ROYAL BELGIAN INSTITUTE OF NATURAL SCIENCES
www.**naturalsciences**.be
E. R.: **Patricia Supply-** 29 Rue Vautier - 1000 BRUSSELS

2020 ANNUAL REPORT

ROYAL BELGIAN INSTITUTE OF NATURAL SCIENCES

museum

CONTENTS

FOREWORD 1

2020 AT A GLANCE 2

WORK GOES ON FOR AN INSTITUTE IN LOCKDOWN 6

THE SCIENCE BEHIND OUR LIVING PLANET 8

RESEARCH 11

12 A FOCUS ON OUR PLANET'S WEALTH OF BIODIVERSITY

15 ONE PLANET: ONE HEALTH

18 STOPPING THE SPREAD: INVASIVE SPECIES

21 YOUR RESEARCH NEEDS YOU!

22 TROUBLED WATERS: FRESHWATER FISHERIES AND BIODIVERSITY IN AFRICA

24 WHAT'S ON THE MENU?

25 TWISTS IN THE TALE OF OUR FOUR-LEGGED FRIENDS

26 WHALE, WHALE, WHALE!

28 KEEPING AN EYE ON OUR SEAS AND OCEANS

33 COLD CASES REOPENED

COLLECTIONS 37

38 OUR COLLECTION GETS DIGITAL

41 THE ETHICAL QUESTIONS AROUND HUMAN REMAINS

PUBLIC 43

44 A NEW GALLERY AND A "NEW NORMAL"

48 MAKING OURSELVES #ATHOME

50 A TIMELY RETHINK OF OUR EDUCATIONAL OFFER

FIGURES 53

54 FINANCES

56 STAFF

59 ENVIRONMENT

60 RESEARCH

62 LIBRARY AND COLLECTIONS

64 MUSEUM

66 PRESS AND INTERNET

THE RBINS IN BRIEF 68

ORGANISATION 69

FOREWORD

There is no doubt that 2020 can be labelled an eventful year. For many of us, it is one that will be etched in the memory for a long time to come: the year in which social life came to a virtual standstill under the pressure of a virus. What an effort it took, to greet each other without touching, with one-and-a-half metres distance between us, each armed with our masks and hand sanitiser, resisting the habit of shaking hands. How often we sighed, at each increase in the infection rate. It often meant the much-welcomed relaxations in the law were pushed back in order to be replaced by new restrictive measures, but each time followed by the realisation of the urgent need to curb the serious consequences of the virus for public health. How difficult it was, to find the right balance between work and home life, with teleworking imposed on us.

And yet, looking back on this corona year, it is clear that our Institute, thanks in particular to the adaptability of our staff, was more than resilient under these exceptional circumstances. Despite 14 weeks of closure and the restriction of visitor numbers, our Museum nonetheless attracted 207,000 visitors: that is still 60% of the numbers we had in a very successful 2019. The opening of our new Living Planet gallery in September, as well as the much-appreciated and thus extended temporary Antarctica exhibition, certainly helped ensure this relative success.

With our online activities under the name #NaturalsciencesAtHome , many families also found their way to our Museum from their own living rooms during lockdown. And even if we were really missing school groups in our galleries, the educational team brought their workshops right into the classrooms. 'Museum on delivery', as it were.

It was not only the opening of Living Planet that underlined the need for a more harmonious and sustainable relationship with nature. The WWF's Living Planet Report Belgium, of which the RBINS was one of the prominent partners, and the "Together for Biodiversity" movement, in which our Institute played a pioneering role, also sent out the same message, which was more crucial than ever in corona times.

Although many scientific missions had to be postponed, the level of scientific publications was guaranteed. After the first lockdown, the essential lab and collection work continued in corona-safe conditions.

Financially, our Institute was able to limit the corona impact quite well by controlling costs, but also by means of a compensation payment - received from our Federal State Secretary - for part of the lost Museum income. As a result, our organisation is emerging from this health crisis relatively unscathed, which will undoubtedly make it less vulnerable in the post-corona era. And that is a significant achievement. After all, the pandemic has accelerated many future trends and it will be important to respond adequately to this from a strategic point of view.

A great deal of time was therefore invested last year in making our strategic plan more concrete, centred around our areas of excellence and attuned to the evolving expectations of our stakeholders. In this way, we aim to anchor the financially balanced and sustainable position of our organisation within the federal landscape and continue to face the numerous challenges ahead with confidence.

Patricia Supply,
General Director a. i.

2020
AT A GLANCE

21.01

Our citizen-science project XperiBIRD.be wins a prize from the National Fund for Scientific Research. With XperiBIRD, students can observe life in a bird's nest thanks to a camera and a nanocomputer installed in the nesting box.

27.01

Three minutes on camera to inform the general public about her work in carpology: the study of seeds to reconstruct the history of plants and humans? Our archaeobotanist Sidonie Preiss stepped up to the challenge, as part of "Science Figured Out".

11.02

Pulled by tugboats, the future Belgian research vessel Belgica was launched for the first time in Vigo, Spain, in the presence of a large Belgian delegation from the Navy, Belspo and our Institute.

15.02

Our colleague Isa Schön receives a Whitman grant from the Marine Biological Laboratory, Woods Hole, USA, for her research on the theme: "Further development of ostracods as model organisms".

