**Report from the LifeWatch Belgium project meeting**

**Thursday June 19th, 2014**

On Thursday June 19th 2014, an important LifeWatch Belgium project meeting was organized at the Flanders Marine Institute (VLIZ) in Oostende (Belgium). During this meeting the ongoing subprojects of all Belgian LifeWatch partners were brought together for the first time and their first results were presented. The meeting was attended by representatives of all Belgian LifeWatch partners (Flanders Marine Institute (VLIZ), the Research Institute for Nature and Forest (INBO), Université catholique de Louvain (UcL), Université de Liège (ULg) and the Royal Belgian Institute of Natural Sciences (RBINS)), scientists of the Belgian research community and users of the Belgian LifeWatch infrastructure.

In the morning an introduction to the European LifeWatch infrastructure was given and each Belgian LifeWatch partner presented their contributions to the Belgian LifeWatch infrastructure, their milestones of 2013 and their planned actions for 2014-2015.

In the afternoon, the ongoing research projects based on data generated by the Belgian LifeWatch infrastructure each presented their scientific background and questions, the devices and sensors used and some first results.

Overview of presentations with short summary:

**The European LifeWatch infrastructure – F. Hernandez (VLIZ)**

LifeWatch is a large scale European research infrastructure and can be seen as a virtual laboratory for the study of biodiversity. LifeWatch is about E-science, web services, data services, ICT infrastructure, High Performance Computing (HPC), GRID, BIG data and workflows. The main goal of LifeWatch is to increase data generation, e.g. through real time monitoring and the use of biosensors. Currently LifeWatch is in the construction phase, which lasts for 5 years. From 2016 onwards LifeWatch should be operational for at least 20 years. Several European countries are participating. As a legal unit, LifeWatch is setting up an European Research Infrastructure Consortium (ERIC). The final ERIC statutes are circulating and are expected to be signed in 2014. At the beginning of June 2014 a LifeWatch Marine Technical Meeting was organized at the Hellenic Center for Marine Research (HCMR). There it was decided a Marine Virtual Research Environment (VRE) will be created. In terms of communication, LifeWatch Belgium will be working closely with the Belgian Biodiversity Platform (BBPf). The Biannual 2015 conference of BBPf will be dedicated to “EU E-infrastructures related to Biodiversity in Europe, what happens in Belgium”.

**LifeWatch @ Flanders Marine Institute – F. Hernandez, A. Goffin, K. Deneudt, F. Waumans (VLIZ)**

The Flemish contributions to LifeWatch are coordinated by the Flanders Marine Institute (VLIZ – marine part) and the Research Institute for Nature and Forest (INBO – freshwater and terrestrial part). The Flemish LifeWatch consortium is funded by the Hercules Foundation. Flanders is contributing to the central (i.e. European) LifeWatch infrastructure with a taxonomic backbone, and to the regional LifeWatch infrastructure with a marine-freshwater-terrestrial observatory, several data systems and data services, and data archaeology activities. The taxonomic backbone is coordinated and managed by VLIZ and will interlink several taxonomic registers, species observations, trait databases and databases holding genetic data. In 2012, the focus of the VLIZ data archeology activities was on biological datasets in the Belgian Marine Bibliography; in 2013 the focus shifted to biological datasets from the Belgian-Kenyan research. In 2014 it is planned to rescue phytoplankton data from the Belgian Part of the North Sea (prior to 1970) through the 4DEMON project (4 decades of Belgian marine monitoring: uplifting historical data to today's needs). The marine observatory that VLIZ is building consists of two components: (1) monitoring campaigns with the RV Simon Stevin (monthly campaigns of 1 day and seasonal campaigns of 2 days), and (2) the construction of a sensor network in the Belgian Part of the North Sea. Most sensors were presented more in detail in the afternoon during the presentations of the separate ongoing research projects. All data generated by the sensor network can be accessed through <http://www.lifewatch.be/sensor-network>. Within the European LifeWatch infrastructure a Collaborative Platform for sensor data processing will be constructed. VLIZ is also making available several data systems to the LifeWatch infrastructure and is building several web services on these internal and also external data systems. These web services can be used in a concatenated way (output first web service is input next web service) as is explained in several use cases. These web services can be reached through <http://www.lifewatch.be/data-services>.

