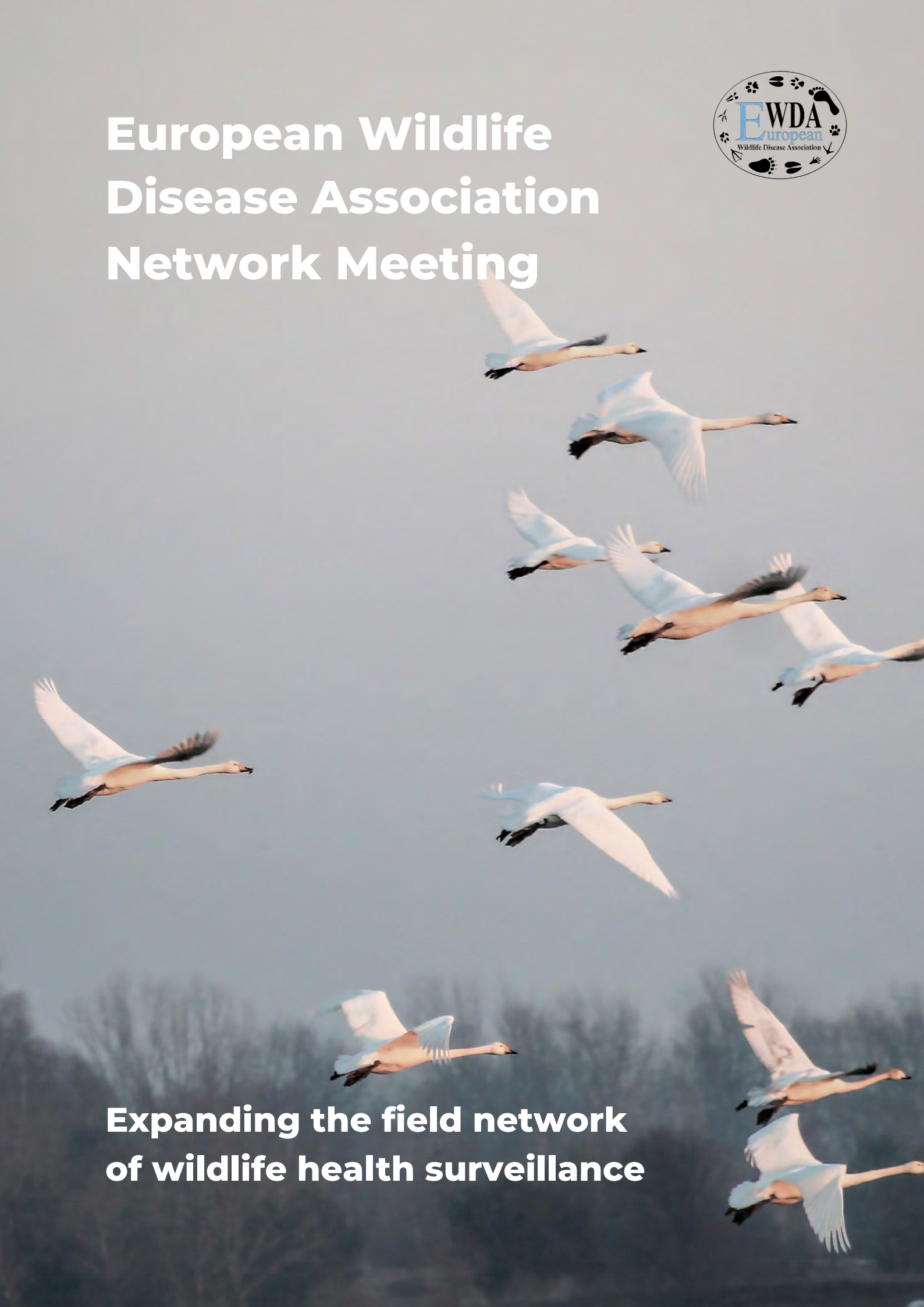
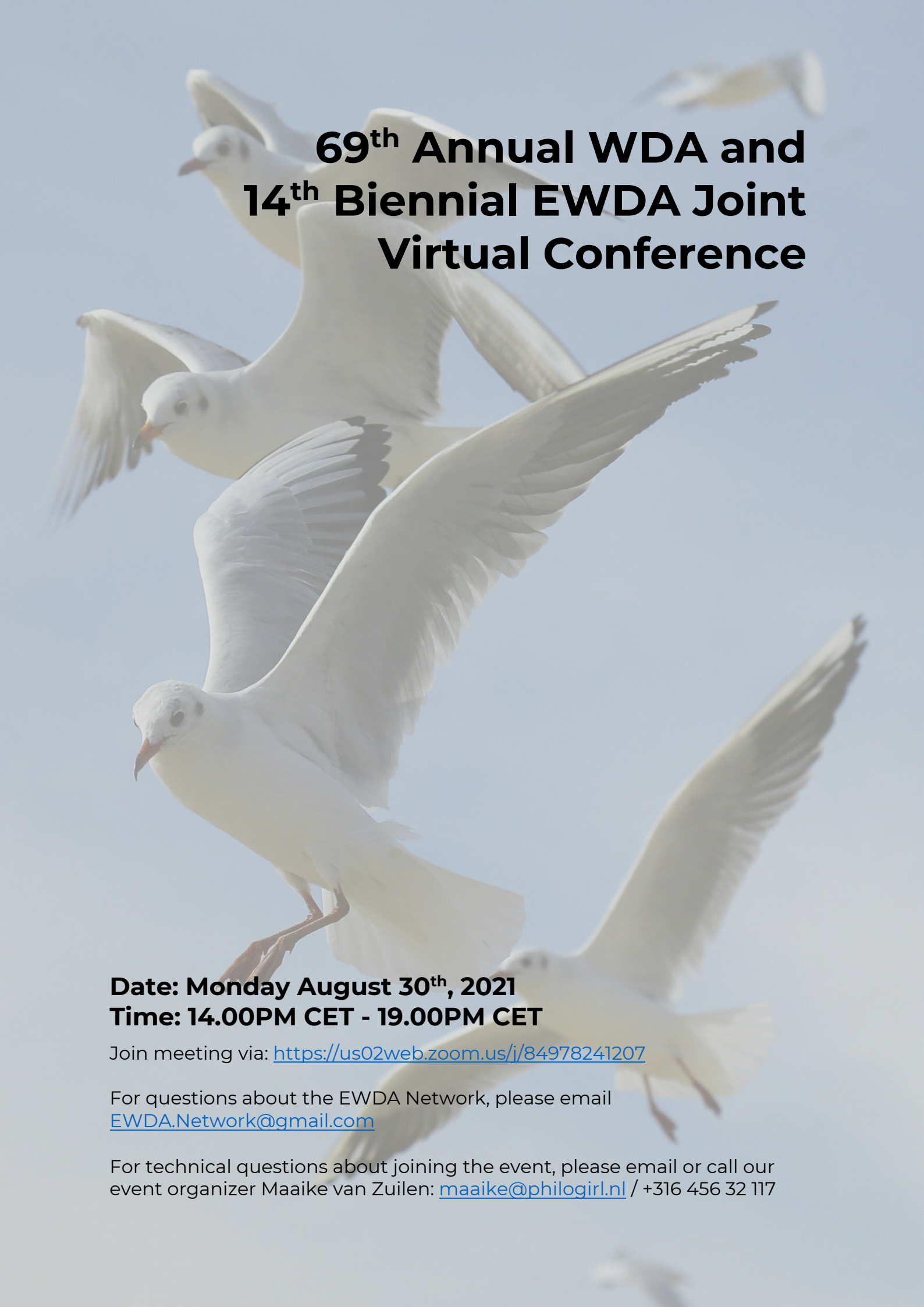
European Wildlife Disease Association Network Meeting