THE UNIVERSITY OF CHICAGO
MARINE BIOLOGICAL LABORATORY

22.02

More and more seals are present on our beaches during confinement, attracting public attention. Our scientists contribute to the dissemination of information and advice to protect them from unwelcome encounters.

24.02

The Institute has been conducting joint entomological research with South-East Asian countries for years. The video "Chu Yang Sin Expedition - Discovering new insect species in Vietnam" is available on our YouTube channel.

12.03

Caroline Laforest, archaeo-anthropologist, shares her working and analysis methods used on the protohistoric and medieval burials of the Grognon during discovery workshops on archaeology-related disciplines at the University of Namur.

14.03

First confinement: the Museum closes and takes advantage of the opportunity to prepare for a safe reopening (online ticketing, tour route, etc.). On 20 May, a masked iguanodon welcomes the first visitors by setting a good example!

17.03

The Institute is contributing to the fight against the COVID-19 pandemic. Our staff donate masks and gloves from our laboratories to the White and Yellow Cross.

03.04

The fifteenth year of our "Falcons for Everyone" operation: no observation point this year, but the spectacle of three livestreams from nests, the blog and social networks captivate the confined visitors, drawn to this window on living nature.

15.04

During one of its observation flights, our plane flies over the entire Belgian coastline and films rare images of beaches that are almost empty due to health restrictions.

19.04

Researchers are reconstructing historical changes in the African landscape by studying the evolutionary history of the African catfish. They have obtained unprecedented dates for geological and climatological events, such as periods of severe drought.

20.05

Flipposaurus, album 299 of the Jommeke series, is out in bookshops. It takes place for the most part at the Museum and was the subject of an editorial and scientific collaboration between the scriptwriter, the illustrator and our palaeontologists.

28.05

Our colleague Thierry Smith is elected member of the Académie Royale des Sciences d'Outre-Mer for his research and paleontological expeditions in India, China and Africa.

29.06

Four new young white storks in the Zwin nature reserve are equipped with transmitters. They provide, among other things, information on migration routes, wintering areas and the dangers faced by the storks.

28.07

Paleontologists describe a new species and a new genus. It is a large owl that killed medium-sized mammals not with its beak but with its feet and claws, about 55 million years ago.

11.08

In the middle of the COVID-19 crisis, a small team from the Institute, in collaboration with Elasmobranch Research Belgium, uncover four 9-million-year-old whale skeletons at a hotspot in Antwerp: the construction site of a new wing of the AZ Monica hospital.

15.08

Strange but artistic orange splotches and strings are observed in the North Sea. This is an impressive bloom of *Noctiluca* plankton, known as sea sparkle, probably due to the heat and lack of waves.

08.09

Paleontologists describe a new dinosaur species from China that dug burrows. It is the most primitive species of ornithopod dinosaurs, a group to which the Bernissart iguanodons belong.

11.09

Nature is not in lockdown... and neither is the Museum! The new permanent Living Planet gallery opens with more than 800 specimens, numerous projections and animations attracting many visitors to the opening.

12.09

At the Walloon Heritage Days, visitors explore the role of plants and animals in the life of the Neolithic communities of Spiennes, a UNESCO site thanks to an outdoor exhibition and the activities of our Archaeosciences unit.

25.09

Neanderthals inherited the Y chromosome from modern humans more than 100,000 years ago. DNA from a Neanderthal fossil from Spy was used for this study published in the journal *Science*.

29.09

The Royal Belgian Institute of Natural Sciences becomes the second official member and the first natural history museum in the world to join the #UnitedforBiodiversity Global Coalition.

01.10

The website of the National Focal Point of the Convention on Biological Diversity, which is part of our Institute, is online. The Focal Point is the official Belgian contact for all matters related to the work of the Convention.

16.10

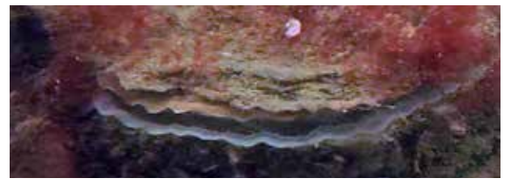
At the Lifewatch meeting, BopCo presents a demonstration video on species identification by DNA, using a case study from when the Flemish TV channel VRT requested identification of bushmeat. The video is on our YouTube channel.

26.10

On the occasion of his visit to the Institute, the newly appointed Secretary of State for Science Policy, Thomas Dermine, expresses his interest in and commitment to our projects and is very impressed by the new Living Planet gallery.

24.11

No tasting on the programme of the first Belgian Flat Oyster Day, but a response to the increased focus on the restoration of oyster beds and oyster aquaculture with all stakeholders.



01.12

After a second five-week lockdown, the Museum reopens. This situation is exceptional, as the Museum has only been closed for eight weeks since its creation, when it was renovated and the Dinosaur Gallery opened in 2007.

02.12

Arkhane, the new Jurassic predator, is extending his stay with us until spring 2021. To celebrate this, our teams have produced three short films to help you get to know him better, which you can watch on our YouTube channel.

03.12

Three exploratory drillings are starting to evaluate the geothermal feasibility of the Paul-Henri Spaak European building, but also that, in the near future, of heating or cooling our buildings by geothermal energy.

