteers in the scientific process, by reducing the gap between science and society and creating a new knowledge. The students actively participated in the quantitative monitoring of the Tiger mosquito. The project proved to be effective in improving scientific topic learning, perception of science and perception of the non-experts role in the scientific process. It also proved its effectiveness at improving the non-experts involvement in the research activity.

RICHTER A.*-*** – HECKER S.** – BONN A.***

CAPACITY BUILDING CITIZEN SCIENCE IN GERMANY: FROM DIALOGUES TO ONLINE CONSULTATIONS

Capacity building, dialogue, online consultation, visions

Capacity building refers to a framework at the levels of individuals and organisations with a particular focus on strengthening and maintaining the capabilities for a certain subject. With the rise of citizen science at the project level, strategic capacity building for science, policy and society at the meta-level is required to further develop and integrate citizen science as integral component of the science-policy-society interface.

Over a period of two years, a comprehensive capacity building program was initiated and performed in Germany to strengthen existing partnerships and competences in Citizen Science and to identify gaps and capacity needs.

Here we present the processes, the outputs and results from national dialogue forums and the online consultation of the Citizen Science Strategy 2020 for Germany – one of the major outcomes of the program.

* Helmholtz Centre for Environmental Research (UFZ), Germany.

** German Centre for Integrative Biodiversity Research (iDiv), Germany.

*** University of Jena, Institut for Ecology, Germany.

SANDULLI R.* – RUSSO G.F.* – VILLANI G.**
MICCIO A.*** – TESTA R.L.***

MARINE EXPERIENCE – A NEW SYSTEM OF “ENVIRONMENTAL ACCOUNTING” CLOSER TO CITIZENS, IN THE MARINE PROTECTED AREA OF “PUNTA CAMPANELLA”

Marine Protected Areas, local community, environmental accounting, scientific information system

The Marine Protected Area (MPA) of Punta Campanella expands along 40 km of coastline including over 1500 hectares of protected surfaces. It stands on a very anthropized territory with a markedly high touristic pressure. Since 2008 it is also classified as a Specially Protected Area of Mediterranean Importance (SPAMI) being characterized by a very high degree of biodiversity and by particularly relevant naturalistic habitats. In view of the important scientific, aesthetic, cultural, and educational role, the MPA has always stood for awareness and natural conservation projects in order to sustain the growth of a more environmentally orientated conscience.

In this respect, we suggest the realization of a new two-way system both for the collection of information and for their guided management, and for the promotion of a deeper knowledge of the territory accessible to any web user. In the recent past, the MPA received many inputs from different stakeholders (scuba-divers, generic citizens, associations) about the discovery of new species/alien species, the presence of foams at sea, mucilage or illegal sewage.

This new system will also allow the acquisition of georeferenced information on a web platform in which anyone, following registration, could input data, images and videos in a very simple way. In this way, it will be possible to keep track of all the events to build up a reliable database.

The citizen will be the main source of information, and a group of university, research institutes and MPA experts will validate the veracity of the reported alerts. Such activities are included in the guidelines and recommendations of the European Marine Strategy Framework Directive (MSFD) aiming at the achievement of GES - Good Environmental Status – of their own marine waters.

In this view the cooperation among MPA, citizens and scientific community becomes a priority in building a very effective instrument to sustain a better

* University of Naples “Parthenope”, Dept. of Science and Technology, 80143 Napoli, Italy.

** Institute of Biomolecular Chemistry (CNR, ICB) (Naples, Italy).

*** Marine Protected Area “Punta Campanella” (Massa Lubrense, Naples, Italy).

knowledge of the coastal marine environment, along with a growing environmental awareness. Moreover, this approach is urgently requested in the present MPA management procedures that favour the maximization of all information into a single major system of “environmental accounting”.

The MPA, in collaboration with the involved scientific community, will make sure that this system be continuously updated through the periodical publication of results by means of newsletter, conferences, and any other dissemination means.

ORGANIZE CAVERS FOR BATS MONITORING IN THE SULCIS IGLESIENTE PROJECT, SARDINIA

Cavers, bats, monitoring, education

Almost all of the cavers groups have bats in the logo but few of them collect information about the presence of a so endangered taxon as Chiroptera in caves. A monitoring program based on volunteer activity of cavers started in 2015 thanks to the support of the Sardinia Region and of the Carbonia Iglesias Province, Environment Services Area, with funds of the Regional law n°4 of 7/08/2007.

The aim of the project was to increase awareness among various speleological groups of the Sulcis Iglesiente area about the values of the presence of bats and the necessity of cave environment protection. The main active participation came from the different local speleological groups, as well as other volunteers associated to the Sardinia Speleological Federation.

Sulcis Iglesiente geologically is a complex of Paleozoic lithologies and large carbonates layers where massive karstic complexes develop, creating the 1289 caves actually known. It is also permeated by hundreds of kilometers of mines galleries thanks to the millennial extraction of important minerals. All these undergrounds are potentially inhabited by bats and many different large colonies are already known. 21 bat species are present in Sardinia and most of them are related to caves in all or few parts of their phenology.

Cavers were trained in a multiple days course to species recognition, ethical and technical approach to the study of bats and the use of bioacoustics, 35 volunteers started to monitor for a year, every month, the caves Cava Romana (Nuxis), Corona Sa Craba, (Carbonia), Grotta dei Fiori, (Carbonia), Sa Crovassa de Pranu Pirastu (Domusnovas), Grotta di San Giovanni (Domusnovas). After a year the number of interested cavers grew to over 60 from all over Sardinia, with a strong emphasis in the cooperative work, despite some minor relationship problems.

These actions will allow the identification of species in caves and their phenology in an area of particular biospeleological interest such as southwestern Sardinia. At the same time the necessity to protect the bats helps to protect underground habitats as caves and mines. A large collection of information

* Federazione Speleologica Sarda, Ex direzione miniera San Giovanni, Regione San Giovanni, Iglesias (CI), Italy.

** ST.E.R.N.A. and Ornithological Museum F. Foschi, Forlì, Italy.

*** Department of Veterinary Medical Science, University of Bologna, Ozzano dell'Emilia (BO), Italy.

was obtained about cave use by bats, colony structure and phenology for 20 taxa and in particular for *M. schreibersii*, *Myotis punicus*, *M. emarginatus*, *Rhinolophus euryale*, *R. mehelyi*, *R. ferrumequinum*, *R. hipposideros*, all species in Annex II of Habitat directive.

The project results mainly in a new consciousness among groups and in more trained people who can play an important role in spreading knowledge and collecting important conservation information.

SCRIMSHAW M.D.¹ – CARERE M.² – MARCHEGGIANI S.²
TCHEREMENSKAIA O.² – GILBERT N.³ – CORDIOLI A.⁴
VAROTTO P.⁴ – FATONE F.⁵ – PAPA M.⁶ – FARINELLI A.⁶
BLUM J.⁶ – BLOISI D.⁶ – ROSSATO M.⁶ – DELLEDONNE M.⁶
TITTONEL A.⁷ – ALLABASHI R.⁸ – BRIGHTY G.⁹ – PARSONS L.⁹
CALISI D.¹⁰ – GIANNONE F.¹⁰ – MALAMIS S.¹¹ – ORDEIX M.¹²

INTCATCH: DEVELOPMENT AND APPLICATION OF NOVEL, INTEGRATED TOOLS FOR MONITORING AND MANAGING CATCHMENTS

Catchments, water quality management, citizens engagement, innovative sensors, decision support system

INTCATCH (Development and application of Novel, Integrated Tools for monitoring and managing Catchments) is a EU Horizon 2020-funded project that aims to instigate a paradigm shift in the monitoring and management of river and lake water quality, by bringing together, validating and exploiting a range of innovative monitoring tools for river and lake water quality into a single efficient and replicable business model for water quality monitoring that engages the widest set of stakeholders and will be fit for European waters in the period 2020-2050. INTCATCH, <http://intcatch.eu/>, will do this by developing efficient, user-friendly water monitoring strategies and systems based on innovative technologies that will provide real time data for important parameters. The INTCATCH project will use demonstration activities to showcase eco-innovative autonomous and radio controlled boats, sensors, DNA test kits, smartphone apps and run-off treatment technologies. INTCATCH will incentivise the engagements of stakeholders and embodying citizen science in improving the water environment. The concept of Citizen Science is endorsed and will be promoted in the project through the active participation of volunteers in actions, such as the operation of the monitoring boats in the demonstration catchments, participation in monitoring programmes, sampling cam-

¹ Brunel University London, London, United Kingdom.

² Italian Institute of Health, Italy, Rome.

³ Thames21 Limited, London, United Kingdom.

⁴ Azienda Gardesana Servizi S.p.A., Peschiera del Garda (VR), Italy.

⁵ Università Politecnica delle Marche, Ancona, Italy.

⁶ Università di Verona, Verona, Italy.

⁷ Technital S.p.A., Milano, Italy.

⁸ Universität für Bodenkultur, Vienna, Austria.

⁹ Environmental Sustainability Associates Limited, Molesworth, United Kingdom.

¹⁰ Algorithmica S.r.l., Roma, Italy.

¹¹ Technical University of Athens, Greece.

¹² Center for the Study of Mediterranean Rivers, Universitat de Vic, Spain.

paings and dissemination activities; the tools will be tested and validated with stakeholders and citizens in the Garda lake (Italy), the great Ouse and urban rivers London (UK), Ilyki lake (Greece), Ter River (Spain). The project will address how the technologies can be integrated with Citizen Science and what the implications are for the use of the environmental data produced by this approach. The capability of stakeholder groups to utilise the INTCATCH tools for the gathering of water quality data and the INTCATCH software and data dissemination tools will be assessed. The socio-economic aspects are addressed by a vision for shifting to monitoring driven by citizen science, rather than solely a regulatory-based delivery. The project will support green growth, increase resilience to climate change and will improve and implement the chemical and ecological monitoring programmes of the EU Water Framework Directive.

SPOTTI F.A.* – CASTRACANI C.* – GIANNETTI D.* – GHIZZONI M.*
ZUCHELLI M.V.** – GRASSO D.A.* – MORI A.*

THE ANT BOX: A TOOL DESIGNED TO INTRODUCE ITALIAN TEACHERS TO CITIZEN SCIENCE

Using ants as study model, the Myrmecology Lab of the University of Parma is investigating the impact of human activities on urban biodiversity in Italy. In many countries, ants are successfully employed as bioindicators, because of their rapid response to environmental changes and because they represent a variety of trophic levels. Moreover, ants mediate many ecosystem services, that improve human well-being, and are a taxon of major economic concern. In our cities, monitoring the ant-fauna can be useful to predict environmental and climatic changes and to detect the advance of potentially dangerous invasive species. Nevertheless, on a national scale, collecting data on ant species distribution in urban areas requires a lot of resources in terms of time and manpower involved.

In Italy, science education in primary and secondary schools generally provides students with little opportunity for field and lab work. This lack in first-hand experience is mostly caused by the structural absence of school laboratory, and teachers are trying to compensate by looking for opportunity for such experiences.

Meeting the requirements of both scientists (in search of data collectors) and schools (looking for “hands on” experiences), we developed the Citizen Science project “The School of Ants: a scuola con le formiche”. This project combines the scientific aim of improving the knowledge on urban ant biodiversity with the chance for schools to participate directly to a field research. In collaboration with the Science Museum of Trento (MUSE), we designed “The Ant Box”, a tool addressed to teachers and students that will get involved in our Citizen Science project. The box contains both scientific and educational materials. The scientific part includes ant collecting kits and the standardized protocol to use them in the schoolyard and in school surroundings. Collected specimens will be sent to the Myrmecology Lab to be identified at the species level. Furthermore, the educational part includes laboratory material to collect, conserve and observe other ant specimens, a dichotomous key to identify them at the genus level and a teacher’s book with more information on ant biology and ecology. These materials were designed to allow teachers to manage the CS project independently with their classes. Finally, in order to evaluate the didactical effectiveness of the project, we provided a question-

* Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Parma, Italy.

** Science Museum (MUSE), Trento, Italy.

naire to test students' attitude towards science, and their knowledge on ants, at the beginning and at the end of the project itself. In spring 2017, 16 classes of both primary and secondary schools participated to our CS project, receiving the Ant Box. The first results outlined the presence of 15 ant species in urban areas of Trentino region and further analyses will give us more detailed information on their frequency and distribution.