Expanding the field network of wildlife health surveillance



69th Annual WDA and 14th Biennial EWDA Joint Virtual Conference

Date: Monday August 30th, 2021
Time: 14.00PM CET - 19.00PM CET

Join meeting via: https://us02web.zoom.us/j/84978241207

For questions about the EWDA Network, please email EWDA.Network@gmail.com

For technical questions about joining the event, please email or call our event organizer Maaike van Zuilen: maaike@philogirl.nl / +316 456 32 117

Background

Successful wildlife health surveillance schemes often benefit from multi-disciplinary teams. Engagement and collaboration with an extended field network can help optimise surveillance outputs and their collective impact. The goal of this meeting is to illustrate the opportunities that exist to expand surveillance through working in partnership with various communities (e.g. general public/citizen scientists, hunters, wildlife rehabilitators, conservation organisations, bird ringers, habitat managers, natural history museums, public health agencies and social scientists) and employing new approaches.

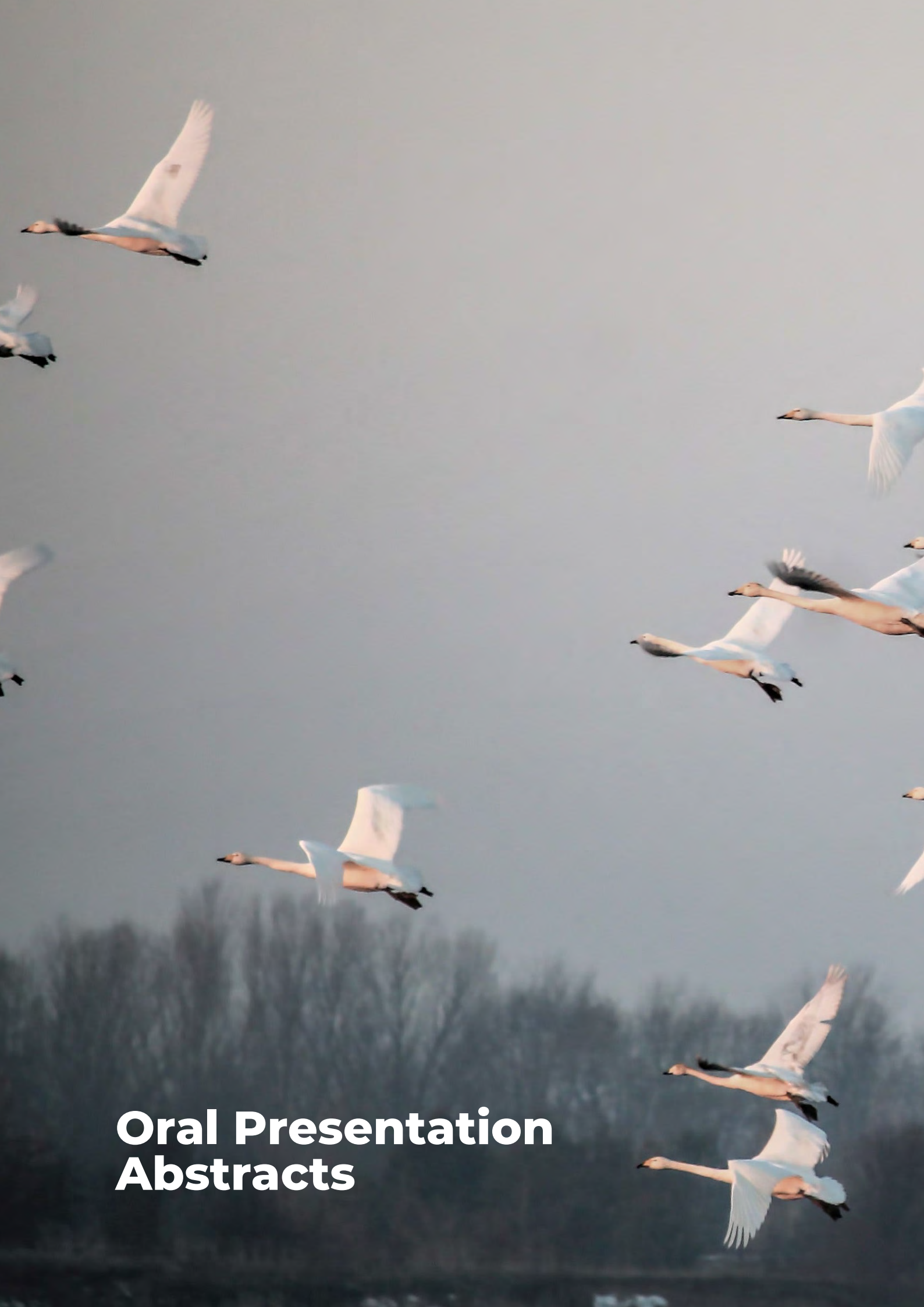
Presentations will highlight projects/schemes that have successfully employed novel networks and/or techniques.

The panel discussion session will enable presenters to explore the benefits and limitations of these methods. We hope that these presentations will provide inspiration to others who may be able to reapply the lessons learned in their countries.