07.12

Our future Research Vessel Belgica is launched at the Vigo shipyard in Spain. No more tugboats: it is now powered by its own engines.

WORK GOES ON FOR AN INSTITUTE IN LOCKDOWN

For our Institute, as for many of our visitors and colleagues, the COVID-19 pandemic brought everything into perspective about our values and priorities. *The huge threat to the health of our staff and the challenges of physical distancing reminded us of the importance of our teamwork and human contact. It also raised big questions about how our work would continue in the unpredictable context of the pandemic, at a time when the importance of research into natural sciences has never been clearer.*

Back at the very beginning of the year, on 8 January 2020, Chinese scientists identified the new coronavirus SARS-CoV-2 as the cause of a string of cases of pneumonia. At the time, few imagined the potential impact of this example of how human interaction with the natural world can put our own lives at risk. Within a few weeks, a pandemic was declared.

THE "NEW NORMAL"

And so in the middle of March, from one day to the next, our Institute, like all workplaces in Belgium, closed its doors. The labs fell silent. Our collections lay untouched. Research trips were cancelled. While our focus turned to ensuring the health of the staff, there was also a strong will emerging to continue our work and research. But with all 400 colleagues confined to their homes, how could we achieve this?

For many of our researchers, this meant putting lab work on hold and focusing on writing up results. Ensuring our work is communicated in scientific publications takes time and confinement meant planning our time differently to make the most of the opportunity to write. But as the year drew on, it was clear that the labs would have to reopen somehow. Particularly urgent was the thesis work of the students supervised by our team: some had enough data to present or managed to adapt to a more theoretical approach, but for others a return to the lab was necessary. Arrangements were made for them to be able to come to the Institute to work in isolation, in full respect of all safety precautions.

One group that never stopped operating during confinement was our ECOCHEM team. They play a key role in monitoring the environmental quality of ecosystems through analyses that rely on the use of our accredited labs in Ostend. Our team quickly set up a plan to ensure colleagues could access the labs individually, and were alternatingly present in the labs while colleagues processed their data from home or office, putting safety at the forefront. Fortunately, the lab spaces were equipped with hand sanitiser and gloves, but also well ventilated and with air conditioning, as well as spaces divided up to let people work in isolation. The result was that the team actually had a particularly productive year, with the team expressing satisfaction that they were able to continue their analyses despite the conditions.

TRAVEL RESTRICTIONS TAKE HOLD

For a team of researchers that is used to travelling, coronavirus measures meant big changes. And it was not only fieldwork trips that were cancelled but also international meetings with colleagues that shifted online and visits to other collections that had to be adapted. One colleague visiting our Institute from Tanzania was unable to return home and was blocked in a hotel room in Brussels for several months - fortunately our team was able to make sure he had everything he needed and could work comfortably from his hotel.

In other cases too, it was clear that working only from home was not going to be an option. Our work to monitor the North Sea includes management of an aircraft and oceanographic research vessel, the RV Belgica. While both had to pause their work initially, our teams were quick to find solutions. For the Belgica this meant close cooperation with the Belgian Ministry of Defence, with whom the vessel is jointly operated. By the end of June, a common strategy of screening, quarantining and testing was in place. Since the Belgica has shared sleeping quarters, its work in June and July was limited to day campaigns only, returning to shore in the evening. Meanwhile the construction of the Belgica's replacement continued in Vigo, Spain: the planned delivery of the vessel in autumn 2020 was delayed as the shipyard closed under coronavirus rules.

Getting our aircraft back in the skies was even more challenging: it requires a pilot and co-pilot sitting shoulder-to-shoulder, as well as two console operators in what is naturally a confined space. For the first month of the confinement, it stayed on the ground. But part of its work is to monitor accidents at sea, and with ships' crews under additional pressure the risk was increasing, so the aircraft remained on call. A working group was set up, drawing on international good

practices to ensure safety and prevention on board. That meant that in May, flights were able to resume with the strategy in place which worked according to the federal risk levels. The numbers of pilots and operators were adjusted accordingly and the aircraft was disinfected in between flights.

OUR COLLECTIONS UNDER LOCKDOWN

For our collections, research visits were cancelled and donations also slowed with donors unable to come to the Institute. And after making significant progress in our quality management, 2020 should have been the year that we established a disaster plan: a strategic document to detail how we prevent and prepare for threats to our collections such as issues with security, flooding and fire, as well as how we react in case of emergency to protect and eventually recover valuable collections. Of course, the emergency conditions imposed by the pandemic meant that it was not possible to access the collections and so this work had to be put on hold.

One opportunity that did arise during the confinement was regarding digitisation. Collection managers were able to turn their attention to ongoing efforts to digitise our specimens, as part of our broader strategy to open up access to our collections as part of the European Research Infrastructure Consortium, DiSSCo. For recent invertebrates, our team was able to digitise a lot of information related to sampling location of the specimens which is now all available online. To access the Institute's micro-CT scanners to produce high definition images of specimens, shifts were organised so researchers could book a few days of scanning in isolation before continuing with the follow-up from home. The use of remote applications meant they could control their workstations at the Institute from the comfort of their laptop.