TRAVAGLINI A.* – BRIGHETTI M.A.* – MIRAGLIA A.R.*
RICCIARDI L.** – SIGISMONDI C.**

CITIZEN SCIENCE: PHENOLOGICAL OBSERVATIONS OF *CUPRESSUS* IN ROME AND POLLEN ALLERGIES

Phenology, allergies, health, scientific information system

Aerobiological monitoring is an important and young discipline with several purposes: the study of flora and vegetation changes, variations in blooming time, possible impact of climate change. Moreover it is very important in helping allergic people towards pollinosis. In these years we decided to support aerobiological monitoring with weekly phenological observations for some species belonging to the genus *Quercus*, and to the Poaceae and Cupressaceae families. Citizen science is the use of people to collect data, generate results, and generally conduct science. Citizen science projects have the ability to collect large amounts of data, due to large volunteer groups, but usually require technical or scientific staff to analyze data and decipher patterns. Citizen scientists represent a recent way to collect data especially in North Europe based on the project Open Air Laboratory (OPAL). The European Environmental Agency underlines the importance and the utility to involve citizens in projects on biodiversity monitoring.

After some years of activity carried out by university researchers and students, we decided to involve citizens in these observation. We invited users of our website to participate in this work.

We sent instructions, pictures and other useful notes according to BBCH Monograph to participants. Every week we compiled pollen data and phenological data directly collected or sent to us by citizen scientists whom we enlist on our website.

We observed in these years more than 60 sites in and out of the Great Ring Road (A90), from the end of October to the end of February, and when *Cupressus* sp. cones reach the final phase.

We have obtained a first map of different phenophases for *Cupressus* in Rome; it indicates how the blooming of these trees starts in the south west of Rome and then moves towards the eastern and northern sector.

Using these data we are testing a model to forecast when the flowering day for Cupressaceae starts.

For the next years, we want to organize a project with schools and devise an app for e-health medicine.

* Department of Biology, University of Rome Tor Vergata, Italy.

** School of higher education "Federico Caffè" Rome, Italy.

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VALERIO F.*-*** – BASILE M.**-***
SANTOS S.M.* – BALESTRIERI R.***

PEOPLE AS OPPORTUNISTIC SENTINELS FOR ROAD SURVEY.

Roadkill, road, network, collision, Via Libera

Road networks represent one of the biggest global threats to biodiversity, as they alter ecosystems and habitats through direct and indirect effects. In disentangling habitat patches, roads affect negatively both habitat quality and species movements, and therefore some fundamental activities within the wildlife lifespan. Linear infrastructures are predicted to largely increase during the current century, pressing the need for accurate wildlife monitoring plans and the development of mitigation strategies. Direct vehicle collisions (roadkills) are considered one of the most important direct effects on wildlife and an important cause in decreasing abundance as well as gene-flow.

Nevertheless, roadkill monitoring projects require a high effort, which usually involves large teams and several *a priori* precautions to decrease biases in the monitoring survey. In this regard, citizen science may play a major role in data gathering and monitoring. In the last decades, the spread of communication devices, jointly with the advances in information technology, have further increased the potential contribution people can make to science. For example, thanks to simple mobile apps, people can easily upload their location, with associated biological data, on an online database, in a parsimonious effort approach.

In our study, we approached citizen science to monitor roadkills occurrence, over two years in Campania Region, south Italy. We developed the project 'Via Libera'. Citizens were asked to send coordinates, pictures and a text message every time they found a wildlife roadkill on roads. The use of smartphone with built-in GPS kept the process as easy as possible. The use of instant message apps, with the option to send the position, increased the easiness even more. Data went through a validation process, after submission to the database by citizens. We collected 530 data and demonstrated citizen science can offer a low-cost opportunity in predicting roadkill hotspots and in identifying road sections that need more focused investment and mitigations to enhance safe road crossing by wildlife.

* CIBIO/InBIO-UE- Research Center in Biodiversity and Genetic Resources, Pole of Évora Applied population and community ecology laboratory, University of Évora UBC - Conservation Biology Lab, Department of Biology, Mitra, Évora, Portugal.

** Associazione per la Ricerca, la Divulgazione e l'Educazione Ambientale (ARDEA).

*** Chair of Wildlife Ecology and Management, University of Freiburg, Freiburg, Germany.

BASTIANINI M.* – SENO G.** – TALAMO T.** – POGACNIK Z.**
NERI G.** – SASSETTO G.** – BASTIANINI E.** – FORIERI C.**

ISedU PROJECT: MONITORING FISH POPULATIONS BY UNDERWATER CAMERA

Fish identification, environmental monitoring, underwater camera, Mediterranean Sea

During 2016 and 2017, students involved in the new project “Work and school alternation” have been asked to develop a platform where observations and identification of fish populations could be performed. Images came from underwater cameras deployed at one of the main marine research infrastructure in the Mediterranean sea, “Acqua Alta” Oceanographic tower. The project has been created within the Zooniverse platform. Here students described the development of the project, upload image sets, prepare small guides to identification and share the results. Small team of students dedicated their time to, bibliographic research, graphics, code development and analysis of the first image sets in order to have a calibration set. They have been ambassadors of the project inside their school and families in order to involve a greater number of people trying to identify fishes swimming around the “Acqua Alta” Oceanographic Tower located in the Gulf of Venice.

The project has been conducted in Northern Adriatic Sea (NAS). The NAS is actually one of the few marine sites belonging to the Long Term Ecological Research (LTER) networks LTER-Italy and LTER International where pluriannual ecological data series are gathered regularly since some decades, with adequate sampling frequencies.

* Institute of Marine Sciences (ISMAR), National Research Council of Italy, Venice, Italy.

** Liceo scientifico G. B. Benedetti, Venice, Italy.

SESSION II

CITIZEN SCIENCE AND SOCIETY

ORAL PRESENTATIONS

BONN A.¹⁻²⁻³ – HECKER S.¹⁻³ – BOWSER A.⁴
MAKUCH Z.⁵ – VOGEL J.⁶ – HAKLAY M.⁷

CITIZEN SCIENCE – INNOVATION IN SCIENCE, SOCIETY AND POLICY

Scientific advances, participation, science-policy interface, evaluation, citizenship

The field of citizen science is growing and making an increasing impact on the world. In the face of significant challenges in relation to environmental, economic, demographic and socio-political change, we need to harness and foster these opportunities of participation in science for enhanced knowledge generation and evidence provision to support societal goals including progressive policy delivery by societal institutions.

Citizen science can contribute to scientific literacy, knowledge and societal advancement that is much needed to support societies at a time where evidence-based policy making, sound scientific expertise and certain foundational truths about democracy cannot be taken for granted in even the most privileged societies. Engagement in citizen science can provide in-depth learning opportunities through learning by doing, and when dealing with data also promoting the ability to understand and deal with variability and uncertainties in complex issues without the need to jump to easy conclusions.

Participation at a range of levels and jurisdictional scales of involvement can foster empowerment as an enlightened, effective citizen. Citizen science offers opportunities to take on responsibility to contribute evidence to better management of our environment, and to engage in developing policies. The ten principles for citizen science need to be tested in practice and evaluation criteria continuously developed and applied.

Citizen science thrives through bottom-up development and participation, and this nature should be supported and further legitimated by the powerful stakeholders that feature in the policy and regulatory life of societies the world over. One of the highest impacts of citizen science in science, society and policy will be achieved when data collected to solve a local problem can also feed into ongoing downstream environmental, social and sustainable economic uses and benefits.

Here, we need to develop ways to marry the individuality of citizen science initiatives with robust scientific practices, to foster both social transforma-

¹ Helmholtz-Centre for Environmental Research – UFZ, Leipzig, Germany.

² Friedrich Schiller University Jena, Jena, Germany.

³ German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany.

⁴ Woodrow Wilson International Center for Scholars, Washington DC, USA.

⁵ Imperial College, London, UK.

⁶ Natural History Museum Berlin, Germany.

⁷ University College London, London, UK.

tion and scientific achievements in citizen science. Perhaps, above all, throughout our communities and formal institutions, we need to further develop and disseminate a participatory ethic – embedded throughout society – that pursues the relevance and impact of scientific citizenship as a key component to innovation in the contemporary world.

L'ASTORINA A.*

CITIZEN SCIENCE: RETHINKING THE ROLE OF SCIENCE (AND SCIENTISTS) IN SOCIETY

Social studies on science and technology, science communication, collaborative research

Citizen science usually describes collaborations between researchers and non-professional volunteers who help with the data collection and other research tasks, such as data annotating, classifying, and reporting. Other forms offer more participative levels of interactions where the roles of the citizen scientists range from defining a need to designing and running the entire research project. Fields explored by citizen science are ecology, astronomy, medicine, computer science, statistics, psychology, genetics, engineering and many more.

It is generally recognized the impact of these forms of collaborative research in bringing people closer to science, improving public understanding and raising awareness toward many social and environmental issues. Citizen science is described as “a new way for the public to look at research” and a means to bridging the gap between science and society.

In my contribution, I will explore citizen science as an opportunity also for scientists to reconsider their role in the society and to discuss the contribution of science as “a privileged form of knowledge” in addressing complex issues in modern societies.

* Social Studies on Science, Communication and Education, Institute for Electromagnetic Sensing of the Environment – National Research Council, IREA CNR, Milano.

LAKEMAN FRASER P.* – MARSHALL K.**
VAN DER WAL. R.** – SLAWSON D.*

CITIZEN SCIENCE NARRATIVES: PERSPECTIVES ON HOW SOCIETAL AS WELL AS SCIENTIFIC OBJECTIVES CAN BE SUCCESSFULLY ACHIEVED

Communication, Face-to-face engagement, Tailoring, Trade-offs, Understanding audience

Citizen science (CS) generates knowledge through the collective voices of citizen science stakeholders. The people behind those voices bring with them an array of aspirations, expectations and goals across the research-outreach spectrum. In a good position to understand these perspectives are the engagement practitioners bridging the gap between these stakeholders. In this talk we draw on research which expresses the narrative of these practitioners (Community Scientists) from a multi-million-pound national citizen science programme in the UK, the Open Air Laboratories (OPAL).

OPAL's remit is to use surveys to promote ecological understanding among hard-to-reach communities as well as schools, families and local community groups. OPAL also seeks to build the capacity of local partners to deliver OPAL Citizen Science, and to maintain involvement of scientists and policy makers. This scope inevitably involves huge challenges. However, understanding the needs and expectations of your audience and finding the most appropriate strategies to engage with them is key to marrying multiple objectives across the project as a whole. This requires those professionals involved in setting up, delivering and/or managing the project to have substantial contact with, and understanding of, those audiences. For OPAL, the importance of on-the-ground Community Scientists is clear, for other CS projects, multi-way feedback is available, for example, through platforms such as online forums.

Benjamin Franklin's maxim, 'Tell me I forget. Teach me and I remember. Involve me and I learn' is frequently used in the field of citizen science to emphasize the impact that science can have on people's lives. CS not only supports learning but opens the door to a deeper understanding, appreciation and drive to protect nature. The narrative that therefore unfolds, is that science and society benefit hugely from CS practitioners holding that door open through sustained dialogue.

* Imperial College London, South Kensington, London, UK.

** University of Aberdeen, Aberdeen, UK.

COPAS K.*

CONTRIBUTIONS OF CITIZEN SCIENTISTS TO OPEN BIODIVERSITY DATA

GBIF – the Global Biodiversity Information Facility – is a research infrastructure and network funded by the world’s governments that makes species occurrence data freely and openly available. Widely used across many biodiversity-related domains, GBIF-mediated data now supports research at a rate of nearly two published peer-reviewed papers each day.

In early 2016, staff of the GBIF Secretariat completed a comprehensive review of the sources of species occurrence datasets available through GBIF.org (<https://doi.org/10.1016/j.biocon.2016.09.004>). While limited to a coarse-scale, dataset-level analysis, the study found that citizen scientists contributed at least 40 per cent of the records mobilized by the GBIF network of participants and publishing institutions. A preliminary review and update of these results suggest that the number of records citizen science projects share through GBIF continues to grow faster than data drawn from field surveys, natural history collections, literature or other sources.