Programme 30 August 2021

Time: 14.00 - 19.00 C(entral) E(uropean) T(ime)

14.00 - 14.05	**Welcome and Introduction** Thijs Kuiken, EWDA Network Chair, Department of Viroscience, Erasmus MC, The Netherlands
14.05 - 14.25	**Working with Citizen Scientists** Becki Lawson, Institute of Zoology, United Kingdom
14.25 - 14.45	**Working with Citizens to Monitor Tick-associated Risk: Lessons Learned from the CiTIQUE Project** Jonas Durand, Project CITIQUE, Tous Chercheurs, INRAE Université Lorraine, France
14.45 -14.50	**Mini break**
14.50 - 15.10	**Stepping up from Wildlife Disease Surveillance to Integrated Monitoring of Shared Infections: The Role of Hunters** Christian Gortázar, University of Castilla-La Mancha, Spain
15.10 - 15.30	**Achieving Health: Working with Habitat Managers** Ruth Cromie, Wildfowl & Wetlands Trust, United Kingdom
15.30 - 16.00	**Break** Mini-presentations available to view
16.00 - 16.20	**Working with Mammalogists** Lineke Begeman, Erasmus MC, The Netherlands
16.20 - 16.40	**Working with Wildlife Rehabilitators** Sonia Hernandez, University of Georgia, USA
16.40 - 17.00	**Bridging Local, Traditional and Scientific Knowledge to Improve Wildlife Health Surveillance and Response** Susan Kutz, University of Calgary, Canada
17.00 - 17.30	**Break** Mini-presentations available to view
17.30 - 17.50	**Using Technology to Improve Wildlife Health Surveillance** Erik Ågren, National Veterinary Institute, Sweden
17.50 – 18.20	**Panel Discussion: Benefits and Limitations of Linking with Various Communities to Expand the Field Network. Lessons Learned and Recommendations.** Panel: all speakers Chair: Thijs Kuiken
18.20 - 18.30	**Concluding Remark** Thijs Kuiken
18.30 - 19.00	**Informal Small Break Out Rooms: Meet, Greet and Network with the speakers. Each speaker will have their own room. Meet the speakers in this room and ask your questions.**



Oral Presentation Abstracts

Working with Citizen Scientists

Name(s): **Becki Lawson**[1], Katharina Seilern-Moy[1], Mike P. Toms[2], Kathy Wormald[3], Will J. Peach[4], Andrew A. Cunningham[1]

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Working with members of the public offers a powerful and cost-effective means to conduct national, year-round, wildlife health surveillance (WHS), which would otherwise be practically and financially infeasible. General or targeted surveillance approaches can be utilised, where appeals are made for observations of morbidity or mortality of certain wildlife taxa, with supporting images sought where available. This facilitates syndromic surveillance and targeted selection of incidents for further investigation (e.g. site visits and/or post-mortem examinations). Whilst this approach has many advantages, there are notable limitations, such as vulnerability to reporting bias and the need for data validation. It is best employed for species that are positively perceived (e.g. charismatic or of conservation concern), and those frequently observed by the public in peri-domestic habitats. The time required for participants to contribute should be considered, with entry level involvement typically including sporadic reporting of wildlife disease (i.e. opportunistic schemes). Where regular reporting is desired (i.e. systematic schemes), yet there exists a low probability of sighting wildlife disease, it may be best to develop existing programmes that monitor species occurrence for other purposes to include an element of WHS. In order to foster and maintain engagement in such 'citizen science', it is important to understand participant motivations and to ensure that the interests of both the public, and the goals of the WHS programme, can be met.

Garden Wildlife Health (www.gardenwildlifehealth.org) is a WHS scheme for amphibians, reptiles, garden birds and hedgehogs in Great Britain, comprising both opportunistic and systematic reporting networks, the latter through collaboration with the British Trust for Ornithology's Garden BirdWatch scheme. Value for conservation and animal welfare, and desire to understand, are key motivations to participate. Translating findings into science-based disease mitigation guidance, providing feedback and disseminating outputs in a variety of accessible formats are therefore recommended to optimise engagement and maximise impact.

Working with Citizens to Monitor Tick-associated Risk: Lessons Learned from the CiTIQUE Project

Name(s): **Jonas Durand**[1], Irene Carravieri[1,2], Julien Marchand[2], Cyril Galley[2], Sandrine Capizzi[1], Gwenaël Vourc'h[3], Pascale Frey-Klett[4,] Annick Brun-Jacob[1]

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Lyme disease and other tick-borne diseases are both a scientific and a societal problem. As such, it is necessary to incorporate citizens in the research on these topics as much as possible. That is why we launched CiTIQUE in 2017: a citizen science program whose main purpose is to study the ecology of ticks and tick-borne pathogens in order to improve prevention. Its core relies on the collaboration with citizen, who can report their tick bite and send the biting ticks to a research laboratory. Reports can be made through an app, a website, or through a paper form, which allows citizens less acquainted with digital technology to participate. Citizen engagement is maintained through regular national and localized communication campaigns on different type of media, through the use of facilitators such as local environmental education associations, through direct interactions with citizens.

Most citizen science programs stop there, with citizens as data providers. Our goal was to involve citizens at the very heart of the research program, by working with them in a research laboratory open to citizens and equipped with cutting-edge research equipment. Here, citizens can participate to 2-days long internships during which they co-construct research questions with a scientist; then perform experiments to answer these questions according to an open investigation process. Both citizens and researchers learn a lot from such collaborations: citizens learn more on ticks, prevention, and improve their critical mind while producing research results with scientists who also enrich themselves from discussing with citizens, sharing scientific and profane knowledge, raising new research questions.

Two main lessons emerge from our experience:
1. It is necessary to involve facilitators to build long-term interactions between citizens and researchers with mutual benefits.
2. It is important to propose different levels of engagement for the citizens and to create the conditions for sharing knowledge in order be able to tackle new research questions related to citizens' concerns.

Stepping Up from Wildlife Disease Surveillance to Integrated Monitoring of Shared Infections: the Role of Hunters

Name(s): **Christian Gortázar,** with help from Bea Cardoso & colleagues at SaBio IREC

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In a context of new emergence of diseases and the ever-growing evidence of the significant role of wildlife in pathogen maintenance, wildlife health monitoring has become crucial, and efforts have been made to develop wildlife disease surveillance (WDS) programs throughout Europe. Disease monitoring is composed of “numerator data”, i.e., number of infected individuals, and “denominator data” i.e., size of the target population. Too often however, information is available for only one of these two datasets. Passive disease surveillance (Component 1) improves the likelihood of early detection of emerging diseases, while active surveillance (Component 2) and population monitoring (Component 3) are required to assess epidemiological dynamics and the outcome of interventions.

Hence, there is a need for developing integrated and harmonized pathogen (or disease) and population monitoring tools for wildlife: integrated wildlife monitoring (IWM). Hunters are relevant stakeholders regarding all three components. We review the characteristics of WDS, list the challenges for improved WDS, and draw a roadmap for stepping up from WDS to IWM. There is need to integrate and maintain an equilibrium between the three components of IWM, improve data collection and accessibility, and guarantee the adaptability of these schemes to each region and temporal period. Methodological harmonization and centralization of information at a European level would increase efficiency of national programs and improve the follow-up of eventual control measures. The ideal IWM would integrate capacities from different stakeholders, and notably from hunters, following the One Health approach; should have dynamic mechanisms to rapidly incorporate relevant new knowledge; and should rely on stable capacities and funding.