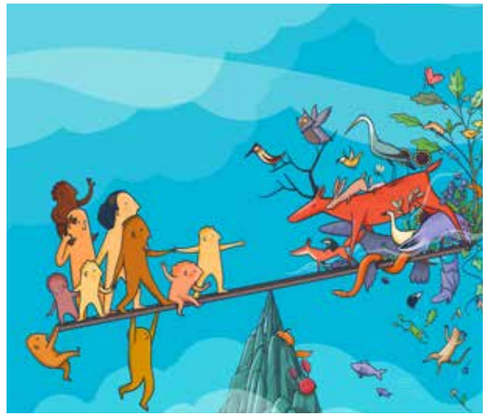
REACHING OUT ONLINE

Confinement conditions also brought about new possibilities in terms of how we communicated our research work in 2020. With face-to-face conferences cancelled, we organised webinars that were able to bring in diverse audiences for our work. One good example was our stakeholder events for GeoConnect^{3}d, our GeoERA project that focuses on opening up geological information for policy support and subsurface management. The June workshops aiming to exchange with stakeholders about the preliminary results of the project moved online, broadcasting presentations widely and making the most of live polling tools to gather feedback from participants. In the end, several hundred people from over 30 countries joined the sessions, demonstrating an impact and added value to the project that could not have been achieved in a traditional meeting.

And if it was tricky for our researchers to communicate about their work this year, imagine the scale of the challenge that our Museum team faced! The story of the Museum under confinement and the opening of our new Living Planet gallery is told on pages 44-47. It shows that the flexibility and resourcefulness that our scientists demonstrated this year is clearly present throughout the staff at the Institute.

THE SCIENCE BEHIND OUR LIVING PLANET

Every year our Institute works to study and communicate on the incredible biodiversity of the natural world around us. *But with the opening of the Living Planet gallery finally completing the renovation of our Museum's permanent halls, 2020 was a year that shone a spotlight on the latest advances in our biodiversity work across a broad range of species, as you will discover in this year's report.*



PAGE 12: This year our Institute took a stand for action on biodiversity: #EnsemblePourlaBiodiversité #SamenVoorBiodiversiteit

PAGE 15: Could this horseshoe bat have been responsible for transmitting the virus behind COVID-19 to a human?

PAGE 19: A little snail that could be cause for concern after it was found in a Vienna zoo

PAGE 21: Are you the missing piece of the puzzle in our next research project?

PAGE 22: What's behind the decline in flamingo numbers on Lake Manyara, Tanzania?

PAGE 24: A protozoa that tells an unsavoury story about hygiene in medieval Brussels

PAGE 25: It turns out humans' relationship with our canine companions goes back longer than we thought.

PAGE 27: This whale from the Pliocene is named after the Antwerpenaar who discovered it

PAGE 28: How following elephant seals can help us protect Antarctic biodiversity

PAGE 35: Our North Sea mussels contain years of data about the changing climate

12 **A FOCUS ON OUR PLANET'S WEALTH OF BIODIVERSITY**
A groundbreaking index for Belgian biodiversity
Belgium unites to sound the alarm on biodiversity
Cities on the rise: species in decline
Return of the grasshoppers
Untangling millipedes in South East Asia
Two new Thai geckos in unexpected places

15 **ONE PLANET: ONE HEALTH**
What can we learn from COVID-19?
Earlier evidence from Ebola
Bird ringing as an early warning system
The time for policy action is now

18 **STOPPING THE SPREAD: INVASIVE SPECIES**
DNA barcodes to spot unwelcome guests
Austrian zoo hosts a snail's European debut
Learning to live with a voracious predator
Spreading the word, not the species

21 **YOUR RESEARCH NEEDS YOU!**

22 **TROUBLED WATERS:**
FRESHWATER FISHERIES AND BIODIVERSITY IN AFRICA
Biodiversity under threat on Lake Manyara
What's worrying fishers on Lake Tanganyika?

24 **WHAT'S ON THE MENU?**
Fish, fresh from the Sahara
Chronic diarrhoea in downtown Brussels

25 **TWISTS IN THE TALE OF OUR FOUR-LEGGED FRIENDS**
10,000 years of canine diversity
Tooth marks that tell an even older story

26 **WHALE, WHALE, WHALE!**
An early sperm whale with a distinctive feature
Antwerp's latest puzzle piece in whale evolution
A new rorqual ancestor found in Wommelgem

28 **KEEPING AN EYE ON OUR SEAS AND OCEANS**
Protecting Antarctic species by following their predators
Did air pollution rules contribute to North Sea acidification?
Towards a warning system for foam at sea
Providing a satellite's-eye-view of our coastlines
A North Sea atlas that looks beyond the waves
Sniffing out even more types of air pollution at sea

33 **COLD CASES REOPENED**
Long-awaited family reunion for a lone planthopper
The Caverne X files: Waulsort revisited
Blue mussels hold clues about climate change
Reconstructing the skull of the "little crocodile of Bernissart"
A Roman fallow deer turns out to be a Herstal local

1 RESEARCH

A FOCUS ON OUR PLANET'S WEALTH OF BIODIVERSITY

While Living Planet opened its doors, our researchers continued their tireless work to study this biodiversity. *This year saw some key results in our steady progress to document and draw conclusions about how best to protect the wealth of species, both in Belgium and on the other side of the world.*

A groundbreaking index for Belgian biodiversity

Farmlands, forests, wetlands, open meadows: Belgium may be a small country, but its fragile ecosystems are swarming with life. To protect this biodiversity around us, we have to understand how species populations are changing. The first Living Planet Report Belgium paints this picture very clearly: it is an inventory of biodiversity in Belgium between 1990 and 2018, measuring biodiversity with a new Living Planet Index. And while overall the results show a slight positive trend, the report highlights some stark warnings.