**LifeWatch @ the Research Institute for Nature and Forest – B. Aelterman (INBO)**

LifeWatch INBO is building a terrestrial and freshwater observatory and in this framework several individual projects are ongoing: (1) European Seabirds at Sea (application for fast data entry), (2) Unmanned Aerial System (high resolution imaging for habitat monitoring), (3) fish tracking network (more than 100 acoustic tags and receivers), (4) bird radar (automatic bird detection in a 5 km range), and (5) bird tracking network (lightweight, solar powered GPS tags). Some of these projects were presented more in detail in the afternoon. The INBO is also making their existing data systems available to LifeWatch, including more than 440.000 fish occurrences. All INBO data is published through the Integrated Publishing Toolkit (IPT): <http://data.inbo.be/ipt/>. All INBO data is also registered with the Global Biodiversity Information Facility (GBIF) to improve discoverability, and is accessible through the GBIF web services. The INBO is also using the CartoDB API to build their own tools. All INBO data has a CC0 license and is in the public domain. The next steps for LifeWatch INBO are to upscale the existing network, develop an open data policy and continue the publication of datasets.

**AntaBIF, The Antarctic Biodiversity Information Facility – A. Van de Putte (RBINS)**

AntaBIF was born during the International Polar Year as the data, visualization and analysis component of the Census of Antarctic Marine Life. The goal of AntaBIF is free and open access to Antarctic biodiversity data. AntaBIF was previously known as SCAR-MarBIN (2005-2008), and from 2015 onwards will be known as AntaBIS (Antarctic Biodiversity Information System). All general information about AntaBIF and access to the individual AntaBIF components can be found on the website: [www.biodiversity.aq](http://www.biodiversity.aq). In the AntaBIF data portal you can search for and visualize Antarctic biodiversity data. The website also incorporates the interactive Antarctic Field Guide (AFG), which you can use to identify Antarctic species based on expert descriptions and where you can also make your personal field guide. Another component of AntaBIF is The Biogeographic Atlas of the Southern Ocean (BASO); currently only available as a static version, but will become available as a dynamic online version. A last component of AntaBIF is the Microbial Antarctic Resource System (mARS), an information system dedicated to facilitate the discovery, access and analysis of geo-referenced, molecular microbial diversity (meta)data generated by Antarctic researchers, in an Open fashion. In 2013 AntaBIF has been working on recommendations (branding, layout website), has published a printed version of BASO and has published a white paper about the mARS vision. The planned actions for 2014-2015 are: initiate LifeWatch (2014), develop a test version of mARS (2014), publish datasets from BASO, make a dynamic version of BASO (2014), further publish data (2015) and develop a thematic virtual (sub?)lab for Antarctica, with dynamic BASO as marine component and mARS as marine and terrestrial component (2015).

**LifeWatch Wallonie-Bruxelles, Ecotope characterization – J. Radoux (UcL)**

The biodiversity community requires more geodata. Nowadays more and more means exist to collect such geodata, but often at local scale, which entails generalization problems. A user survey amongst the biodiversity community revealed there is no agreement on the classification system, there is a need for high level of detail and geodata collection is time consuming. This is where remote sensing can help for coherence: there is a single data collection framework across the globe, there is a good revisiting time, and operational products already exist or will be delivered soon. However, remote sensing data still lack thematic details. In order to overcome this, LifeWatch WB is focusing on quantitative parameters. BDIV models will be used towards object-based geodata: objects can be described through land use, land cover, seasonality and abiotic factors. In order to obtain the required data the best sources of information are being integrated (classification of freely available images, GIS analysis, summary of time series). The spatial unit for the data integration are irregular polygons derived from automated image segmentation. Basic land cover classifiers are used as building blocks for the model. The end product are ecotopes (combination of delineation and attributes), which are very easy to use in models. Observable biophysical variables are key component to seasonal dynamics, therefore LifeWatch WB adds 4 biophysical variables: snow, sunshine, greenness and fire. Those will be included in the ecotope database, but they are already freely available through a WebGIS viewer ([www.uclouvain.be/lifewatch](http://www.uclouvain.be/lifewatch)). The WebGIS viewer also offers a visualization and point based extraction tool where values can be extracted by coordinate lists or by selecting a location on the viewer. All four layers (snow, sunshine, greenness and fire) are WMS enabled. A subset extractor is in development. Anomalies in the geodata are published in a bi-yearly bulletin.

**GPS tracking network for large gulls – E. Stienen (INBO)**

In the last few years a change was observed in the breeding behavior of large gulls: there is an increase of birds breeding in urban areas, an increase of roof breading birds, and an increase of birds breeding in non-coastal areas. In Flanders a strong increase of the breeding population could be observed, followed by a recent decline. Furthermore, more than 95% of the breeding population can be found in Zeebrugge, where more birds start to breed on roofs and in non-coastal areas. In terms of feeding behavior, the gulls feed on discards from fishing boats, agricultural products, human waste, garbage dumps and hard substrates. These changes in breeding and feeding behavior entail several nuisance problems. To counter this a management plan was designed: protect the gulls in non-nuisance areas and remove gulls from nuisance areas. In the framework of LifeWatch a GPS tracking network for large gulls was constructed. Several gulls were equipped with lightweight solar-powered GPS tags and several relays and base stations were set up in the vicinity of the breeding grounds: Oostende for the Herring Gulls and Zeebrugge for the Lesser Black-backed Gulls. The research objectives of this network are to increase the knowledge about habitat use during breeding season and wintering, to increase the knowledge about gull nuisance, and advice for management, to raise public involvement and awareness, and to make more data available. The GPS data gathered so far revealed that the Lesser Black-Backed Gulls prefer to move along a north-south transect perpendicular to the coast, while the Herring Gulls prefer to move alongside the coast. The data also revealed that the birds are very individualistic in their breeding and feeding behavior (as was demonstrated in several individual bird stories). Furthermore, some of the Lesser Black-backed Gulls migrated to the south of Spain and Portugal during winter, while others remained in Belgium and the north of France.