Achieving Health: Working with Habitat Managers

Name(s): **Ruth Cromie**[1], Rebecca Lee[1,2], Jonathan Reeves[1], Julia Newth[1].

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If so many of the drivers of ill-health result from mis-management of the environment, targeting those who literally manage habitats provides a powerful way of embedding practices which both prevent problems or allow quick and appropriate responses.

The talk will focus on two levels:

1. Working directly with wetland habitat managers within the UK, the Wildfowl & Wetlands Trust (WWT) manages 10 nationally and internationally important reserves where health protocols were integrated into management plans to reduce risks from a range of wildlife diseases. Despite challenges, understanding the priorities of managers, and developing trusted relationships, allowed even retrofitting of practices.
2. Providing global guidance for wetland managers: having been given a mandate by a resolution of the Ramsar Convention on Wetlands, we produced guidance targeted for wetland managers - the Ramsar Wetland Disease Manual. It was clear from the outset that understanding your target audience was key to framing the guidance appropriately.

Ultimately it is the national and international policies and government commitment which will determine health or otherwise. However, there is a role in influencing policy, bottom up, by demonstrating the benefits of land management which services the health of wildlife, livestock and people. Although the talk will focus on habitat managers it will ask who are the other land-managing stakeholders? Recognising both the connectivity of health and that much of the environments in which we live are not ‘nature reserves’, it will highlight the importance of working with farmers, other private land-owners, local councils and other decision makers. Engaging with these key groups allows the expansion of the concepts of ‘management for health’ which holds the key not just to wildlife health but to that of ourselves.

Working with Mammologists

Name: **Lineke Begeman**

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The ‘Zoonoses in the Night’ project aims to determine the zoonotic potential of viruses from bats in the Netherlands. It is a collaboration including mammologists, virologists, and public health managers. For the first steps, to determine virus diversity in Dutch bats, we needed bat samples. For the second and third step, to determine exposure to bat viruses, we needed sera and bat contact information from bat workers. Obtaining samples from free ranging species is generally challenging, e.g., sampling is labour intensive and population densities are poorly known. For bats specific challenges are detection of (weekly changing) roost locations, their sensitivity for disturbance, and determining the species. Bats are slow reproducers suffering from habitat and prey losses. Many people see bats errantly as pests and fear them for transmitting diseases. Thus, our study was controversial: we depended on the voluntary help of many different bat workers to gather enough bat and serum samples to be able to answer our research questions, while we feared that this study, whatever the outcome, might threaten bat conservation efforts. To overcome bat sampling challenges, we chose noninvasive sampling: fresh faeces and carcasses. We accepted all fresh samples, while aiming for a sample size based on the ‘rule of three’, for more common bat species. For determining bat species, the knowledge of the bat network was used. To mitigate the concerns for increasing bat fear, we put much effort in our communication. Communication was prepared with input from the different disciplines involved, which helped to get it balanced. Communication to the bat workers was early, frequent, and proactive. Bat sample sizes increased over time, and over 90% of bat workers donated serum and filled out questionnaires. This suggests our communication strategy worked and the bat network trust and enthusiasm for the project grew.

Working with Wildlife Rehabilitators

Name: **Sonia M. Hernandez**

Affiliation: Warnell School of Forestry and Natural Resources and the Southeastern Cooperative Wildlife Disease Study in the Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, Georgia, USA

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For clinical wildlife veterinarians, a positive working relationship with wildlife rehabilitators is often fostered, as rehabilitators can be an invaluable resource to: 1) help in reconditioning the animal prior to release, 2) determine if clinical intervention (e.g. surgery) has the desired effect on the patient. Yet, the value of wildlife rehabilitators to wildlife disease researchers and managers has been underestimated, in part, because wildlife rehabilitation is often viewed negatively by those who believe individual animal care diverts resources away from more important issues such as habitat preservation and population management. However, a strong relationship between wildlife rehabilitation facilities and wildlife disease specialists and managers is crucial. Wildlife rehabilitation facilities have an expansive network of volunteers, donors and the public that can easily be activated to answer requests for information or become attentive to a condition causing morbidity/mortality of wildlife.

The sheer number of animals that present to wildlife hospitals provide unique opportunities for
1. surveillance of syndromes and diseases that are occurring in free-living populations,
2. collection of biological material that can be used to investigate various conditions.

A positive working relationship between wildlife hospitals and wildlife disease investigators has allowed for
1. filling in important gaps on the epidemiology of various pathogens such as geographic distribution, seasonality, cyclicity, relative importance of hosts or differences in pathogenicity among hosts (e.g. West Nile virus in raptors in the USA and fibropapillomatosis in sea turtles)
2. discovery of novel pathogens or toxicants in wildlife (e.g. parvovirus in raccoons and *Karenia brevis* blooms toxicity in cormorants),
3. the significance of management decisions after animals are treated for a specific pathogen (e.g. treatment of songbirds with Mycoplasma conjunctivitis),
4. long-term surveillance for single or multiple pathogens or investigations of mortality events can lead to data sets that allow questions to be asked regarding host-pathogen–environment interactions.

Bridging Local, Traditional and Scientific Knowledge to Improve Wildlife Health Surveillance and Response

Name: **Susan Kutz**

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Inclusion of Indigenous knowledge is core to the wildlife co-management mandate of the northern Canadian territories and in responding to the calls of the Truth and Reconciliation Commission (Canada) and the UN Declaration on the Rights of Indigenous Peoples. Indigenous Knowledge is also increasingly valued, but not always mobilized, in conservation frameworks from local to international scales. We have partnered with Inuit communities to design and implement a community-based wildlife health surveillance program in the Arctic. This program brings hunter-based sampling, Indigenous Knowledge, and conventional western science together to monitor local muskox and caribou populations. The resulting collective body of knowledge has provided broad spatial and temporal coverage and led to detection of changes in wildlife health, including large-scale mortality events, emerging zoonoses, and population declines, that were not detected using western science alone. Inclusion of Indigenous Knowledge in the wildlife co-management framework has also improved trust between Indigenous communities and government wildlife managers and facilitated collaborative wildlife management decision-making. Implementation of community-based wildlife health surveillance in an ongoing and standardized manner can bridge gaps in monitoring of remote and sparsely populated areas and can provide critical insights into wildlife health that scientific monitoring alone cannot.