While spatial, temporal and taxonomic gaps and biases exist across all sources of GBIF-mediated data, the results of this analysis highlight the current scope and proportion of biodiversity-related citizen science across different spatial scales as well as its comparative strengths and weaknesses. Large regional disparities also underscore the potential for even greater engagement of citizen science projects, given that large amounts of potentially useful data remain closed and inaccessible to research. Taken as a whole, the results also signal how citizen science can be guided toward specific regions or taxa to improve data coverage and link local efforts with global scientific and policy needs.

* Global Biodiversity Information Facility – GBIF, Copenhagen, Denmark.

CITIZEN SCIENCE, HYDROLOGICAL MONITORING AND PUBLIC AWARENESS

Hydrology, water, flood, open data, QR code

The EU Water Framework Directive 2000/60/EC as well as the EU Floods Directive 2007/60/EC encourage the effective public participation in order to increase public awareness of environmental issues and support for the decisions taken.

In Italy the Water Framework Directive has been transposed by Legislative Decree 152/2006, which recently received, from February 2016, the River Contracts, as voluntary tools for strategic and negotiated programming at a basin and sub-basin scale.

River contracts, through public participation, pursue the protection, proper management of water resources and enhancement of river territories, together with the safeguard from the hydraulic risk, contributing to local development.

The widespread technologies and sensors useful for data collection (e.g. via smartphones) enable the involvement of citizens in the measurement, transmission and analysis of data. The research concerns the development of a web application for Citizen Hydrology, called CITHYD (www.cithyd.com) for the collection of hydrometric measurements in rivers from citizens.

This is of particular interest in ungauged or poorly gauged basins, often of small size, where there are very few data, but often the hydraulic risk is high.

CITHYD is an application that receives water level data, collected and sent by citizens, in river cross sections instrumented with a staff gauge and an information panel, performs simple reliability checks, stores the data, publishes them and creates statistics freely available for all (under Italian Open Data License 2.0).

The application needs an information panel containing a unique QR code for every staff gauge. Through smartphones and TLC network the citizen can transmit the water level seen on a staff gauge existing on a river basin to a geodatabase with web interface. The user, thanks to the QR code, immediately accesses the data entry mask form related to that staff gauge and can insert the water level just read. Data are published almost in real time on a map and the data, inserted by all users, can be read and downloaded, as text files, tables and graphics. The Open Data stored in the DB can be used for scientific research, for calibration and validation of models, to improve the knowledge of the territory and for planning and design.

* Wise srl Società Benefit, Garbagnate Milanese (MI), Italy.

** Studio Majone Ingegneri Associati, Milano, Italy.

The Citizen Science experience supports the involvement of local communities in living and taking care of the rivers of their territory and can promote the creation of a virtuous circle in data collection through social networks, educational and communication events. The application also helps to increase the awareness of the risks associated to floods and the presence of rivers in inhabited places. It can also be used during emergencies, by authorized users, to collect level measurements for risk management and flood protection. Moreover it can be an important people involvement instrument in the context of River Contracts.

POSTER PRESENTATIONS

ALVISI F.*-** – COSCIONE G.M.** – COSTANTINI L.**
LESTI C.** – SAVINI S.** – VELLA S.** – GRIMALDI I.S.G.**
RAINERI M.** – TERRONE M.**

6 YEARS OF INTERNATIONAL COOPERATION IN EL SALVADOR

Local communities, international cooperation, participatory planning, environment sustainability

In the winter of 2008, the CORDES Association from El Salvador pointed out the Microregion Oriental de Chalatenango as a geographical area where international intervention was required. The Italian Association GSF was therefore asked to develop a study to scientifically support a proposal of including this area among the protected ones to avoid the development of mining activities by foreign companies that, as already happened in other regions of El Salvador, have proved to be more harmful than beneficial for the environment and local communities. This region is located in the NE part of the Republic of El Salvador, in the Department of Chalatenango, a territory characterized by rural areas located at the border with Honduras. The population is over 13,000, largely resident in rural areas mainly focused on farming and pastoral activity for family support. Difficulties in the employment field result in widespread critical social conditions with the development of 42% poverty pockets. A first project, CAPACE (Capacitacion y Proteccion Ambiental en El Cerro Eramón), was therefore presented in 2011. The overall project aim was to protect the area and improve living conditions of local populations, by contributing to build useful tools for the spatial planning policies of the region, and raising public awareness on protection of natural resources and on land sustainable management. Three main actions were implemented: a) a multidisciplinary scientific investigation on the territory conservation state; b) the training of local technicians with necessary and appropriate technical and scientific tools; c) awareness raising activities to promote environmental knowledge of the area with local population, local and government authorities. As a result, the area under consideration proved to have the requirements to be inserted into the list of protected areas according to the “Area de protección y restauración” under Article 14 of Legislative Decree 579/05 - Ley de Areas Naturales Protegidas, given an upgrading of the area environmental conditions. A second project, CREA (Conservation, Restauración y Educación Ambiental), was thereby proposed in 2014 in order to start environmental recovery activities in El Cerro Eramón area. The main aim was to strengthen environmental

* Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Bologna, Italy.

** Geologia Senza Frontiere Onlus (GSF), Roma, Italy.

awareness and sustainable use of resources and actually improve the living conditions of local population. Project activities were to: 1) promote sustainable agriculture techniques; 2) deepen the multidisciplinary study of El Cerro Eramón area; 3) promote the development of ecotourism through creation of a hiking guide as well as provision of training courses for the use of the trails; 4) dissemination of results to the population both in El Salvador and in Italy. The collaboration with the CORDES Association strongly encouraged interaction with local population, farmers, women's communities, school children, and ultimately local and central administrations of El Salvador, who were all involved at different levels both in the training as well as in the environmental study phases, monitoring of the environmental parameters, building of the hiking trails, new agricultural techniques and field management, awareness raising activities and environmental education. This experience showed that involvement of local organizations in the project planning and activities resulted to be fundamental in order to enter inside the local social tissue and to make life-style changes possible and achievable by citizens.

“IL PESCE GIUSTO”: AN EDUCATIONAL CITIZEN SCIENCE PROJECT

Citizen science, education to sustainability, ICT, sustainable consumption

“Il pesce giusto” is a Citizen Science project (CS) that encourages consumers to record their consumption from the point of view of ecological sustainability. Aims of the project are to encourage a consumers’ sustainable food consumption and to reveal information about the ecology of the seafood purchased. Over the last decades, the Mediterranean marine resources have been heading to a progressive decline. But biodiversity, food production and food consumption are strictly interconnected elements. The scientific literature as well as political documents underline the need for urgent efforts able to connect ecological, economic and social knowledge. Actually, the society can play an active role in sustainable management of the environmental heritage: properly used, CS can improve the linkage among ecological research, ecological education and sustainable behaviour.

In this framework, in 2014 “Il pesce giusto” has been ideated. In 2016 our working group, composed of ecologists and computer scientists, realised the App for IOS and Android devices. This tool can be considered as a double side source of information: from one side it can be practically utilised for data collection by the measurement of the seafood purchased and the easy submission of its pictures. From the other side, the device can be considered also as an educational tool: the app can give easily accessible information and introduce a novel pathway to inform consumers, increasingly selective and competent, on their personal purchasing choices in real time. An immediate feedback to the user about the sustainability of the food choice (according to criteria of size and seasonality) is provided, and other sections of the app are dedicated to the spread of information about ecology, conservation and sustainability, contributing to the educational goals of the CS research. While the campaign is active throughout the national territory, it is focused however in the Argentario area (GFCM sub-area 9) with the partnership of local organisations. In fact, the literature recommends local community activities and underlines the importance of developing initiatives to connect volunteers and researchers to build a sense of community. In order to support the campaign and to engage people, various kind of activities have been planned in different contexts as restaurants, cultural and recreational places as aquarium and boat fishing for tourism. Supporting material has been developed and a mini-guide on sustainable consumption of marine resources has been ideated and provided.

* Department of History, Humanities and Society, University of Rome “Tor Vergata”, Roma, Italy.

PARTICIPATORY SCIENCE TOOLS FOR TERRITORY DEVELOPMENT: FOOD SOVEREIGNTY IN THE DOMINICAN REPUBLIC

Food sovereignty, social maps, participatory knowledge, education, territory

For more than 20 years, the Politecnico Milano promotes urban planning research based upon the relationship between experts and the environment. Similarly to the citizen science approach, the “territorialista” is a participatory approach applied to territory planning that involves citizens in the process of collecting and interpreting information. Methodologies have been developed to set up project scenarios in which the contribution from social sciences is extremely important, and bear the roots into the definition of territory as the outcome of the evolution process of the relationships between men and the environment they live in. Such an approach aims to raise the awareness of citizens on conservation, transformation and governance issues as well as integrate the technical/scientific approach to the social one. The territory planning process includes an important preliminary phase and three main steps: accreditation, analytical, interpretation, and project. During accreditation, the experts set the basis for a valuable collaboration with the community and all the stakeholders, sharing competencies and methodologies; in the first proper step of the planning process, called “analytical”, data and information on the territory are collected and digital systems are developed; during the interpretation phase, the physical, environmental and social information from the collected data are interpreted with the aid of the involved stakeholders; and finally the planning project is presented to the whole community, to promote the habitat-conservation and management transformation.

The Politecnico Milan/DAStU was involved, together with other partners, in the International Project Edulink II “From University to territory” in the Dominican Republic: the project dealt with the development of concepts of food security and value chains establishing post-graduate degrees, a professional certificate and a Master course with the aim of “strengthening university capacity and management for learning in the field of food security in areas of poverty”. To give students tools to be able to build knowledge to manage natural resources, understand the transformation of soils and ultimately manage the local agro-environmental development the main subjects of the degrees included the use of a participatory approach, concepts of food security and the interpretations of territory characters. Further, the project included a work-package for a participatory mapping of the local food value

* Politecnico Milano, Milan, Italy.

** OSTEMI, Osservatorio Territorialista Milanese, Milano, Italy.

chains that has been carried out using expert tools as well as the interactions with the citizens: interviews, mapping together with the citizens, official repository of data, swot analysis methodologies, reports and final mapping. This work-package will be integrated into the post-graduate degree courses as a field experiment: the students will be able to learn from the methodologies and replicate the process in other case studies. To map the value chains, the available maps from the local institutions were first analysed, to select through a SWOT analysis the appropriate area for the field experiment. Then, during participatory meetings with the communities, institutions and local stakeholders, all the valued characteristics were compared and contrasted using expert knowledge. The outcomes of these meetings were further investigated through field sampling during which meetings with local stakeholders took place. All the information, showing the food value chains and the proposed actions for their management aimed to a local development have been prepared and made available online for free. All deliverables have been shared with the populations during workshops as well as on line through a blog platform where they are still available for download, as a starting point methodology to further projects in the field.

CAMILLI F.¹ – BAGNOLI F.² – ZALDEI A.¹ – DI LONARDO S.¹
CAVALIERE A.³ – DINI F.⁴ – GUALTIERI G.¹ – NUNZIATI W.⁴
VAGNOLI C.¹ – PACINI G.²

A PARTICIPATORY RESEARCH APPROACH FOR ROAD TRAFFIC AND AIR POLLUTION MONITORING

Communities, environment, Citizen Science networks

Citizen Science is a research strategy based on participatory methods and aimed at shortening the gap between citizens and research, actively involving citizens in studies issues of public interest. In this perspective, a survey regarding urban quality air monitoring was conducted to elicit the readiness of Italian citizens in hosting at their living and/or working places sensors connected to an integrated monitoring platform (IMP) developed to monitor road traffic and related air pollution. The observation system, composed of an air quality sensors box and a traffic monitoring device, is a portable and easy-to-be-handled device which can be placed on windows facing high traffic flows roads. The survey based on an online (anonymous) questionnaire (<https://docs.google.com/forms/d/1dExoTcMI6cksmH8luLFTi4E465OosCOL8gjbmOd9xHo/viewform>), was developed on the “Google form” platform and aimed at: i) creating a direct contact with citizens; ii) understanding the level of interest of respondents in environmental/traffic (and health) issues; iii) involving citizens in a network of participatory environment monitoring and city management activities; iv) characterizing the respondents’ profiles; v) validating the IMP model; vi) supporting local governance. Information was collected on respondents’ age, gender, education, profession as well as on familiarity with ICT and social media. Furthermore, the questionnaire was set up to receive citizens’ suggestions useful to support and improve the research. People responding to the questionnaire were invited to a workshop held in Florence at the Osservatorio Ximeniano (February 2017) where the functioning of the platform was illustrated. The analysis of quali – quantitative data will be exploited in order to possibly support local institutions in territorial governance choices.