**Bird and bat research with the ‘ROBIN 3D flex’ radar system – J. Everaert (INBO)**

One component of the planned bird and bat research is the monitoring of the impact of wind farms (collision risk, avoidance rates, mitigation measures, etc.) through field surveys at proposed and existing locations, including updating a regional risk atlas. The second component is biodiversity monitoring (feeding behavior, migration corridors, etc.), especially at Natura 2000 sites, but also to develop a warning system for intense (local) migration for airport safety (Bird Control). Since the automatic radar systems have several advantages over the manually operated radars, the ROBIN 3D flex radar system was purchased in the framework of LifeWatch. The system has two radars: a horizontal S-band radar and a “vertical” FMCW radar, which can be used in three modes: scanning, staring and tracking. The FMCW radar is used to detect the altitude of the birds and can also detect wing beat frequencies. Together the two radars create a 3D image. The raw data will be processed and visualized. The system also includes an automatic report generator. Normally, the radar system will be delivered in July 2014, and a training is scheduled. From July to December 2014 the radar system will be tested at 3 locations: Zeebrugge, Waaslandhaven and Knokke-Zwin. Furthermore, INBO is involved in ENRAM (European Network for the Radar surveillance of Animal Movement), which goal is to join forces to foster “European-scale” radar remote sensing of animal migration for the first time, by the use of existing weather radars. Since the Zeebrugge and Knokke-Zwin test locations are within the range of the weather radar in Jabbeke, these calibration experiments can also contribute to ENRAM.

**An acoustic telemetry network in the Belgian part of the North Sea – J. Reubens (Ugent, VLIZ)**

Acoustic telemetry literally means ‘measuring from a distance using sound waves’. Since observing fish in the field is rather challenging, acoustic telemetry is the perfect solution when it comes to fish monitoring. Therefore, in the framework of LifeWatch, an acoustic telemetry network for fish was set up. The goal of this network is to collect crucial knowledge on migration routes, spatiotemporal habitat use and fish behavior. The network consists of transmitters (tags), which are surgically implanted in the fish, and receivers. Each tag has an unique code, and every time a fish passes a receiver, the tag signal is registered (taking into account a tag delay). Two types of receivers are used: manual download of the data and real time data transfer. Currently (19/06/2014) 52 receivers with manual data download have been installed on buoys in the Belgian part of the North Sea and the Western Scheldt estuary. In this set up the receiver is attached to a steel cable, while the weight is attached to a separate steel chain. The receivers with real time data transfer will be attached to wind turbines in July 2014. In this set up the receivers will be encased in plastic tubes. Species currently tagged are Atlantic cod and European eel. In the future also European sea bass, twaite shad, river lamprey and sea trout will be tagged. Some results for eel and cod are already available, including results from previous INBO research. A PhD study was designed at Ghent University to build further on this existing knowledge. The goals of this PhD study are to (1) characterize migration routes, hotspots and bottlenecks of the fish, (2) develop habitat suitability models, and (3) come up with suggestions for fish management.

**Flow cytometry – W. Vyverman (Ugent)**

Microbes have multiple ecological roles and are of key importance for organic carbon and nutrient flows in marine planktonic food webs. Microbes display an enormous range in size, taxonomic diversity and functional traits, including e.g. widespread mixotrophy, the production of a range of toxins, etc. Several observational techniques exist to assess the microbial biodiversity: inverted microscopy, HPLC pigment analysis, remote sensing, DNA-based methods and continuous observations such as fluorescence and flow cytometry. In the framework of LifeWatch a CytoSense Flow Cytometer was purchased to establish a near-real time monitoring program of coastal plankton. A flow cytometer is a laser based instrument for the detection and characterization of particles (<1μm – 1.5 mm diameter; few mm length). Both fluorescence, side scatter and forward scatter are measured and can be combined into a taxon/group-specific signature. In parallel, images can be taken of individual particles, which can assist in their identification. The data can be viewed as cytometric profiles or diagrams for cluster analysis from which functional groups and taxonomic composition and abundance can be derived. The CytoSense is installed on board the RV Simon Stevin. It is connected to a continuous water flow system and is operated in parallel to a fast repetition rate fluorometer installation. It takes 1 sample every 5-15 minutes. The use of the flow cytometer thus allows to perform high-frequency measurements with high spatial and temporal resolution. To calibrate the flow cytometer and to analyze the generated data, a joint PhD study was designed by Ghent University and VLIZ.