Using Technology to Improve Wildlife Health Surveillance

Name: **Erik Ågren**

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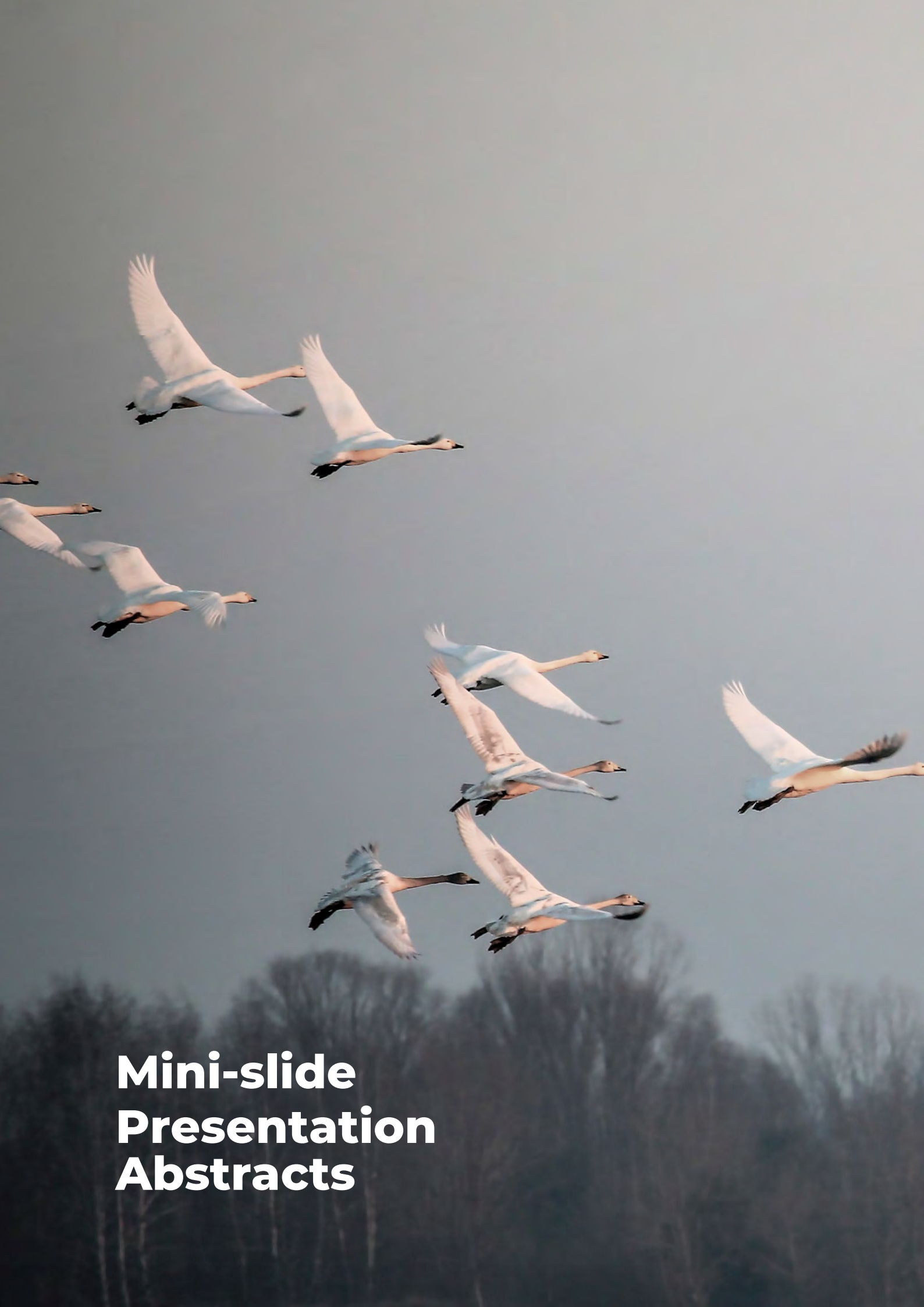
Technology can and should be used to improve wildlife disease surveillance, as it is a challenge to monitor all wildlife species, small and large, cover all geographic areas, and to follow population numbers, as well as continuously note absence or presence of disease and mortality. An example of using easily available technology in Sweden has since 2017 to target the ubiquitous smartphone carried by almost everyone, by developing a mobile friendly online reporting form, similar to an “app”, where the public can report sick or dead wildlife. By reporting what species, number of animals affected, carcass condition, county, municipality, and map coordinates, adding images or film, and possibility for free-text message, incoming computerized reports can be filtered, mapped and used for early warning systems, syndromic surveillance, and continuous surveillance and research. Some difficulties are to involve and inform the broader public, to achieve good geographic coverage, GDPR issues, staff resources to respond and give feedback when report numbers explode, as well as poor reporting of small or cryptic species. Seasonality and other issues such as advertising efforts or targeted surveillance projects can bias reporting, which needs to be considered when assessing the results of incoming reports. Improving the surveillance can be to have dedicated reporters in each area, and for certain species, finding people or groups with specific species or wildlife interest, researchers, and maybe best, well-established organisations for hunting, birding, or wildlife rehabilitation to cooperate with, for mutual benefits. The number of online reports has increased over the years, and the next step is to give continuous feedback by publishing the input online in user-friendly graphic “dashboards” to visualize results from reports and necropsied submitted cases.



Mini-slide Presentation Abstracts

From Event-Based Surveillance to Active Search Protocols: How to Strengthen Wildlife Surveillance in Different Contexts. Experience of SAGIR National Wildlife Disease Surveillance Network

Name(s): **S. Desvaux**[1], Payne A[2]., E. Faure[3], P. Chaigneau[3], Hivert.L[2]., Cardoso O[2]., Van De Wiele A[4]., Chollet J.Y[4]., A. Decors[2]

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SAGIR is a participatory network dedicated to wildlife disease surveillance in France, organising an event-based surveillance which aims at detecting the main causes of wildlife mortality (Decors et al., 2015). This generalist surveillance network relies mostly on the detection and the collection of dead or dying animals in order to diagnose the cause of mortality (morbidity). However, event-based surveillance does not always allow to detect, follow or confirm the absence of a specific disease. To do so, we had to strengthen the surveillance in some wildlife sub-populations using different approaches.

Firstly, without any impact on field activity, systematic analysis of collected samples can be organised (e.g. every wild boar collected by SAGIR is now tested for African Swine Fever (ASF)). Other ways to strengthen the surveillance are to increase the collection and/or the detection of carcasses. This can be achieved by lifting some collection restrictions. Thus, road-killed animals, normally not collected by SAGIR, may be targeted for some epidemiological reasons. We can also ask the network to collect carcasses even if the mortality is not identified as abnormal (e.g. for avian influenza surveillance, dead swans are collected from the first individual detected). To increase detection, we have been mobilising observers which usually do not contribute to our network but have a good knowledge of their territories and their species and can probably identify unusual events more easily (foresters, fishers, naturalist associations etc.). So far, we have not mobilized public, to avoid being overloaded by mortality reports that do not fit with our criteria for collection.