¹ National Research Council-Institute of Biometeorology (CNR-IBIMET), Firenze, Italy.

² University of Florence, Department of Physics and Astronomy, Sesto F.no, Firenze, Italy.

³ University of Florence, Department of Information Engineering (DINFO), Firenze, Italy.

⁴ Magenta s.r.l., Firenze, Italy.

CERRANO C.¹⁻⁸ – CASABIANCA M.² – FIGURELLA F.³
LUCREZI S.⁴ – MARRONI A.⁵ – MILANESE M.⁶
PIERLEONI P.⁷ – TURICCHIA E.⁸ – PONTI M.⁸

CITIZEN SCIENCE AND DIVING SYSTEM: AN OPPORTUNITY FOR MARINE BIOLOGISTS CAREERS

Sustainability, marine environment, Ocean Literacy, training, volunteers

There is a great and effective effort by the present educational approaches to increase awareness towards marine environment in kids and young students, and the number of activities developed under the umbrella of Ocean Literacy are clearly mirroring this situation.

As a consequence, the attention of young generations towards the sea is rapidly growing, as demonstrated by the increasing number of academic courses focused on marine biology, both at national and international levels.

The increasing number of students with a master degree in marine biology is in deep contrast with the little attention that our political system is giving to the potential opportunities that our coastlines or the sea in general can offer.

The great expectations by several fragments of the civil society towards the Blue Growth strategy of the EU are being addressed, although with limited job opportunities for young marine biologists.

In the frame of the EU project Green Bubbles (<http://www.greenbubbles.eu/?lang=en>) focused on the sustainability of diving tourism, the opportunities available in the scuba diving industry has been analysed, inspiring a collaboration between academia and the recreational diving system. A new profile of marine biologists, expert in citizen science (CS) research programmes has been designed. When adequately structured, CS is definitively accepted as a credible and effective contributor of scientific data but its impressive potentials are still undervalued, in particular for the benefit of the marine environment. Marine biologists expert in CS projects can add value to the offers of a diving centre, involving trained volunteers in several activities, which could represent a unique way to collaborate with local entities as marine protected areas. CS projects could build a strong network at an international scale and trigger a win-win-win strategy for scientists, managers and the public at large.

¹ DISVA, Università Politecnica delle Marche, Italy.

² Project AWARE.

³ PADI EMEA The Pavillion Bridgewater Road, Bristol BS13 8AE UK I.

⁴ TREES, North Western University South Africa.

⁵ DAN Europe.

⁶ GAIA.

⁷ Dipartimento di Ingegneria dell'Informazione, Università Politecnica delle Marche, Ancona, Italy.

⁸ Reef Check Italia onlus.

DE CASTRO P.* – AGRESTI C.* – AMBROSINI E.* – BARBARO M.C.*
DE SIMONE R.* – SALINETTI S.* – SORRENTINO E.*

HEALTH INFORMATION LITERACY AND RESEARCH: NEW HORIZONS IN THE ITALIAN SCHOOL-WORK ALTERNATING SYSTEM

Scientific communication, training, research, science, society, schools

Disseminating science outside the boundaries of research is a new challenge for the Istituto Superiore di Sanità (ISS, the Italian National Institute of Health). In particular communicating research data on health issues is the first step towards health information literacy to promote life skills and healthy life styles.

To reach this goal the ISS has been engaged in collaborating with schools offering seminars and workshops as well as handbooks and leaflets addressed to young people. Training our future citizens becomes strategic to fill in the gap between science and society increasing students' interest in health sciences and providing them tools to gain awareness on responsible healthy behaviours.

In Italy the Law 107/2015 introduced the school-work alternating system, which requires students from 16-18 years of age to spend a period of time at workplace, as a way to implement the training courses and promote student orientation. This has offered the researchers of the ISS the opportunity to host students in laboratories and to make them aware of the value of health research through practical activities. Using strategies, tools and languages that can be easily understood by lay people, the ISS experts have developed science communication skills to catch students' attention on both science and health as part of their research commitment. In 2016-2017, over 200 ISS experts designed 50 training modules with more than 13,500 hours of activity within four public health research areas: environment; biology; prevention; communication. Thirteen schools participated in the project and 260 students attended the modules.

A very positive feedback was given by both students and teachers, who appreciated the ISS high quality scientific contents and to the multidisciplinary approach to scientific research. Both these aspects allow integrating scientific and social-cultural knowledge to improve science literacy for a win-win agreement between science and society.

The chance of the school-work alternating system can help in looking at research in a new way towards reaching the goal of a citizen science.

* Istituto Superiore di Sanità, Rome, Italy.

**VOLUNTEERS SUPPORT SCIENTIFIC RESEARCH AND
INCREASE PEOPLE AWARENESS:
THE CASE OF LEGAMBIENTE'S BEACH LITTER SURVEY**

Beach litter, Marine litter, Citizen science, Public engagement, Awareness raising

Marine litter is a pervasive and complex societal problem but has no simple solution. Inadequate practices at all levels of production–use–disposal contribute to accumulation of waste on land and at sea. Citizen Science experiences can be a powerful tool to build effective cooperation between science and society, to recruit new talents for science and to pair scientific knowledge with social awareness and responsibility.

Legambiente is the most widespread environmental NGO in Italy, with 20 Regional branches and more than 115,000 members. One of the most important topics for the organization is the marine environment. In fact, in the last years, Legambiente promotes national campaigns all around Italian seas and coasts, monitoring land based pollution like wastewater, coast degradation and littering. Since 2014 Legambiente has increased its activity linked to the presence of marine litter and microplastics in seas and freshwaters. A beach litter survey was started in 2014 as a preliminary phase of “Spiagge e fondali puliti - Clean-up the Med”, an international beach cleaning campaign that involves every year, in May, thousands of volunteers from Algeria, Croatia, France, Greece, Spain, Tunisia and Turkey.

In this work, the “Clean-up the Med” initiative is presented, analyzing results of beach litter monitoring of more than 200 beaches monitored from 2014 to 2017 (75% Italian and the rest from other Mediterranean countries involved in the initiative). The citizen science potential for an NGO was also explored to match the needs for science and public involvement with the right method of public participation. Citizen science can be a powerful tool to employ in the environmental NGOs' strategy, as large amounts of data can be collected while engaging the general public at the same time. The interaction with citizens assisting in data collection is growing as a cost-effective way to deploy continuous large scale environmental monitoring. Before the cleaning activities Legambiente and other NGO volunteers analyzed samples of garbage: data on stranded waste are collected following a monitoring protocol developed by the Technical Subgroup on Marine Litter (TSG ML) Mediterraneo, with a standard list of items and specific codes that are used to catalog objects. Using the same references and a standard classification is very important for spatially and temporally data comparison, but also to avoid the

* Legambiente, Roma.

lack of important data. Taking advantage of the enormous potential of a cleaning campaign, Legambiente involved volunteers in a pan-Mediterranean citizen-science based monitoring activity which provided reliable, accurate and comparable marine litter data, an activity well recognized at the European level, from Unep, Environmental European Agency and by the US Department State, among others. Recording the most common sorts of waste, the possible origin, the human activity linked to them and others parameters, this survey analyzes a dangerous phenomenon for environment, tourism, and local economy and introduces the emergency of a rapid implementation of programs for waste reduction in seas and on coastal strips, as indicated by the European Directive Marine Strategy 2008/56/CE. In the meantime, actions, policies and good practices input are suggested starting also from data analysis, as the plastic carrier bags ban in all the Mediterranean areas in based on the Italian ban, launched in collaboration with other environmental organizations.

THE 2017 SUMMER CAMPAIGN FOR NIGHT SKY BRIGHTNESS MEASUREMENTS ON THE TUSCAN COAST

Citizen science, light pollution, marine coastal biodiversity, environmental education

The presentation will report the activities managed during the Summer of 2017 by a team composed by staff from a University Department, a National Research Council Institute, and an outreach NGO, collecting measurements of night sky brightness and other information on artificial lighting, in order to characterize light pollution issues on portions of the Tuscan coast, in Central Italy.

These activities combine measurements collected by the principal scientists, citizen science observations led by students, and outreach events targeting a broad audience. This campaign aggregates the efforts of three actors:

- the BuoMetria Partecipativa project, which started collecting light pollution data on a national scale in 2008 with an environmental engineering and free/open source GIS core team;
- the Institute of Biometeorology from the National Research Council, with ongoing studies on light and urban vegetation and a consolidated track record in environmental education and citizen science;
- the Department of Biology from the University of Pisa, which started experiments to assess the impact of light pollution in coastal environments in 2015.

While the core of the activities concerns *in situ* data, the campaign will account also for remote sensing data, thus considering heterogeneous data sources.

The aim of the campaign is twofold:

- 1) To test actions of citizen and student engagement in monitoring sky brightness
- 2) To collect night sky brightness data and test a protocol for applications to studies on the ecological impact of light pollution, with a special focus on marine coastal ecosystems.

The collaboration of an interdisciplinary team in the study of artificial lighting issues is not a common case in Italy, and the possibility of undertaking the campaign in Tuscany has the added value of operating in one of the territories where it is possible to observe both sites with extremely high lighting levels, and areas with extremely low light pollution, especially in the Southern part of the region. Combining environmental monitoring and communication actions in the context of the campaign, this effort will contribute to the promotion of night skies with a good quality as an important asset for the sustainability of coastal ecosystems, as well as to develop opportunities for environmental education and sustainable tourism.

* pibinko.org, Torniella, Italy.

** Institute of Biometeorology, National Research Council, Florence, Italy.

*** Department of Biology, University of Pisa, Italy.

CITIZEN SCIENCE “OSSERVATORIO” TO PROMOTE RESPONSIBILITY AND MEMBERSHIP IN PILOT PROJECTS

Citizen Science services, environmental education, mobile Applications, Freshwater Watch, Mini Sass

Citizen science has started more than 20 years ago, however, in recent years it has been growing steadily thanks to the widespread diffusion of mobile devices such as smartphones and tablets.

Citizen Science Osservatorio” is a new Italian platform built to manage and promote citizen science projects. The main objectives are engaging people and promoting the sense of membership to a research group, as well as bringing the citizen closer to environmental issues by establishing a dialogue between local stakeholders. Together we try to solve situations of conflict between man and nature, through a process of responsibility and awareness of the work done to preserve the environment.

In order to achieve this we aim to disseminate good practice for data collection and develop new applications and methodologies as required in response to citizen need or technological advance.

Ours goals:

- to be the first Italian nested group of the Freshwater Watch network within Earth Watch platform;
- start some pilot experiences with local environmental organizations and associations;
- spread good practices for data collection;
- developing new methodology applications (*App*) as needed;
- sensitize the population with public events (*blitz*);
- thesis and research activities.

We are currently working on:

- Freshwater Watch program;
- Develop a photogrammetric user friendly App to implement monitoring for conservation purposes;
- “Mini Sass” aquatic macroinvertebrate at school project: share experiences between Italy and South Africa.

The Citizen Science “Osservatorio” is supported by Fondazione Flaminia (Ravenna-Italy).

* Department of Biological Geological and Environmental Science (BiGeA), Bologna University, Bologna, Italy.

**THE QUESTIONNAIRE “THE EARTH IS SPEAKING, LISSEN TO IT”:
BI-DIRECTIONAL DIALOG AMONG CITIZENS, SCIENCE AND
SOCIETY, TO STUDY SEISMOGEOCHEMICAL AND ANIMAL
BEHAVIOUR ASSOCIATED TO AND BEFORE STRONG EARTHQUAKES**

On-web Questionnaire on Transient Earth Phenomena, Seismo-geochemical Transients, Public Awareness and Participation in Natural Hazards Transient/Forerunners

Since Citizen Science can have an important impact on Society, the aim of the present work is to build effective cooperation between science and society by recruiting new talents for science and by pairing scientific excellence with social awareness, active participation and responsibility. Dozens case histories were reported about the anomalous behavior of animals before the main shocks of the 2016-2017 Umbria-Marche-Lazio seismic sequence, that killed hundreds of people.