Efforts to protect our biodiversity over the last three decades yielded meagre results: analysing the average change in population size of 283 species, we see just a 0.2% increase each year. In wetlands and natural open environments, conservation projects appear to have been most successful. Farmland, however, has seen a dramatic drop in biodiversity, and Belgian forests have seen bird populations decline in particular.

The partnership behind the report includes our Institute, WWF, Natagora, Natuurpunt and the Belgian Biodiversity Platform, which our Institute also coordinates, alongside more than twenty experts from universities, public institutions and conservation organisations. It provides a solid basis to support action in the field to rebuild our ecosystems, engage the public and spark more sustainable approaches.

Belgium unites to sound the alarm on biodiversity

The launch of the first Living Planet Report did not go unnoticed. A community of over 100 expert organisations from across Belgium came together to call for concrete action from decisionmakers to make biodiversity a priority in the years to come. And as hosts of the National Focal Point on biodiversity, our Institute had a key part to play.

The message from #TogetherForBiodiversity is both unambiguous and scientifically sound: our way of life poses a serious threat to biodiversity. And it is this biodiversity that provides us with so much: from the oxygen in our air to the medicine in our hospitals. Our way out of the COVID-19 pandemic cannot be business as usual. We need a transition to a more sustainable future where healthy ecosystems have a central role.

The strength of this movement is the way it unites scientific heavyweights from across institutional

and community divides: researchers, associations, educators and authorities in Wallonia, Brussels, Flanders and at federal level have all joined forces. And the public response has been massive: the launch video featuring Veerle Baetens and Loïc Nottet was seen by hundreds of thousards. Find out more at www.samenvoorbiodiversiteit.be www.ensemblepourlabiodiversite.be and listen to our EOS podcast.

Cities on the rise: species in decline

For city dwellers in Belgium, the 2020 confinement brought urban wildlife to everyone's attention as traffic noise made way for birdsong. But research at the Institute this year shows that the expansion of urbanised areas is responsible for a decline in species diversity. For a country like Belgium where built-up areas are still on the rise, this suggests that urban planners need to urgently focus on protecting and connecting natural habitats.

Researchers from our Institute worked with UCL, KU Leuven, UGent and UAntwerpen to investigate areas in and around Ghent, Antwerp and Brussels, comparing across and within rural, semi-urban and highly urbanised areas. Sampling with safety nets and traps revealed how abundant and species-rich the invertebrate groups are there, including water fleas, butterflies and snails.

The results, published in *Global Change Biology* showed that more densely built areas have lower numbers of spiders and insects, including 85% fewer butterflies. What is more, expanding urbanised areas also means lower species diversity for most animal groups. We see more of the same species from one urbanised area to the next.

Return of the **grasshoppers**

What's that sound? Just outside of Bruges lie heaths that have been restored over recent years. And if you listen carefully enough, you can hear the results: grasshoppers have made their long-awaited comeback. Conservation work has meant removing forest and soil litter, allowing plants to grow back and letting sheep graze there so that trees and grasses don't dominate the landscape. Several varieties of heather are on the increase, along with the insects that call them home.

Entomologists from our Institute have been sampling the Bruges heaths intensively for insects and other arthropods since 2014 with the help of volunteers. Sixteen species of grasshopper have been found, together with the field cricket *Gryllus campestris* (extinct for decades around Bruges), the centipede *Geophilus easoni* (a recent addition to the Belgian fauna), Ephydridae shore flies, and many species of beetles, ants and spiders. The results were published in

a thesis from a student at the Hogeschool Gent under the supervision of a colleague from the Institute.

The return of grasshoppers and field crickets tells us that heathland recovery and management around Bruges is going in the right direction, and that isolated areas of heath should be connected to ensure even greater biodiversity.

Untangling millipedes in South East Asia

Thailand and Vietnam are hotspots for biodiversity in South East Asia. This year researchers from our Institute made discoveries which reveal even greater species diversity than we had previously thought: from millipedes to geckos.

Our researchers have a longstanding partnership with universities in Thailand and in 2020 their focus was the enigmatic millipede family Pseudospirobolellidae. After joint field work all over Thailand and subsequent morphological and DNA studies, the Thai, Belgian and Danish team discovered no less than 10 species new to science, tripling the number of species in the family, and for which a new genus had to be established. The results were published in *Invertebrate Systematics*.

Another striking millipede discovery this year was strangely familiar. In Central Vietnam, a particularly colourful species of millipede, *Alienostreptus bicoloripes*, was collected and described for the first time by the Institute and an international team in the *European Journal of Taxonomy*. It was particularly notable for its bright colours, appearing very similar to those of another species in Borneo. However, the two species were not closely related.

Two new Thai geckos in unexpected places

Visitors to Thailand's Cha-Am district will have admired its stunning beaches and historic temples. What they might not have noticed is a new species of gecko, one of two described for the first time by our Institute in 2020 in partnership with Thai researchers.