Another option to increase detection was to develop dead wild animal active search protocols, involving either volunteers (e.g. patrols by volunteer hunters for ASF surveillance at the border with Belgium in 2018) or professionals specifically contracted (e.g. carcass detection by trained dogs). Active search protocols allow the measurement or evaluation of the surveillance effort.

A Prioritisation Process to Implement Surveillance of Wildlife Pathogens

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The surveillance of wildlife diseases is generally constrained by human and material resources available to collect and analyse samples. Identifying species and diseases to be monitored in priority is necessary. However, several, potentially conflicting, prioritisation rules may be applied. Surveillance may focus on remarkable species, zoonotic pathogens, diseases transmissible to livestock or threatening endangered species. Each wildlife management and health surveillance actor has his own decision rules, which leads to inconsistent methods and field actions in time and place.

Here we present the ongoing development of a prioritization method for couples of species and diseases to monitor in French metropolitan protected areas. Following principles applied in livestock (e.g. Discontools), we build a database including key information on wild-living species, diseases and their relationships. Each disease and species is described by scores on several criteria, concerning legal status, conservation and health issues. A ranking of disease-species pairs is obtained by combining scores of all weighted criteria.

The method is designed to be applied either at large scale or locally in each area. It involves the necessary commitment of all stakeholders involved in human health, animal health and wildlife conservation. Starting from the list of species and diseases that are locally relevant, including diseases at risk of introduction, the first step is to weight each criteria, considering local situation and priorities, to obtain a first list of diseases and species to monitor. Then a discussion among stakeholders will allow them to agree on a final panel. The database and process should be easily updated to be efficient in a long-term perspective.

The method will be tested in 2022 in the Pyrenees National Park, before being extended to other protected areas. The use of a common method among protected areas should result in an improved surveillance network in French protected areas.

Hunting: a Valuable Support for the Monitoring of Avian Influenza in Wild Birds

Name(s): Tiziana Trogu[1], Mario Chiari[2], Monica Cerioli[1], Marco Farioli[2], Sabrina Canziani[1], Davide Lelli[1], Enrica Sozzi[1], Ana Moreno[1], **Antonio Lavazza**[1]*

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The European situation about highly pathogenic avian influenza (HPAI) is constantly evolving. The circulation of avian influenza (AI) viruses among wild birds, along with their great capacity for mutation and adaptation, emphasises the importance of continuous monitoring in avian reservoir species. In Italy, a national surveillance plan is in place in poultry and game birds farms, and in wild birds. We recently implemented it in the areas of highest risk of Lombardy, with the sampling of wild duck faeces within protected areas. In addition, at the end of 2020, to further increase the efficiency of monitoring in identifying viral introductions, sampling of wild birds shot during hunting was activated in eleven sites in high-risk areas distributed in four provinces (Brescia, Cremona, Mantua, Pavia). Hunters involved in the project were trained and then supplied with swabs, test tubes and recording sheets for sampling. A total of 156 faecal swabs were collected in January respectively from six different species of anseriformes, in particular 62 common teal (*Anas crecca*) and 63 mallards (*Anas platyrynchos*). After the hunting season and till the end of August, to intercept incursions and subsequent spread of the virus during the non-migratory period, hunters collected every 10 days wild duck faeces within risk-based selected grounds/areas. Specific Real Time RT-PCR to detect AI was performed on these samples, which resulted all negative, as expected considering that no AI positive cases in domestic and wild birds have been detected during the last year in Lombardy.

This type of monitoring, based on the active contribution of hunters, represents a fundamental support and fully integrates with the active surveillance of influenza viruses performed by official authorities. The involvement of hunters can therefore help in identifying the presence of the AI viruses at a very early stage in the potential bird reservoirs and clarifying their epidemiology and distribution.

Hard Data from Soft Sources: Birdwatchers Solve a Herring Mystery

Name: **Frederick A. Leighton**

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In November 2016, large numbers of dead and dying Atlantic Herring (*Clupea harengus*) were found on several beaches in SW Nova Scotia, Canada. The responsible government agencies immediately collected samples and engaged laboratories to assess possible causes, but they did not have the regional personnel and resources required to determine the location(s), extent, magnitude or duration of the mortality event. The author attempted to gather these data on their behalf by engaging bird watchers in the region who frequently visited coastal habitats. These birdwatchers were contacted through the Facebook page of the Nova Scotia Bird Society and the additional social networks of its members. Participants were asked to observe whether or not they saw dead herring on the beaches they visited in the region and to send the author their observations (yes or no) with date, time and location, by email. Twenty-six citizen scientists participated, and many maintained regular, sometimes daily, vigils in winter weather until the event ended in the first week of January 2017. A total of 123 reports were submitted. From these field data, three, and only three, affected areas were clearly delineated, as was the duration and termination of the event at each, on different dates. These data were essential to making estimates of total mortality and assessment of cause, none of which would have been possible with government agency resources alone. The event is fully described here: https://static1.squarespace.com/static/526023e0e4b01b05c602a5d6/t/5a6f1e6a71c10beb5b40e6e3/1517231758748/RuralDeliveryherring.pdf

Monitoring Rat Nuisance on National Scale through an App: the Rat Monitor

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Knowledge about (changes in) the rat population size is important for pest management and in various fields of research, e.g. public health (i.e. rat-borne zoönoses) or rodenticide-related research. Rat nuisance reports can be a proxy for the rat population size. However, in the Netherlands, no central registry of rat nuisance in the Netherlands is present. This triggered the collaboration of various (research) institutes, branch associations, NGOs and municipal pest control contractors to explore the combined needs and opportunities in the field of rat monitoring. This resulted in the development of an interactive website (useable as an app): the Rat monitor (www.rattenmonitor.nl), in which pest control contractors can report sites with rat nuisance. These are anonymously shown on neighborhood level on a public map.

Though the collaboration between the diverse partners is successful, it proved to be challenging to engage the community of pest control contractors, as for now, no direct benefits, nor obligation is present. Recent shifting the lead for promotion of the app from RIVM to branch associations will hopefully help. The reporting system is very easy and quick to use, and users can download their own reports for administration. One of the limitations is that absence-measurements in neighborhoods cannot be registered, complicating the interpretation of neighborhoods without nuisance reports. Furthermore, it may be difficult to distinguish between increases in reports due to increased rat populations, or due to increased participants.

Lessons learned/future recommendations: participation of the majority of the large pest control companies had been confirmed verbally beforehand, but the current situation shows it is better to have this in written form.

Development of the app was complicated due to unclear responsibilities regarding finance and content and due to different project management styles (agile vs an agreed set of requirements). Having an experienced person “in between” the content-side and the development-side, was worth the investment.