Common people described it by web or/and by completing the questionnaire “THE EARTH IS SPEAKING, LISSEN TO IT” we predisposed. The completed questionnaires reported several transient phenomena, contemporaneous in different sites, clearly observed and certified. This bidirectional tool – suggested citizens themselves – should be available in any municipality that is recognized as seismically, geochemically or hydrogeologically hazardous, for the frequent occurrence of earthquakes, slides, dams perturbations, flooding, geochemical mixing etc. Hence, the questionnaire is now available on the web site in different regions and municipalities in Italy: Bagni di Lucca, Pietralunga, Spoleto, the Perugia Province. Recently, L’Aquila approved it and other towns are following (<http://www.comunespoleto.gov.it/questionario-la-terra-ti-parla-impara-ad-ascoltarla/>, <http://www.comunebagnidilucca.com/ita/pagine/notizia.aspx?art=4025>).

Moreover, citizens are involved in advising seismo-geochemical transients associated to main seismic events. Seismo-geochemical shared methods are able to: i) recognize hidden or buried faults and “crossing points” among two systems (i.e. Apenninic and Antiapenninic fault segments, of the Monte Vettore or Mt. Sibillini system, tentatively discriminating tectonic from gravitative features too), when blind faults are un-visible by classical geo-structural methods, and ii) timely interpret seismo-geochemical time series recorded along these “geochemically active faults”, and therefore give hints about possible imminent earthquakes, when the signals are really numerous. Apart from radon, which requires a separate discussion, an opportune “early alarm” evacuation, not

* Istituto Nazionale di Geofisica e Vulcanologia (INGV).

** INGV external collaborators.

far away from an “imminent” main shock, could rely on the anomalous animals and fluids behavior due to the immediate closeness of this kind of transients to a stress-release event (minutes/hour/days instead of days/weeks, months/years).

The presentation discusses preliminary results in the Amatrice-Accumuli-Norcia NW-SE elongated area, as well as in the Spoleto-Foligno NW-SE seismogenic segments, not yet completely activated now, after the 1832-1838 quakes.

MARANGONI C.¹, COLOSIMO G.³, DE FELICI S.²
PINZARI M.⁴, MERZAGORA L.⁵

“OCCHIO ALLE PENNE”: A PILOT PROJECT TO SUPPORT THE DIGITAZATION OF AN HISTORICAL BIRD COLLECTION

Crowdsourcing, schools, museum, hand-written cards

Crowdsourcing is an innovative sourcing model through which individuals or organizations seek the help of Internet-users to complete a specific task. Key to this approach is the interaction between scientists and non-specialized users. Such interaction shall benefit all involved parties: on one side, scientists can gather data otherwise difficult to obtain; on the other side, users directly participate in a scientific endeavor and can learn and acquire new skills through the help of professional scientists.

Students and non-professional naturalists represent the ideal “crowd” to help with the digitalization of naturalistic collections. Such approach values and enhances the visibility of animal and plant collections hosted in Natural History Museums. At the same time, it promotes an innovative use of such collections by making them directly available to a large crowd of users like High School and College students, as well as amateur naturalists.

The project “*Creativi per Natura*”, initiated by RESINA (REte Sistemica NATuralistica) within Regione Lazio, is fostering a collaboration between the Museo Civico di Zoologia di Roma and a small group of schools in Rome and its province to initiate a digitalization project named “*Occhio alle penne*”.

Aim of this collaboration is the digitization of specimens, and related hand-written cards, belonging to an historical ornithological collection from the Roman Countryside. This collection comprises specimens collected from all around Lazio, some of which are now rare to find in the wild. At the end of the project the obtained data will be completely free and available to any user through the Museo Civico di Zoologia di Roma and the Network Nazionale della Biodiversità. A secondary objective of this project is to stimulate interest towards biodiversity, the different methods to classify it, and how it changes over time.

¹ Civic Zoology Museum, Rome, Italy.

² LifeWatch-ITA, Collections Thematic Center; CNR-IBAF, UOS Montelibretti (Rome), Italy.

³ “Nature Lab” Association, Rome, Italy.

⁴ Department of Biology, University of Rome “Tor Vergata”, Italy.

⁵ Natural History Museums System, RESINA Lazio.

ORLANDO M.T.* – ROMANELLI M.G.** – AURIEMMA F.**
DALLA PALMA M.* – PIOVAN R.*

HIGH SCHOOL STUDENTS HAVING THE CHANCE TO BE AUTHORS OF SCIENTIFIC PRESENTATIONS ON NUCLEAR FUSION

School, educational institutions, scientific presentation, educational kit, nuclear fusion

The threat of global warming and climate change is raising an increasing concern on society and demanding more and more awareness on mitigation activities to be planned and put in place.

A correct information on energy scenarios and energy options must be pursued through a wide dissemination of the available data at all target levels.

“Porto la fusione alla maturità”, is a citizen science project based on the involvement of high school students who become protagonists of fusion science dissemination and owners of the knowledge necessary to get a scientifically-based personal opinion in this field.

Consorzio RFX has elaborated a template for a presentation on energy scenarios and nuclear fusion energy to be personalized by students facing their final degree thesis.

Starting from the information in the template, students have to collect further details and elaborate a personal scientific talk for the final examination.

The role of secondary teachers gets significance, by guiding the students' growth in knowledge, analysis capability and elaboration of thought.

It's not only a matter of simply collecting data and repeating statements; students will face the difficulty of re-elaborating the content in order to make it comprehensible to their fellow students and even to teachers who have no experience with the discipline.

The kit for high school students has been made available on the IGI-Consorzio RFX webpage (www.igi.cnr.it); it can be downloaded after subscription for free.

A piloting exercise has been done to evaluate the effectiveness of the project. Three high schools from Padova and Vicenza have been invited at Consorzio RFX for the presentation of the tool. Students have established much interest in the topic and expressed appreciation for the dialogue with the experts from Consorzio RFX. Nevertheless just a couple of thesis has been finalized at the end of the 2017 School Year, which is probably due to the fact that publicity of the educational kit occurred too many months before. A second attempt experiment will be carried out for the 2017-2018 school year with a different schedule. Results will be reported when available. Final presentations will be published on the website of Consorzio RFX and the Padova Area of Consiglio Nazionale delle Ricerche, as well as on the Consorzio RFX Facebook page, for a larger dissemination of the information and to facilitate the young to get across it.

* Istituto Gas Ionizzati of CNR – Consorzio RFX, Padova, Italy.

** Consorzio RFX, Padova, Italy.

RANCI ORTIGOSA G.¹ – ORLANDI S.¹ – CECERE F.² – ROSSETTI G.³
DELLOCCA A.⁴ – URSO M.⁵ – SONGIA A.⁶
CREPALDI C.⁷ – MELIÀ P.⁸

AUDIENCE SURVEY IN LOMBARDY BIOBLITZ: METHODS AND RESULTS FOR A MORE PARTECIPATORY CITIZEN SCIENCE

Audience Engagement, Open Source Survey, Participant Motivation, Bioblitz

An active and engaged volunteer base is fundamental for the life itself of citizen science projects but, in spite of that, there are little data or research about different audiences who take part in these projects.

First an audience research – that means discover demography of participants but also their interests, motivations, skills – is needed to design projects, activities and methodologies suitable to engage volunteers and maintain their engagement over time. Furthermore study of real and potential public helps on the way to an inclusive and participatory citizen science, improving the evaluation of projects also “for participant experience and wider societal or policy impact”, as stated in principle 9 of “ECSA Ten Principles of Citizen Science”.

We report a preliminary investigation of the audience engagement in Bioblitz taken place in 29 parks and protected areas in Lombardy, Northern Italy, on 20-21 May 2017 (second edition). Our pilot study aimed both to investigate people who joined the Bioblitz and to design and test a method, easy to reproduce, reliable and affordable, to survey participants in citizen science activities.

The survey consisted of a on-line questionnaire that volunteers could fill in directly by their smartphone, quickly and easily in order to minimize dropping out by volunteers. The 21 questions were the result of comparison with questionnaire used in different European Bioblitz, plus specific requests of local organizer, and social researcher suggestions. All the questions were multiple choice with the possibilities to add open sentences. The questionnaire run on free access internet tool, easy to be filled in by participants and to be edited and modified by organizers. Data results were shared with organizers and public according to principle 7 of “ECSA Ten Principles of Citizen Science”.

¹ scienzacollaborativa.it, Milano, Italy.

² Riserva naturale e fattoria didattica Le Bine, Acquanegra sul Chiese (MN), Italy.

³ Parco Regionale Oglio Sud, Calvatone (CR), Italy.

⁴ Area Parchi, Milano, Italy.

⁵ Parco Regionale Nord Milano, Milano, Italy.

⁶ Regione Lombardia, Italy

⁷ Istituto per la Ricerca Sociale, Milano, Italy.

⁸ Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano.

Even if 112 completed questionnaires could not be a representative sample of all the Bioblitz visitor population (2355 person, children included) they give us some interesting info about their motivation, provenience, interests in science, nature or outdoor activities, and also about self-perception of their role and active participation in the activities.

About methodology, our study indicates the importance to collaborate to a broader scale than the single Bioblitz or protected area, to share ideas, needs and also resources. In this sense, the construction and availability of our survey questionnaires – that will be shared with Italian citizen science community as an Open Source tool, and that can be easily adapted and used in different citizen science activities – can contribute to build common investigation and evaluation criteria useful to move towards a more participatory and inclusive citizen science.

SESTILI M.L.*

FROM FIELD TO TABLE: THE IMPORTANCE OF SCHOOL ORGANIC GARDENS

Biodiversity, communities, educational institutions, scientific information system, open movement

As part of a project an organic didactic vegetable garden has been built in a Primary School garden. The young farmers have been engaged in agricultural landing and planting operations and have had, as tutors, the students of the Technical Institute for Agriculture. School gardens, available since primary schools, are places where students can learn and teach a lot more than mere cultivation. The educational purposes go far beyond simple cultivations. Besides the historical, geometric and physical work values, the garden can also teach: the patience towards and respect of the rhythms of nature; the direct relationship with the land; the rediscovery of manual skills, doing things together; the direct relationship with food: eating seasonal organic and fresh; biodiversity and cultural reconciliation with the territory rediscovering the value of grandparents, thus reinforcing the affectivity between generations. The link with the Agricultural School reinforces the concept and opens the way for the exchange of knowledge and experience between schools and communities. Such food-based strategies have also the merit of promoting sustainability and biodiversity (ancient varieties, local ecotypes) as they create long term dietary habits and put food choices into the hands of the consumer.

* Istituto Tecnico Agrario Statale "Celso Ulpiani", Ascoli Piceno, Italy.

JOINTLY CREATING KNOWLEDGE: THE TRANSFORMATIVE POTENTIAL OF CITIZEN SCIENCE IN HIGH SCHOOL EDUCATION

Citizen Science, school education, biodiversity research, biology, didactics

New forms of integration of knowledge domains, as well as innovative ways of knowledge transfer and exchange are required to tackle global challenges like the biodiversity crisis we are currently facing. Citizen Science holds an untapped potential to integrate prospective citizens (students) in research processes. This cooperation between teachers, students, and scientists leads to a new situation where knowledge is not just presented and open for exploration, but actively explored and experienced by all actors that are involved in these processes. Most importantly, scientific topics such as biodiversity become an integral element in the reality of people's lives and lead to increasing competencies, such as scientific literacy and acceptance for conservation actions. At the same time, social-ecological systems are highlighted for the scientific community, encouraging a scientific culture that carries out research with and for society.

There is urgent need to take advantage of this potential to improve public understanding and raise awareness for the importance of biodiversity in theory and practice. Students and teachers play a significant role in this process, since they represent pivotal points of knowledge exchange and social transformation at an early stage. By integrating Citizen Science in high school education, scientific literacy as well as media and societal competences can be enhanced to prepare pupils for their future role as citizens and potential scientists. Within our presented project, this approach will be applied to the specific example of assessing local hot and cool spots of biodiversity in Leipzig (Germany). The project integrates the perspectives of learners, teachers and researchers on biodiversity to open up new possibilities for the integration of knowledge domains by enabling exchange on an equal footing.