Like its millipedes, Thailand's vertebrates are far from completely inventoried. The two new species belong to the genus *Dixonius*, a group of small geckos living on the ground and among rocks. They are sometimes called leaf-toed geckos because the adhesive pad at the end of their toes resembles a tiny ginkgo leaf.

And the locations of these new species were not exactly remote. The first was on a hill just a few kilometers from Cha-Am beach. The second discovery was in a garden just a few metres from our Thai colleague's office in the city of Ranong. The two new species were described in the scientific journal *Zootaxa*.

ONE PLANET: ONE HEALTH

Never before has the link between animals and human health been made clearer than in the midst of the COVID-19 pandemic. *For an Institute of Natural Sciences, this is a crucial moment to speak out about a subject that is at the very heart of our research and policy work: the importance of biodiversity: for the health of our population and for the health of our planet.*

What can we learn from **COVID-19?**

There is little doubt about it: the source of the COVID-19 pandemic can be traced back to the unhealthy relationship between humans and nature. In a special edition of the University of Antwerp's Coronablog this year, a team of researchers from our Institute and the university's Evolutionary Ecology Group explored what we know about zoonoses: diseases transmitted from animals to humans.

The evidence suggests that the virus responsible for COVID-19 was transmitted to humans by bats, probably via another mammal acting as an intermediary. Although we don't know exactly how the first human was infected with this coronavirus, we do know from genetic analyses that the virus is very similar to coronaviruses known in bats and pangolins. After this one-off contact between animal and human, the coronavirus spread from human to human, similarly to the zoonotic origin and spread of Ebola virus. HIV too has a zoonotic history, since it had a precursor in great apes.

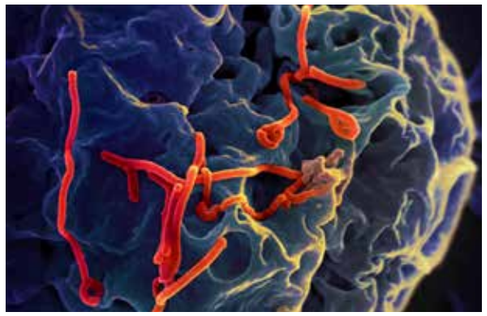
How can we prevent zoonotic outbreaks like this in the future? There is no one-size-fits-all measure that can prevent such outbreaks because the transmission routes of zoonoses are very diverse. In any case, to avoid pandemics like COVID-19, we have to reflect on the ways that humans and wildlife come into contact.

Earlier evidence from **Ebola**

March 2017 saw the outbreak of another zoonotic disease, that spreads less quickly among humans, but is a lot deadlier. When a new virus is found, researchers rely on the study of earlier zoonotic viruses to make predictions about potential strategies to tackle the spread. The Institute has been working closely with Congolese researchers on the 2017 Ebola virus outbreak to understand how patient zero was infected and the results were published in the middle of the current pandemic, in the journal *Emerging Infectious Diseases*.

The team began work around the Likati river in the northern Democratic Republic of the Congo to sample 467 rodents, shrews and bats in the area where it was assumed that the virus was first transmitted to a human. The first patient ate bat meat before falling ill and we know that bats can host Ebola and other similar viruses. For the virus to be passed to humans, we would assume that it would first have been circulating among wildlife. But the mammals sampled showed no signs in their genetic material or antibodies that they had carried the virus.

As such we cannot say for sure how this outbreak started. This type of research is challenging because of the remoteness of the affected regions like Likati and the time it inevitably takes to reach these locations after an outbreak has been reported. What is clear is that investing in increased surveillance of African forest wildlife would help us to be much better prepared for future outbreaks of this particularly devastating disease.



Bird ringing as an **early warning system**

At the end of October 2020, the Belgian Federal Agency for the Safety of the Food Chain contacted the Institute about two sick birds found in the south of the Netherlands, not far from the Belgian border. These birds were carrying the highly pathogenic influenza virus H5N8, causing bird flu. And while the virus was not transmitted to humans this time, there is always a risk, as we remember from the global spread of H5N1 in 2005.

How can the Institute help respond to an outbreak? We coordinate the BeBirds national bird ringing scheme, built up over 90 years, ringing hundreds of thousands of wild birds every year. Its work is crucial in tackling outbreaks thanks to its expertise on bird populations and migration as well as its work on sampling both healthy and ill birds for virological material.

BeBirds was able to provide accurate information to stakeholders at federal and regional levels and the general public on the risks of virus circulation by wild birds, as well as scaling up our sampling work. This meant that for only the second time ever we were able to catch a healthy bird that tested positive for H5N8: an indication that birds can carry the virus without having symptoms. And the network's monitoring work continues, helping to protect the poultry industry and hobbyists from future outbreaks.

The time for **policy action** is now

The warning signs were all there. This was the message of a letter published in *Science* and co-signed by our Institute. Researchers have been highlighting evidence of risk factors for outbreaks of diseases like COVID-19 for decades. We must take action to scale up wildlife monitoring but also to ensure that policy makers manage risks better. This means a shift in mindset about how we see the connection between human health and biodiversity, towards a "One Health" paradigm.