Wildlife Health Surveillance Program in Norway (ViltHOP)

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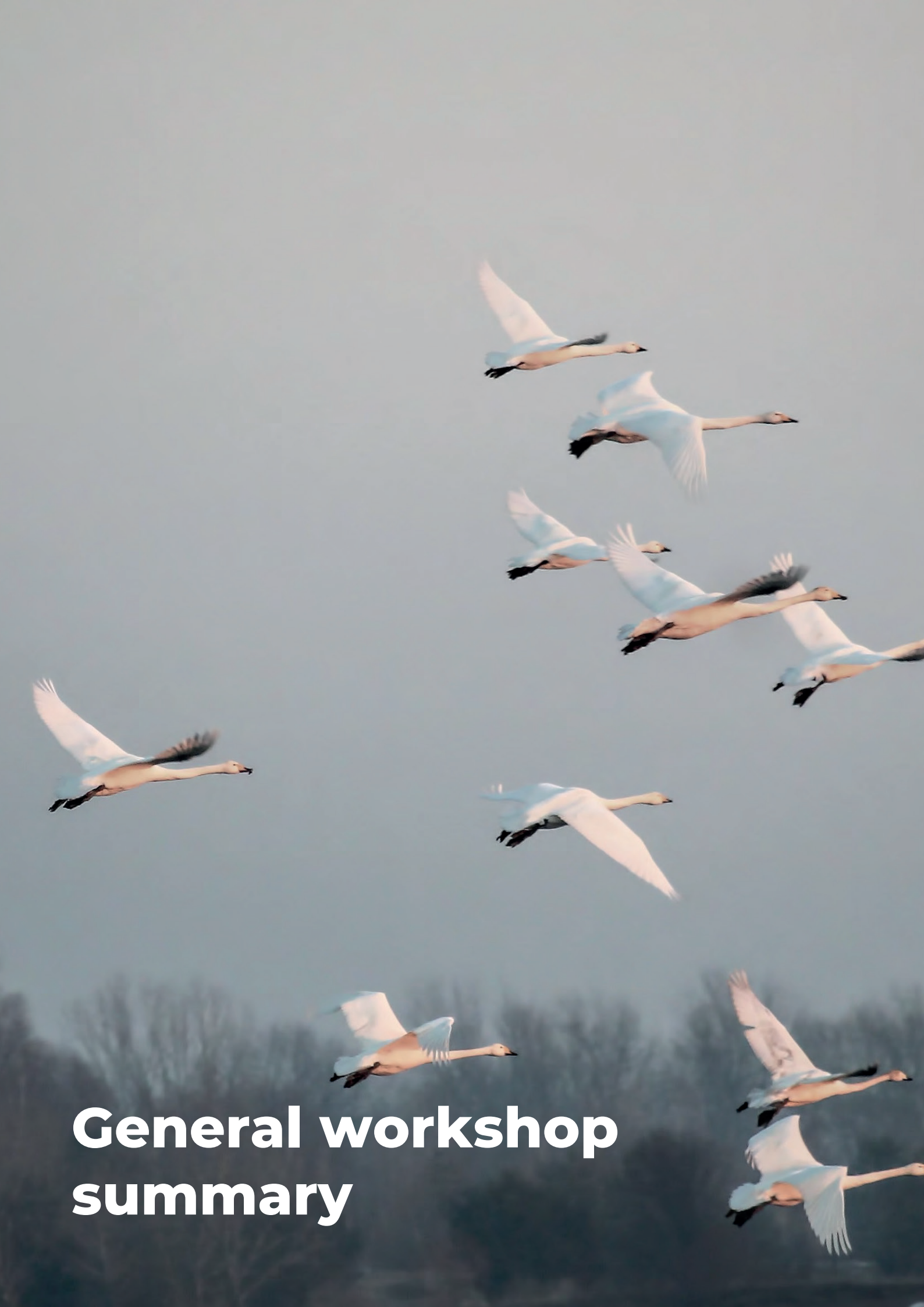
Norwegian wildlife has traditionally been considered healthy, especially compared to wildlife in southern Europe, partly due to harsh winters in the northern hemisphere that impede the survival and development of infectious diseases. This fortunate situation, however, changed drastically in 2016, by the detection of CWD in Norwegian Cervids.

Around 1995, after decades of increase in Cervid population densities, Norwegian veterinary- and wildlife management authorities realized the need for access to systematic health data from Cervids. Hence, the Health Surveillance Program for Cervids (HOP) was initiated in 1998, including muskox (*Ovibos moschatus*) in 2004. Based on the useful experiences from HOP, the program was expanded to apply to all wild species in 2020, and thus changed its name to Wildlife Health Surveillance Program (ViltHOP).

Cervids, mountain hares (*Lepus timidus*) and carnivores are monitored by systematic surveys of diagnostic samples collected by hunters, post-mortem examinations and by analysing population data from the national Cervid Register. Non-infectious diseases, transfer of infectious diseases between wildlife and livestock, as well as the significance of wildlife as reservoirs for infections that can be transmitted to humans (zoonoses), are the main areas of focus. Collection and storage of serum samples from captured Cervids is also an important part of ViltHOP.

ViltHOP covers the whole mainland Norway and Svalbard and is operated by the Norwegian Veterinary Institute. ViltHOP is funded by the Norwegian Environment Agency and these funds, about 400 000 EUR/year, derive from compulsory fees for hunting permits.

HOP/ViltHOP has contributed to the publication of about 100 scientific papers about wildlife health and CWD was actually detected in a wild reindeer in Norway in 2016 through the activity of HOP.



General workshop summary

Although a wide range of partner communities and initiatives were presented, they had several aspects in common. Based on these commonalities, the main advantages and limitations of expanding the field network of wildlife health surveillance (WHS) along with general recommendations for successful partnerships are summarized below.

Advantages:

- Access to otherwise unavailable samples and data (e.g. increased spatio-temporal and species coverage, access to restricted or inaccessible areas; access to complementary types of knowledge)
- Opportunities for mutual learning and consolidation of complementary knowledge and expertise
- Efficient use of resources
- Empowers citizens and other partners to engage in issues of concern for them and become direct actors for biodiversity conservation
- Can increase or renew trust of citizens and partners in science and management decisions
- Access for scientists to new channels through which to disseminate information

Limitations:

- Objectives and priorities of partners may not be aligned or may even conflict with your own
- Partners have variable levels of expertise (e.g. species identification, sample collection)
- Training is needed for quality assurance, harmonisation of sample and data collection and to minimize biosafety risks
- Data may need to be validated
- Potential bias in data need to be identified and considered
- Providing timely feedback and maintaining motivation, long-term participation and program sustainability across partnerships can be challenging

Lessons learned and recommendations:

Partner with other initiatives to increase the power and scope of your WHS scheme