This poster illustrates the conceptual framework of a PhD project at the interface of citizen science and biology education. The project aims to investigate the transformative potential of participatory research in high school education and presents our vision how we can jointly create knowledge with new learning environments.

¹ Institute of Biology, University of Leipzig, Leipzig, Germany.

² Department of Ecosystem Services, UFZ – Helmholtz Centre for Environmental Research, Leipzig, Germany.

³ German Centre for Integrative Biodiversity Research (iDiv), Leipzig, Germany.

⁴ Department of Ecosystem Services, Friedrich Schiller University Jena, Jena, Germany.

CELL SPOTTING: IN-DEPTH ASSESSMENT AND OUTCOME OF A CITIZEN SCIENCE PROJECT AT SCHOOL

Cell Spotting, science education, high school, pharmacology of cancer, Socientize

Introduction

Given the strong link between research topics and secondary education science programs, citizen science (CS) projects at school have the potential to reach a highly receptive audience and to get closer to students' curricula. The partnership between schools and researchers to promote citizen science is considered beneficial for all the parties involved, but participant-learning outcomes are often difficult to assess.

Our case study describes a CS project realized with 10 Italian high-school classes (275 students from different fields of study, aged 15–18), that participated in a project of cell biology research and cancer – Cell Spotting – as part of their regular classroom activities. The project was already performed in several Spanish and Portuguese classes (see *SOCIENTIZE Project*), and evaluated via an online survey in terms of perceived ease, motivation to participate and impact of participation at a personal level. However, this type of analysis works fine for the perceived ease of investigation (i.e.: “*The project was easy to understand?*”), while potentially it failed to reveal less structured and more complicated viewpoints on the project.

In order to assess the success of the proposed activities and to better discern their outcomes, we present an in-depth assessment of the educational impact of the Cell Spotting project. The work's aim is to understand students' perceptions of scientific research, researchers and participatory research in science – and how the project contributes to shape them.

Material and method

Our evaluation activities employed a set of qualitative data collection tools. We realized a sample of 32 semi-structured interviews to participating students (average time: 15 minute each), balancing age and gender. The conversations were registered with a recorder, classified by age and gender, stored and then transcribed for data analysis. Then, we used a summarizing qualitative content analysis to identify the students' viewpoints on previously described topics (perceptions of research, researchers and participatory research in science).

* Master's Course in Science Communication “Franco Pratico” at SISSA, Trieste, Italy.

** Centro Interdipartimentale di Microscopia Avanzata at University of Milano, Milano, Italy.

Results and discussion

Preliminary data seem to suggest that all the interviewed share high consideration of science and scientific research, often perceived as an “ongoing process” to improve life conditions and technology. Researchers are seen as “passionate”, “skilled” and “talented”, while sometimes a bit “nerdy”. Students, however, can be divided into two groups with no significant difference in age or gender: those who perceived their data-gathering job as “valuable” and “precious for the scientists”, and those who were unconfident – looking for “researcher’s feedback”. Lastly, social implications and the awareness of CS seem to become more evident as the age of the users increases. While Cell Spotting looks like a common science project for younger trainees, older students became more curious about the real magnitude of the project or about how their own contribution can impact the whole work, and they got even frustrated or confused if scientists double-checked their data. Make the students feel responsible, in addition to involved, may play a key role in the project success.

WU D.¹⁻²⁻³ – WEI S.¹⁻² – ZHANG Y.¹⁻² – LIU X.¹⁻² – STEIN G.¹⁻²
LIU C.¹⁻²⁻³ – CONG N.⁴ – BEST L.¹⁻² – PAN W S.¹⁻²⁻³ – TANG W.¹⁻²⁻³⁻⁵
FU H.¹⁻² – ONG J.¹⁻² – TUCKER D.J.¹⁻²⁻³

COMMUNITY PARTICIPATION IN HEALTHY CITIES IN CHINA: AN ANALYSIS OF TEXT DATA COLLECTED THROUGH A NATIONAL CROWDSOURCING CONTEST

Healthy cities, China, crowdsourcing, contest

Background: Community participation is fundamental to defining and developing healthy cities.

This study examined public perceptions of healthy cities in China.

Methods: A steering committee organized a crowdsourcing contest during eight weeks in 2017.

Crowdsourcing contests invite a large group of individuals to complete a task. The committee distributed an open call for entries to the public through social media and participants submitted texts, images and videos online. Descriptions of healthy cities and strategies for creating healthy cities were solicited. We extracted the text entries and analysed the data using a thematic approach. Three individuals independently coded the data.

Findings: We received 251 text descriptions and 231 were eligible and coded. Thematic analysis revealed components of what a healthy city ought to include and strategies for creating healthy cities. The public noted that a healthy city ought to provide sustainable local environments, elements essential for livelihood (food and income security, clean water), physical infrastructure, a fair education system, just laws and judicial system, and a cohesive society. Strategies for creating healthy cities included public education, community engagement, urban planning, environmental improvements, and policies. Specific strategies included sponge cities, vertical farming and a waste recycling credit system. Some remarked that urban floods were common and recommended sponge cities using water-permeable materials to capture, control and recycle rainwater to mitigate the impact of floods. A few participants suggested that urban cities had limited space and vertical farming could take advantage of spare space in buildings and natural resources for planting. Another participant described an online waste recycling system

¹ SESH study group of University of North Carolina at Chapel Hill, Guangzhou, China.

² The University of North Carolina at Chapel Hill Project-China, Guangzhou, China.

³ Institute for Global Health & Infectious Diseases, The University of North Carolina at Chapel Hill, Chapel Hill, USA.

⁴ Department of Earth System Science, Tsinghua University, Beijing, China.

⁵ Guangdong Provincial Center for Skin Diseases and Sexually Transmitted Infections Control, Guangzhou, China.

where people gain credits for recycling waste and use the credits to purchase other products.

Interpretation: Text descriptions from a crowdsourcing contest helped to understand public perceptions of healthy cities in China. Community participation may help healthy city planning to become more people-centred.

SESSION III

NATIONAL CITIZEN SCIENCE NETWORKS

ORAL PRESENTATIONS

CITIZEN SCIENCE PLATFORM IN GERMANY – BÜRGER SCHAFFEN WISSEN (CITIZENS CREATE KNOWLEDGE)

Citizen Science Projects, Internet Platform, Citizen Science Community, Citizen Science Strategy for Germany, Tools and support

The German Citizen Science Platform is accomplished by an online portal (www.buergerschaffewissen.de) where projects from various disciplines (c.f. Pettibone et al. 2017) present themselves, can be searched applying different filters, and which offers information material such as news, events, or handbooks. Also, it represents a community which meets for workshops and other events in order to support specific aspects of citizen science, for example to explain projects with a storytelling approach or improve data quality.

The establishment of the internet platform started in 2014 parallel with a 2-year strategic process in Germany in order to explore opportunities and needs for Citizen Science (Bonn et al. 2016; Pettibone et al. 2016). Outcomes were a strategy for Citizen Science, a variety of topic papers, and suggestions how to support Citizen Science. A call for citizen science projects by the Federal Ministry for Education and Science (BMBF) results now in 13 projects from about 300 submissions. Next to lighthouse projects Citizen Science also becomes a component of the research activities in other contexts.

Criteria are needed to name the different forms of Citizen Science, and to guarantee specific quality standards. Two main criteria apply: The citizen science project or activity has to generate new scientific knowledge, and the interaction between citizens, professional scientists and others has to be fair and appreciating.

Bonn, A. et al. (2016): *Green Paper Citizen Science Strategy 2020 for Germany*.
<http://buergerschaffewissen.de/citizen-science/ressourcen>

Pettibone, L. et al. (2016): *Citizen science for all – a guide for citizen science Practitioners*. <http://buergerschaffewissen.de/citizen-science/ressourcen>

Pettibone L., Vohland K., Ziegler D. (2017). *Understanding the (inter)disciplinary and institutional diversity of citizen science: A survey of current practice in Germany and Austria*. *PLoS ONE* 12(6): e0178778. <https://doi.org/10.1371/journal.pone.0178778>

* Museum für Naturkunde Berlin, Leibniz Institute for Evolution and Biodiversity Science.

** Wissenschaft im Dialog.

HEIGL F.*

“ÖSTERREICH FORSCHT” – THE AUSTRIAN CITIZEN SCIENCE PLATFORM

Network, quality criteria, national conference, project platform

The Austrian Citizen Science Platform (www.citizen-science.at) was established in 2013 with the aim of building a network of all citizen science actors in Austria. The coordinators of the platform organize the annual Austrian citizen science conference and additionally, founded the Citizen Science Network Austria in 2017 to connect all institutions working in the field of citizen science. Today 28 institutions signed a Memorandum of Understanding and agreed to foster citizen science in general and the quality of this scientific method in particular. On its website, the platform displays citizen science projects that invite people to participate in scientific endeavors all over Austria. More than 50 projects can be found so far. To increase the quality of citizen science in Austria, a dedicated working group is developing a quality criteria catalogue for projects listed on the platform. This catalogue will be presented at the 4th Austrian Citizen Science Conference in February 2018. From this day on, all projects listed on the platform must fulfill the criteria presented in this catalogue. This is the first step to ensure and increase the quality of citizen science in Austria.

* University of Natural Resources and Life Sciences, Vienna.

SLAWSON D.*

CITIZEN SCIENCE NETWORKS IN UK

In the UK, assorted Citizen Science (CS) networks exist. Often these are based around specific science areas e.g. ecology (The British Ecological Society's Citizen Science Group) and tree health (The Tree Health Citizen Science Network). The former is one of several special interest groups of a well-established scientific society and is well-supported by a website, governance arrangements, mailing list and a programme of meetings etc. The latter is currently an informal group that arose originally from a single project advisory board, the OPAL Tree Health Survey and which has continued to meet voluntarily on an *ad hoc* basis. Alternatively, networks may be based around methods e.g. bioblitzes (The Bristol Natural History Consortium Bioblitz Group) or around supporting web infrastructure (e.g. Zooniverse and its web platform and Project Builder). In addition, public sector bodies engaged with environmental monitoring, observation and surveillance (The UK Environmental Observation Framework) have their own citizen science working group which, amongst other things, has successfully sponsored the production of a number of useful best practice guides. Internationally, many UK practitioners contribute actively to international networks, including European Citizen Science Association and the Citizen Science Association. Careful consideration needs to be given to the need for and the process of further networking so as to maximise benefits such as efficiencies from unified platforms, data sharing, signposting between projects etc., but without stifling innovation or reducing participation of all sectors of society.

* Imperial College London, UK.

LOÏS G.*

NATIONAL CITIZEN SCIENCE IN FRANCE: NEED FOR TOOLS

Citizen Science, enhancement, emulation, cooperation, NGO, institutions

Citizen Science uptake seem to vary from one country to another. In France, where standardized citizen science programs were initially launched by museums, it gradually went popular among naturalists and naturalist NGOs as a way to collect opportunistic data. While this type of data collection is valuable in many terms, it often lacks basic information about collection processes and effort to be analyzed. On the other hand, this type of data collection appears to be very exciting for naturalists, especially with new collaborative and sharing tools and gathers millions of records every year. Standardized data collection doesn't share these properties and collection process and participant recruitment needs a lot of effort in terms of animation to gather at the best hundreds of thousands data per year. Nevertheless, such data are of need as they seem to be a way to value opportunistic ones.

Based on this assessment, a 4 year grant has been attributed to develop tools to facilitate animation and spreading at wide as at local scale and for specific ecology matters as for very general recreational purpose in order to support both data collections.

While first outputs gradually arrive, we have to acknowledge that 1) task is as huge as demand, 2) some solutions seem to be fulfilling needs and 3) even if tools exist, some specific animation will still be needed.

* Vigie-Nature, Centre d'Ecologie et des Sciences de la Conservation, Muséum National d'Histoire Naturelle, Paris.

THE SWISS CITIZEN SCIENCE NETWORK

In 2015 the Office for the Swiss Citizen Science Network was founded by the Foundation Science et Cité as a result of a self conducted informal national inquiry in 2014, funded by the Swiss Federal Office of the Environment.