Our Institute's CEBioS programme works on biodiversity conservation linked to sustainable development, as part of, and financed by, the Belgian development cooperation. CEBioS co-signed a report by the United Nations Environment Programme on the link between pandemics and biodiversity and contributed to a paper published by the Flemish public broadcaster VRT. This paper underlined the urgency of international cooperation to work towards resilience: a biosphere that is adaptive to climate, where biodiversity is conserved and economic development happens sustainably. In that spirit, CEBioS was among the founding organisations to co-create a joint strategic framework on 'ecosystem resilience' with 5 environmental NGOs.

The role of the Institute in this cooperation is an important one. As Belgian Federal Minister of Development Cooperation Meryame Kitir acknowledged in her policy statement of November 2020, that the CEBioS programme has acquired a solid reputation in the field of biodiversity conservation, helping to address the "existential threats" we currently face.

STOPPING THE SPREAD: INVASIVE SPECIES

To protect ecosystems on our living planet, our Institute has a key role to play. *As the hosts of Belgium's National Scientific Secretariat on Invasive Alien Species, we support work to prevent and manage the spread of invasive plant and animal species, in line with European law. And in 2020 our researchers made some breakthroughs on this crucial topic.*

DNA barcodes to spot unwelcome guests

Houseplants saw a surge in imports during the confinement in 2020. But among the roots of the exotic plant you ordered, you may find a surprise: flatworms, which are predators of earthworms. As such, they can severely disturb soil ecosystems, posing a serious threat to agriculture. Plus, they are extremely resilient: if they are cut in two, each half can regenerate to create two flatworms.

The federal government contacted the Institute to help identify invasive terrestrial flatworms as part of their work to screen imported plants. Our species identification team, BopCo, put together a series of factsheets as a guide to the DNA identification of the flatworm species that are most invasive in Europe. Identifying these flatworms through DNA analysis can be a challenge because one needs a comprehensive set of DNA sequences of well-identified reference specimens for every species, to allow an identification. For most flatworm genera, however, many species are missing from the DNA reference databases, making it tricky to identify species reliably by DNA sequencing.

The factsheets, launched in 2020, each present one of the most invasive species for Europe, compiling information on its taxonomy and worldwide distribution, as well as giving an indication of how easy it will be to identify using DNA barcoding. The factsheets have shown that there is an urgent need for more comparative DNA barcodes to improve the accuracy of DNA identification.

Austrian zoo hosts **a snail's European debut**

Paropeas achatinaceum might seem an unremarkable snail: small, with a long waxy-looking shell, native to South-East Asia where it feeds on plant materials. And it had never been identified in Europe until recently when it was found in the rainforest pavilion of the Vienna Zoo in Austria, having probably clung to an imported plant on the journey over. What danger could this little mollusc pose?

The RBINS is a partner in the European Alien Species Information Network which maintains an inventory of introduced land snails in Europe. In this context, our researchers, jointly with colleagues from Hungary and the UK, reported in 2020 on the discovery of *Paropeas achatinaceum*. The species belongs to the Achatinidae, a family of land snails that has been reported all over the world. Species include the giant African land snail, the world's most frequently occurring invasive species of snail, that causes severe damage to crops.

Could *Paropeas achatinaceum* become more established in Europe? In greenhouses it undoubtedly can, but as climate change progresses, it may have the potential to reproduce in habitats outside of greenhouses as well, by which it could upset local ecosystems. And this type of threat is on the rise, as a warmer European climate provides a more welcoming environment for exotic species to thrive. This report was published in the journal *Malacologia*.

Learning to live with a **voracious predator**

As if our honeybee populations were not already under enough pressure, the recent appearance of the Asian hornet *Vespa velutina* in our country spelled even more bad news: these hornets actively prey on bees, raiding hives and capturing workers to feed to their young. Our Institute has been working to take stock of data around the hornet's presence in Belgium from its discovery to the end of 2019, published in the journal *Lambillionea*.

Vespa velutina first appeared in southwestern France in 2005, probably accidentally introduced with boxes of Chinese pottery imported by a bonsai producer. From there it colonised the whole of France, as well as parts of Spain, Portugal, Germany and Italy. Its first known appearance in Belgium was in 2011: a male hornet, spotted in a garden. In 2018, numbers increased considerably across the country, leaving only the provinces of Luxembourg and Liège relatively unaffected.

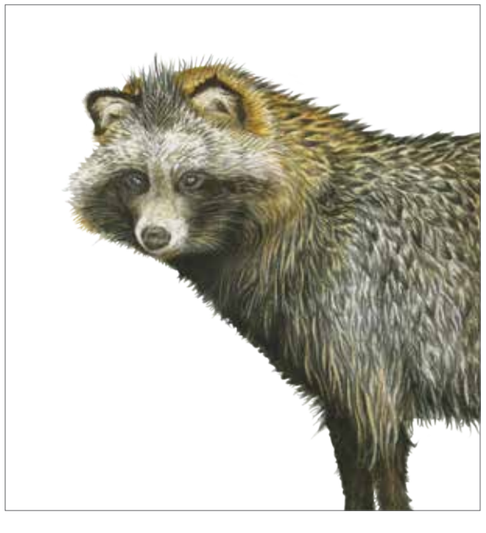
So far all efforts to limit its progress have failed: we now need to find ways to adapt and manage hornet populations to minimise their negative impact on our bees and environment in general. There are insecticide-free solutions: destroying nests and vacuuming up the hornets appear to be successful options, but should of course only be attempted by professionals.