- Pair with existing monitoring schemes (e.g. species abundance and distribution, systematic surveillance) to integrate disease surveillance and wildlife population monitoring and control for reporting bias based on variation in observer effort, expertise and knowledge.
- Learn and borrow from initiatives in other disciplines (e.g. utilize available resources on best practice for conducting citizen science)

Build mutually beneficial partnerships based on trust and respect

- Be open to and incorporate other types of knowledge (e.g. traditional knowledge); trust partner experience to help identify abnormal events and trends
- Communicate program purpose early, frequently and proactively to build trust and recruit individuals from the target community
- Show interest in your partner community ('swap spectacles'); understand and address partner's needs, concerns, priorities, goals, motivations and incentives
- Ensure goals and interests of field network partners can be aligned with yours
- Highlight how you can make your partner's job easier by partnering with you
- Engage a local contact to facilitate community participation
- Manage expectations; have clear guidelines/messaging on what you can and cannot provide for your partners and have realistic expectations of what your partners can provide for you

Cooperative or consultative WHS can increase engagement and success

- Co-design your WHS programme with your field network partner to be able to co-solve problems, and include partners in funding proposals
- Co-develop sampling strategies to ensure feasible, reliable and acceptable protocols
- Validate your results and conclusions with your partnering community and offer co-authorship or acknowledgement as appropriate

Be inclusive to increase participation and coverage

- Offer different levels of involvement for broader and more flexible participation (e.g. entry level may be opportunistic reporting)
- Consider targeting certain groups/areas to encourage diverse representation
- Provide alternate ways to report for those without digital access (e.g. telephone hot-line)

Dedicate resources to maintain partner engagement and motivation

- Tailor programme outputs and communication of results to maintain engagement
- Provide relevant incentives e.g. expertise, material support, scientific/veterinary support, training, consultation

Training is a necessary component for safe and successful partnerships

- Provide standard operating procedures (SOPs) for safe, reliable, and harmonised sample and data collection and transport, and train partners how to use them
- Training can be made more accessible and efficient using a variety of delivery platforms e.g. on-line videos, through a local facilitator

Regular and effective communication is essential for success

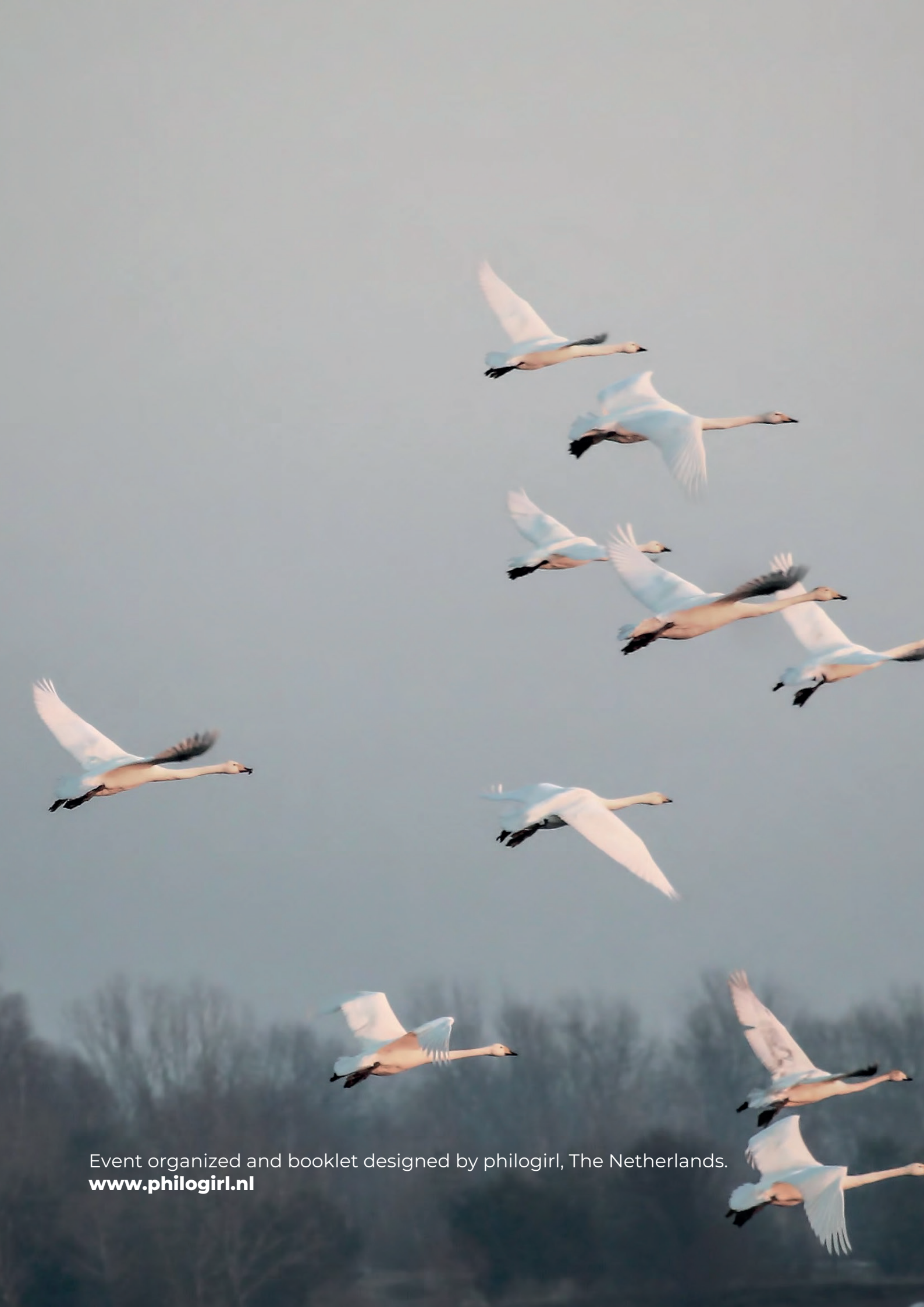
- Establish regular opportunities for communication e.g. bi-annual or annual meetings
- Include project management in your budget to provide resources to support regular communication
- Employ careful and consistent communication that also takes partners' concerns and sensitivities into account
- Establish a communication protocol with all partners involved so that the right expert answers the right questions to ensure consistent and accurate messaging
- Use a variety of communication avenues for flexible and wide-reaching communication

Plan to maximize programme outputs

- Translate WHS results into a range of outputs to address different purposes (e.g. feedback to partner community vs informing policy)
- Systematise and coordinate all sample and data collection and maintain an archive to enable multi-purpose use by all partners

Plan for long-term sustainability of your partnership

- Succession planning of people, especially for coordinators, is important to create continuity in the programme
- Similarly, succession planning of short-term projects is important to continue relationships with partners and create continuity in the long-term WHS program
- Incorporate schools in your programs to build capacity for future researchers/partners



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