The main result was that many Citizen Science projects already exist, however feedback from Citizen Scientists made clear, that a nationwide strategy to acknowledge and promote Citizen Science itself or knowledge transfer between the projects was lacking so far. Although there was a demand, Science et Cité could only respond after financial supporters were aboard.

Today, the Swiss Citizen Science Network focuses on these issues and provides a website for Citizen Science Projects in Switzerland (www.schweiz-forscht.ch). It also organizes yearly 2 to 3 networking meetings for knowledge transfer and to discuss current questions.

Additionally, other players are active in the domain of Citizen Science. Swiss Universities have been instrumental in conceptualizing and formulating guidelines for scientists who engage in Citizen Science projects (University of Zurich and ETH), as well as meta research on the phenomena of Citizen Science is conducted (University of Geneva, Bruno Strasser: „Rethinking science and Public participation“). Also, there are other Citizen Science web portals (with a more specific or narrower focus than www.schweiz-forscht.ch). All these initiatives are complementary and collaboration exists when it is useful. The interest in Citizen Science is also growing on the administrative level and on the side of funders.

Science et Cité is organizing on behalf of ECSA the Second International Citizen Science Conference in 2018, which will be held in Geneva/Switzerland next June (www.ecsa-conference.eu).

After 3 years the main challenges for the future are to consolidate the network, to specify the network mission and to intensify collaboration with other players. Last but not least financial support after 2018 has to be gained.

* Head of the Swiss Citizen Science Network Office, Science et Cité, Bern (CH).

SESSION IV

PLATFORMS AND E-SERVICES FOR CITIZEN SCIENCE

ORAL PRESENTATIONS

CITIZEN SCIENCE, INTERNET AND CITIZENSHIP RIGHTS

Scientific citizenship, knowledge democracy, open digital platforms, digital rights

The importance of citizen science through digital technologies is evidenced by the increasing interest of European and US institutions for the roles citizens have and should (be empowered to) have in creating knowledge and in not only using, but also building technologies through online platforms allowing data and information exchange and sharing. To confirm the centrality of the phenomenon in the current reflections on science communication, in recent years academic interest in various aspects of the relationship between digital communication and citizen science has strongly increased. In our view, an unexplored topic in this area, however, concerns new and potential scientific citizenship rights, related to the potential exploitation of online production and sharing of scientific information by consumers, patients, and parents. From the rights to be informed and to have access to available data, to participatory rights and upstream engagement in social issues with a relevant technical-scientific component (GMOs, nanotechnologies, assisted fertilization, vaccines, etc.) involving individual and collective choices: all these claims that call for rethinking the quality of relations between institutions and citizens and the reconstruction of trust, have an unprecedented importance in the wide array of digital spaces where people can participate in the scientific and technological enterprise.

In this contribution, we would like to argue that in the interplay between citizen science, digital shift and rights related to scientific citizenship the signs emerge for radical changes in the co-existence between science and technology and liberal-democratic societies. These signs point at a valuable meaning for the expression “knowledge democracy”.

* Master in Comunicazione della Scienza “Franco Pratico”, Scuola Internazionale Superiore di Studi Avanzati - SISSA, Trieste, Italy.

** Facoltà di Economia e Giurisprudenza, Università Cattolica di Piacenza, Piacenza, Italy

OGGIONI A.*-** – TAGLIOLATO P.*-**-*** – PAVESI F.*
CRISCUOLO L.* – CARRARA P.*

ADAPTER APPROACH TO BRING CS OBSERVATIONS TO INTEROPERABILITY STANDARDS

Citizen observations, OGC, O&M, interoperability, adapter

iNaturalist, Ornitho, Indicia, and other CS data repository are growing up to millions of observations, fed by smart applications and enthusiast users. They are often characterized by very well structured systems and community practices, but until now they lack in interoperability among each other and other systems.

The need for an interoperable standardization of Citizen Science (CS) data and metadata is an emergent topic. The main Citizen Science Associations (U.S. Citizen Science Association CSA, European Citizen Science Association ECSA, and the Australian Citizen Science Association ACSA) are collaborating on this process [1]. Some proposals are considering OGC (Open Geospatial Consortium) and ISO observations and measurements (O&M) [2], a conceptual model that could be ideal to standardize data representation without losing specificities of distinct projects and letting them being shared with a wider audience.

Our proposal aims to preserve community practices, to ease the integration of data from different sources, to improve the re-use of data by other research domains and immediately increase their usefulness by interoperability approach.

The idea is to follow the adapter pattern [3] between an original CS system and an international interoperability standard. In this way the legacy Application Programming Interfaces (API) and data structures could be exploited by using a *lingua franca*. We agree that Observations & Measurements (O&M) OGC standard could be a good candidate for interoperable representation of Citizen Science data and integrate within e-infrastructure.

We will present our development of an O&M adapter and a map client to show observations harvested from iNaturalis jointly with environmental data. We will show mapping for other data repository.

[1] <http://staging.citizenscience.org/2016/02/09/data-and-metadata-reporting-from-the-citizen-science-data-and-service-infrastructure-meeting-in-italy/> last accessed June, 2016

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* National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Milano, Italy.

** National Research Council, Institute of Marine Sciences (CNR-ISMAR), Venezia, Italy.

*** LifeWatch Italy.

MASSIVE VOLUNTARY BIODIVERSITY CHARTING

Artportalen – The Swedish Species Observation System – is *the* repository for species observations in Sweden, used by governmental monitoring, inventories, consultant's environmental impact assessments and, in particular, by amateur naturalists. Observers' reports, often accompanied by uploaded photos, are instantly publicly visible and available on the web. Validation of species identity etc. is made by the user community and to a certain extent by dedicated species specialists.

Currently, Artportalen harbours 60 M observations of c. 32,000 species, free to view and use for anybody. Almost 15,000 new observations are submitted every day, the year around. About 95% of the uploaded observations concern common and widespread species. Circa 80% of all data (92% of bird data) reported are entered into the system within 24h after the field observation was made.

Different functions provided lead to most users apprehend Artportalen as a system for *their* benefit (cf. Facebook), rather than a governmental system where you are expected to deliver data. Lists of whom among the rapporteurs have observed the highest number of species of various groups in different areas and time periods also highly trigger people to submit more reports.

Besides society receiving a huge material of species occurrence, useful for nature conservation and planning, the competition in species observation has led to a surprising number of people, earlier interested in merely birds (or not naturalists at all), now are skilled in identifying insects, fungi, bryophytes and other organism groups. This has been stimulated also by the emergence of new identification guides, both printed, such as *The Encyclopedia of the Swedish Flora and Fauna*, and web based, including many Facebook groups discussing species identification. As an examples, from having had less than a handful experts (almost all men) of spiders in Sweden, there now is a Facebook group with 4,500 members (with a high proportion of females) dedicated to spider identification.

Consequently, while the number of professional taxonomists are continuously decreasing, the numbers of skilled amateur naturalists, experts in an array of organisms, are steadily increasing. Much qualified inventory work has been taken over and even improved by citizen scientists!

* ArtDatabanken (Swedish Species Information Centre), SLU, Uppsala, Sweden.

BASSET A.*-** – MONTINARO S.*-** – FIORE N.*-**
CALCAGNILE D.*-** – COZZOLI F.*-** – GJONI V.*-**
SANGIORGIO F.*-** – TARANTINO D.*

LIFEWATCH – A RESEARCH INFRASTRUCTURE FOR CITIZEN AND SOCIETY

LifeWatch, civic biodiversity & ecosystem platform, scientific gaming

Biodiversity, healthy ecosystems, ecosystem functioning and related services, natural beauties and heritages are common goods of major interest to every single inhabitant of the Biosphere. LifeWatch-ERIC, as a e-Science Infrastructure for Biodiversity and Ecosystem is aimed at boosting the development of science in order to increase our current knowledge on biodiversity and ecosystems, to deepen our understanding on the underlying mechanisms and to improve conservation and governance of those common goods, securing healthy ecosystems to future generations. Taking into account the general relevance of these key research subjects and their inter-connection with the major social challenge of achieving a real sustainable development, LifeWatch-ERIC considers the involvement of citizens with a fully participative approach as a key component of its mission. Therefore, the infrastructure is working to build and make operational a civic biodiversity & ecosystem platform finalized to both open information, knowledge, data and training material to citizen and get information, traditional knowledge, data and scientific questions and perceived priorities by citizens. The rationale behind, the design and a few already operational components of the platform will be presented at the workshop with a particular focus on a specific target group of citizen scientist, i.e. students of different levels and types of secondary schools in Europe.

* University of Salento, Lecce ITALY.

** Service Centre. LifeWatch-ERIC.

WWW.ISPOTNATURE.ORG – A CITIZEN SCIENCE, E-LEARNING PLATFORM FOR NATURE LOVERS

Citizen science, learning, rewards and recognition, species identification

www.iSpotnature.org (iSpot) is a citizen science platform that was launched in 2009 and uses the challenge of identifying nature to engage people as citizen scientists, encouraging learning about wildlife while building species identification skills. iSpot provides a multifaceted experience, incorporating participatory science research with e-learning opportunities. The website hosts an active online community of thousands of expert and novice users who support each other in answering identification questions.

Learning was always part of the design, with innovative educational technology based tools and features incorporated (Woods *et al.*, 2016) along with activities that encourage public participation and engagement that help to facilitate a unique learning journey (Ansine 2013). This presentation will share how iSpot creates and supports informal and formal learning journeys through a five-step process under the themes: explore, identify, contribute, personalise and recognition; each demonstrating how authentic inquiry, through a citizen science platform environment, facilitates learning (Ansine *et al.*, 2017).

First is participatory learning through exploring the site; the site is free and easy to use, anyone can browse and learning is encouraged as they explore. Secondly, iSpot helps to identify species through crowdsourcing as participants seek help and share their expertise with each other; while a bespoke multi-dimensional managed reputation system rewards and motivates members of the community (Silvertown *et al.*, 2014) as they contribute demonstrating participatory learning in species identification. Individual experiences can also be personalised; filtered through a range of options and demonstrated as projects. The fifth and final stage focuses on more experiential learning, presented in two parts: recognition for informal and formal learning through integrated quizzes that build and test knowledge as skills increase and structured courses like the OU's *Introduction to Ecosystems*, which encourages learners to take on the role of citizen scientists.

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* The Open University, Walton Hall, Milton Keynes, UK.

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THE EARTHQUAKE NETWORK PROJECT: CROWDSOURCED SMARTPHONE-BASED EARTHQUAKE EARLY WARNING

Real-time detection, early warning, false alarm monitoring, Android

The citizen science Earthquake Network project (www.earthquakenetwork.it) implements a world wide crowdsourced smartphone-based Earthquake Early Warning (EEW) system. EEW systems use earthquake science and the technology of monitoring systems to alert devices and people when shaking waves generated by an earthquake are expected to arrive at their location. Although they are currently operating in several countries, their implementation and operating costs are in the order of tens of millions of dollars. This dampens their diffusion in under-developed and developing countries as well as in developed countries.

The idea at the basis of the Earthquake Network project is to use the accelerometer on-board smartphones and tablets to detect quakes in real time. While the single smartphone is not reliable, a network based on a large number of devices detects earthquakes more accurately and with a low false-alarm rate. When an earthquake is detected, a warning is issued toward all the smartphones in the network. This allows people living not too close to the epicenter to take cover before they are reached by the damaging waves of the earthquake.

The detection of earthquakes is based on a statistical algorithm which runs in real time on a server. The algorithm takes as input all the signals sent to the server by the devices and it decides if an earthquake is occurring. The algorithm is calibrated in such a way that the probability of false alarm is below a desired value.

Since 2013, the network of the Earthquake Network project has detected more than 440 strong earthquakes in real time. The Earthquake Network Android app (<https://goo.gl/GSgxtL>) was particularly useful to alert the population of Italy during the recent seismic swarm, the population of Ecuador during the strong replicas of the 7.8 magnitude earthquake (April 16, 2016), and the population of Nepal after the 7.8 magnitude earthquake (April 25, 2015).

The success of this citizen science project, which currently involves more than 250'000 people all over the world, stems from the fact that the smartphone performs the dual function of detector and alert receiver. This enables loyalty of the project participants, who provide their devices for the scientific research and they receive in return a useful service for their safety.