**Video Plankton Recorder – K. De Schamphelaere**

Global climate change is causing a distributional shift of marine fish and invertebrate species and is reducing biodiversity, which is further exacerbated by ocean acidification. Mitigation options are limited: we need to improve resilience by reducing other stressors such as pollution and eutrophication, and we need to enhance the water quality. For this we need improved understanding of (combined and interacting) factors influencing all aspects of biodiversity (genetic, species, functional). In the framework of LifeWatch a Video Plankton Recorder was purchased. The general aim of the VPR project is to determine the relative contribution of various changing environmental conditions (temp, nutrients, pH) and pollutants on the (high-resolution) spatiotemporal dynamics of abundance and diversity of zooplankton in the Belgian Part of the North Sea (BPNS). More in detail this means to determine (1) factors influencing community diversity dynamics (e.g., Simpson index, species abundance distributions, etc.), (2) factors influencing population density dynamics of selected taxa (likely copepods, sensitive to endocrine disrupter compounds), and (3) factors influencing functional diversity dynamics: fatty acid profiling (implications for higher trophic levels). To achieve this a PhD study was designed at Ghent University with several steps: Step 1: calibration and optimization of the VPR; Step 2: High-resolution monitoring of the zooplankton community along pollution-gradient transects in the Belgian Part of the North Sea, using the VPR; Step 3: Mechanistic population and ecosystem models to generate hypotheses about relative contribution of environmental factors to eco-dynamics from monitoring data; Step 4: Experimental validation of these hypotheses in multi-factorial lab experiments (likely with copepods).

**Biodiversity in the marine environment, Monitoring of aquatic ecosystems based on environmental DNA – P. Boets and J. Asselman (Ugent)**

Ecosystems disappear at an alarming rate and species get extinct, but there are still several gaps in our knowledge: What is the spatiotemporal distribution of marine species? What is the effect of anthropogenic stressors on the occurrence and distribution of marine species? What is the resilience to perturbations? To answer these questions we need monitoring and research. Current monitoring methods to study biodiversity are invasive, labor intensive, prone to errors in identification, time and money consuming, and species selective. A recent innovative and promising technique is DNA-based bio-monitoring. Environmental DNA (eDNA) is nuclear or mitochondrial DNA originating from an organism and ending up in the environment via faeces, mucus, etc. eDNA monitoring has several advantages over more traditional methods: it allows a fast and efficient detection, eDNA degrades relatively fast in the environment(allowing to detect the recent occurrence of the species) and it is an easy (standardized) and non-invasive sampling method. The aims of this LifeWatch project are to (1) map biodiversity via DNA-based bio-monitoring, (2) develop, optimize and apply the eDNA method for the Belgian part of the North Sea, and (3) use eDNA method as an “ecotoxicology tool”. To achieve this a PhD study has been designed at Ghent University with several steps: Step 1: Validate known DNA primers for species occurring in the Belgian part of the North Sea; Step 2: Quantify DNA for selection of species; Step 3: Develop DNA primers for different species in the North Sea; Step 4: Detect species through sequencing technologies; Step 5: Quantify DNA through sequencing technologies.

**About diversification, diversity and ecophylogenetics – O. De Clerck (Ugent)**

Although very successful at explaining interactions between organisms and the biotic and abiotic environment, ecological explanations often benefit from taking into account processes that play at larger time-scales. Diversification (the net result of speciation and extinction), and time-for-speciation often complement ecological explanations. Over the last decade comparative phylogenetics has become a rigorous framework to test ecological and evolutionary hypotheses. And although comparative phylogenetics can get quite technical since extinct taxa are very difficult to incorporate in phylogenies, it has been hugely successful and influential. Comparative phylogenetics may help us to address and understand big issues in biology such as ocean acidification (phylogenetic signatures of past ocean acidification can be seen in calcified red algae) and global warming (as can be seen in Dictyotales, an order of brown algae). In order to be able to answer biological questions in an explicit evolutionary framework data of various nature need to be integrated: taxonomic data (e.g. World Register of Marine Species – WoRMS), distributions (e.g. Ocean Biogeographic Information System – OBIS), and traits (e.g. European Marine Observation and Data Network – EMODnet). However, data systems containing phylogenies (trees) are rather scarce, although there is a high need for trees and trees are very important. One of the main initiatives is the Open Tree of Life Project. A Marine Tree of Life however does not exist. Perhaps something to consider to develop. Also techniques to make really big and dynamic trees need further developing.

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