* University of Bergamo, Dept. of Management, Information and Production Engineering Bergamo, Italy.

POSTER PRESENTATIONS

ANTONAKOPOULOU A.¹ – THEODOROPOULOS T.¹ – TSERTOU A.¹
AMDITIS A.¹ – MIORANDI D.² – COHEN B.³ – BRAGA R.⁴
TAMASCELLI S.⁴ – JONOSKI A.⁵

SCENT TOOLBOX SYSTEM ARCHITECTURE

System Architecture, Environmental Policy, Crowdsourcing, Harmonisation Platform, Intelligent Engine

Whilst citizen participation in environmental policy making is still in its infancy, there are signs of a growing level of interest. The majority of citizens, though, both as individuals and as groups often feel disengaged from influencing environmental policies. They also remain unaware of publicly available information, such as the GEOSS or Copernicus initiatives. The SCENT project aims to alleviate this barrier. It will enable citizens to become the 'eyes' of the policy makers by monitoring land-cover/use changes in their everyday activities. This is achieved through an integrated set of smart collaborative and innovative technologies that constitute the SCENT toolbox and augment costly in-situ infrastructure: i) low-cost and portable data collection tools, ii) an innovative crowd-sourcing platform, iii) serious gaming applications for a large scale image collection and semantic annotation, iv) a powerful machine-learning based intelligence engine for image and text classification, v) an authoring tool for an easy customization by policy makers, vi) numerical models for mapping land-cover changes to quantifiable impact on flood risks and vii) a harmonization platform, consolidating data and adding it to GEOSS and national repositories as OGC-based observations.

The design and description of the functional blocks that constitute the SCENT toolbox as well as the relations between them specify the architectural design of the system that serves the following goals: (a) Complement existing in-situ infrastructure through a network of low-cost portable sensors and smart collaborative technologies. (b) Generate an unprecedented and low-maintenance pool of near real-time observations that will monitor land-cover/ use changes and related environmental phenomena like floods. (c) Offer data via web services into existing repositories, as the GEOSS portal. (d) Allow policy makers to obtain a dynamic view of land-use changes while directly involving citizens in the decision making process. (e) Go beyond a research prototype level by clearly fitting and extending evolving market needs through its oper-

¹ Institute of Communication and Computer Systems, Greece.

² U-Hopper Srl, Italy.

³ IBM Haifa Research Lab, Israel.

⁴ XTeam Software Solutions srls, Italy.

⁵ IHE Delft Institute for water education, Delft, The Netherlands.

ational sustainability and complementarity with existing initiatives (eg. the Geo-wiki).

The proposed architectural design addresses the above aims in a more generic context, trying to be compatible with a variety of in-situ infrastructure and envisaged application scenarios, targeting at a holistic view of the system. High-level message sequence charts (MSCs) based on indicative scenarios, such as “Flood extend maps extraction from drone images” and “SCENT gaming through SCENT Collaborate app”, were created so that the detailed information flows among SCENT toolbox components are clarified. Additionally, a distributed deployment-focused architectural design is proposed, where specific implementation strategies and technologies are suggested, listing their benefits over other options and with the pilot sites in mind. Finally, the security as well as the performance system architecture perspectives are examined that grasp key non-functional requirements.

THE “LABORATORIO PLURIMO”: A PARTICIPATORY SCIENCE TOOL FOR TERRITORY DEVELOPMENT

New ruralism, territory, digital technologies, participatory, scenario

Ostemi, the Osservatorio Territorialista Milanese, asserts a participatory approach with local communities to enable scientists to propose solutions for environmental problems, advance sustainable economic opportunities and contribute to environmental data sets. Ostemi, as part of “Territorialisti”, roots its approach into the definition of territory as the outcome of the relationships between humans and the environment they live in. Such an approach aims to raise the awareness of citizens on conservation, transformation and governance issues as well as include the citizens point of views in the planning process.

Within this approach, Ostemi, focusing on new ruralism experiences, centred on the interaction and integration of knowledge from both experts and practitioners, leading to a process of reciprocal learning, is carrying out the “Laboratorio plurimo” experience in the Lombardia Region.

The project stemmed from a workshop organised in Milan in February 2016: stakeholders from University, civil society, farmers, and local government representatives were involved with the aim of finding a new common platform and tools to interact and ultimately proposing solutions able to value local products and thereby benefit the local economy. The main actors as well as the participants were involved since early stages of the workshop’s planning through online blog narratives. Following the workshop, regular meetings have taken place in order to identify problems and issues for producers as well as consumers and finding expert solutions through a participatory approach: the “laboratorio plurimo” in which all knowledge whether from experts or from experience is valued and exchanged. In addition, all participants were involved through social media, in events, such as farmers markets and other workshop in other parts of Lombardy. This continuous interchange of information led to planning for a project that will start in the area of “Martesana”, North/West of Milan. It will be a prototype of actions that can be replicated elsewhere, collecting data and information on new ruralism, both from official sources and from practitioners, to build a data repository and a spatial data infrastructure (SDI) called ODISI (Open Data Infrastructure for spatial interaction), within the INSPIRE/AgID guidelines. The data and the infrastructure will allow to build complex maps with several layers of information that can be used also to stimulate the process of knowledge building and education, raising the awareness on the potential of new ruralism and leading to the empowerment of the tools from the practitioners.

* Politecnico Milano, Milan, Italy.

** OSTEMI, Osservatorio Territorialista Milanese, Milano, Italy.

GJONI V.* – FIORE N.* – SANGIORGIO F.* – TARANTINO D.*
MIGLIETTA C.* – MONTINARO S.* – BASSET A.* – ANDRIANI C.*

SERIOUS GAMING: AN APPROACH INVOLVING YOUNG CITIZEN IN BIODIVERSITY AND ECOSYSTEM SCIENCE

Serious gaming, educational tools, citizen science platform, ecological sustainability, biodiversity and ecosystems

Ecological sustainability is a grand challenge for our societies, which need to cope with conservation of ecosystem services, improvement of quality of life and well being and reinforcement of justice in resource allocation at every national and global scale. Success or failure in current efforts on ecological sustainability will affect future quality of life and well-being of young generations, who are also the component of our society most open to the ecological issues and to a change in current paradigms dealing with ecological sustainability. In this context, we have run educational projects, using serious gaming as an educational tool, introducing citizen science in the European school system and promoting a student participative approach in the application of the science of ecology to biodiversity conservation and ecological sustainability.

Here, we present a citizen science platform targeting students of all levels of secondary classes. The platform, which has been developed in a Long-Life Learning Project and applied in different H2020 projects, is an interactive platform. It has been designed to support contents aimed to deepen students' knowledge of the scientific methods, as well as of key thematic issues dealing with biodiversity and ecosystems science and to connect the student teams with each other. The platform opens calls for students' team research projects, has spaces for hosting the team's project activities and offers a citizen science tool, *the serious gaming*, for evaluating the overall performances of the teams in developing a scientific culture and becoming actors of science development towards an ecological sustainability.

We present as a study case an application of serious gaming on biodiversity at the European level, with the participation of more than 50 schools pertaining to eight different countries in the context of the 'Scientific Game' Comenius project.

* Biological and Environmental Sciences and Technologies Department, Salento University, Lecce, Italy.

STEIN G.*-**-** – PAN W S.*-**-*** – TUCKER J D.*-**-***

DESIGN CONTESTS FOR HEALTH: A SYSTEMATIC REVIEW AND CONTENT ANALYSIS

Health promotion, education, community health programs, crowdsourcing, prize

We undertook a systematic review of studies evaluating the effectiveness and cost of health-focused design contests. We followed Cochrane guidance and systematically searched eight databases. Articles were included if they reported on a contest that focused on improving health, required participants to submit a finished design solution, contained a prize structure, and had sufficiently detailed methods. We defined design contests as open contests that solicited finished solutions to design problems and then awarded prizes to finalists based on pre-determined criteria. The review was registered on PROSPERO (42016038107). We searched 3579 citations and identified 29 health-focused design contests. Contests solicited submissions worldwide (7), from low-income countries (3), middle-income countries (6), and high-income countries (5). The number of submissions per contest ranged from three to 11,354, with a median of 73. Two types of contests emerged – those focused on high-quality, innovative outcomes and those focused on the process of mass community engagement. Among seven studies that evaluated outcome-oriented contests, all seven found that design contest solutions were equivalent or superior to the comparator. Two of two studies found that design contests saved money. Among seven studies that evaluated process-oriented contests, five concluded that the contest had improved at least one health indicator. Design contests are an effective way to solicit innovative solutions to health problems and spur mass community engagement. If integrated into health policy planning, design contests may help health systems become more people-centered and inclusive.

* SESH study group of University of North Carolina at Chapel Hill, Guangzhou, China.

** The University of North Carolina at Chapel Hill Project-China, Guangzhou, China.

*** Institute for Global Health & Infectious Diseases, The University of North Carolina at Chapel Hill, Chapel Hill, USA.

SCENT CITIZEN OBSERVATORIES: CONSIDERATIONS ON THE USE OF GAMIFICATION IN CITIZEN SCIENCE PROJECTS

Gamification, citizen observatories, alternate reality games, environmental monitoring, citizen engagement

This presentation will provide some preliminary considerations on the use of gamification for engaging users in citizen science projects. The considerations will be based on our experience in SCENT, an EU-funded project now entering its second year. Through a constellation of smart technologies – including web-based platforms, mobile applications and sensing kits – SCENT enables citizens to actively contribute to the collection and interpretation of information on land-cover and land use. Citizen-generated knowledge is combined with data from authoritative sources, in-situ sensors and information generated through advanced artificial intelligence tools. In one of the use cases of SCENT, citizens download a free mobile application and participate to a game where they have to visit specific geographic areas (e.g., the Danube Delta or the Attica Kifisos river), find specific objects (e.g., vegetation in the river bank, waste and brought materials in the manholes, tree banks/branches, dustbins, cars and vehicles along the river bank or in smaller streams connected to the main river) and take and annotate pictures. Pictures annotated by the users are sent to a cloud-based engine for further processing and then they can be uploaded onto existing earth observation repositories, such as GEOSS.

The major challenge of initiatives like SCENT is how to secure the continuous participation and commitment of the citizens. SCENT leverages proven gamification mechanisms (incentives, goals, change of levels, points, badges, etc.) to ignite and secure the interest of the citizens over time.

In this presentation for the First Italian Citizen Science Conference, we would like to (1) share the results of an analysis we conducted on select video games already developed by third parties, mostly in the area of environmental sustainability and water management and/or based upon crowd-sourcing processes, and (2) show how the best practices emerging from this analysis have been used to design and implement the SCENT applications.

* XTeam Software Solutions, Italy and Aalborg University, Denmark.

** XTeam Software Solutions, Italy.

*** U-Hopper srl, Trento, Italy.

CLOSING LECTURE

SCHADE S.*

QUO VADIS CITIZEN SCIENCE?

Citizen Science, European perspective, Reflections

This closing lecture of the conference provides impressions from the two-day event and adds reflections about the outcomes of the different sessions – departing from the thematic focus on biodiversity monitoring (from the first day) all the way to the horizontal considerations of the societal dimensions, emerging organisational structures and the role of technology (from the second day of the conference). The connection of the ongoing and emerging activities in Italy and in other countries to the European level is particularly emphasised. The talk especially highlights personal observations considering Citizen Science in the European Union (EU), such as the richness and diversity of Citizen Science across the EU, differences in the manifestation of Citizen Science, efforts considering knowledge exchange, arguments about the differences between Citizen Science and ‘classical’ research projects, and the potential impacts of digital transformation. Taking these considerations as a departing point, the presentation closes by suggesting several possible trajectories of where Citizen Science might go from here. In this way, it hopefully inspires further actions, including future Citizen Science conferences at national and international level.

The views expressed are purely those of the presenter and may not in any circumstances be regarded as stating an official position of the European Commission.

* European Commission, Joint Research Centre (JRC).

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ORGANIZING SECRETARIAT

Giulia Trimani

Francesca Gitto

Accademia Nazionale delle Scienze detta dei XL

Via L. Spallanzani 7 – 00161 Rome

Tel. +39 6 44250054 segreteria@accademixl.it www.accademixl.it

csconferencerome2017@accademixl.it

www.citizensciencerome2017.com