Spreading the word, not the species

How can the public tell the difference between a tropical plant that is legal in Belgium and one that could have severe consequences for our ecosystems? Getting the message out about invasive species is essential if we want to ensure the Belgian population takes action. To keep people informed, the Federal Public Service Health, Food Chain Safety and Environment has scaled up its communication work with the release of a toolkit, thanks to cooperation with our Institute as host of the National Scientific Secretariat on Invasive Alien Species.

The toolkit includes two posters that highlight the fact that among the team at the Institute we have not only skilled researchers but also talented artists. The beautiful illustrations on each poster represent each of the animal and plant species that appear on the European list of species of union concern, prohibited for sale, possession and breeding in Belgium and across the European Union.

As well as the posters, the Institute produced a full information guide that gives detailed descriptions of each plant and animal on the list. For professionals or wildlife enthusiasts, these guides could be the key to identifying Belgium's next big biodiversity threat.



YOUR RESEARCH NEEDS YOU!

What does our Institute have that most research institutes in Belgium don't? The public! *And all over Europe, the role of non-professionals in scientific research is changing. From experienced hobbyists to primary school children, thanks to citizen science, anyone can make an important contribution to natural sciences research.*

Amateur scientists have long played a part in the work of the Institute. Alongside our researchers, around a hundred volunteers are contributing actively to our research, in collaboration with our team. Some are retired scientists themselves, but many are simply enthusiasts with another day job - teachers or photographers that just happen to be passionate about insects, molluscs or fossils. And the added value they bring to the Institute is massive: not only do they collect and identify specimens, enriching our collections, they also author scientific papers, contributing to the Institute's research output.

There is one area of citizen science in particular where the Institute has 90 years of expertise: bird ringing. And as we saw in this issue's article about avian flu on page 16, the work of volunteers in the BeBirds network that we coordinate makes a substantial contribution to policy as well as research. Over 350 bird enthusiasts across Belgium have been trained and certified to capture and ring wild birds, ensuring the quality of the data they collect. The results provide valuable insights into bird populations and how we can preserve species at risk.

These days though, it is not only expert hobbyists who get actively involved in our research. Thanks to projects like Falcons for Everyone, BioBlitz, XperiBIRD and XperiLAB, visitors to the Museum, schoolchildren and other groups can get involved in science projects, whether they are making inventories of the wildlife present in the park around the Institute or setting up webcams in bird boxes to observe nesting blue tits. Citizen science projects are more than just a way to learn about science - they are ways to empower people to be a part of the process, adding real value to the research. The Institute has set up a Citizen Science Working Group to coordinate these activities which take place across every directorate of the organisation and are important to our institutional strategy.

At European level, our Institute also plays an active role in citizen science. In 2020, as a partner in the Citizen Science COST Action, the Institute organised a workshop on inclusiveness. Participants explored how we can ensure that all voices are represented in citizen science projects. There was a particular focus on how to ensure gender inclusiveness with online publishing, harnessing the potential of next-generation crowdsourcing tools. The Institute is also part of EU-Citizen.Science, a platform launched in 2020 that brings together a European community around public involvement in scientific research. At the heart of all the projects in EU-Citizen.Science is the role of the public not only in collecting data, but also in interpreting results and defining the scientific challenges of the future.

TROUBLED WATERS:
FRESHWATER FISHERIES AND BIODIVERSITY IN AFRICA

The work of our Institute to support biodiversity policy with research spans the globe, but Africa is unique in many respects. *While it is home to some of the most incredible biodiversity hotspots, it also faces some of the greatest socio-economic challenges. Issues around fishing in Tanzania and the Democratic Republic of Congo are particularly complex, as shown in research published this year.*

Biodiversity under threat on Lake Manyara

The stunning Lake Manyara Basin in northern Tanzania attracts tourists from across the world with its spectacular landscapes, rich in biodiversity, including over 390 species of bird. The soda lake's biodiversity also makes it an important source of fish for the 18,000 locals who depend on it for fishing, while agriculture depends on the incoming rivers. As a result of excessive water extraction from the rivers, less water reaches the lake, so water levels have been dropping. At the same time, erosion is on the increase due to overgrazing. The multiple threats to the ecosystem are clear, while the impact on locals is complex.

The changes to the lake affect its biodiversity: flamingoes, for example, have been dying off in great numbers. The drop in biodiversity escalates conflicts among people who depend on the lake basin for their livelihoods. Revenue from tourism also is under threat. This, in turn, makes people more likely to accept the need for nature conservation.

As part of UNESCO's Man and the Biosphere programme on sustainable development, our Institute led a study around the management of the lake, published in the *Journal of Environmental Management*. A series of workshops with locals highlighted water use and distribution, participation of all interested parties and governance as key priorities to be developed. Policy action along these lines can help move all parties take ownership of the lake's management, with a positive impact on the sustainable development of the Lake Manyara Basin.

What's worrying fishers on Lake Tanganyika?

To prevent overfishing and protect biodiversity, policies need to be well-designed and implemented. But to adapt the regulations to people's needs, you have to know their point of view. Biologists from our Institute were part of an international team conducting more than 1,000 interviews with fishers, fishmongers, government officials and other stakeholders of the fisheries of Lake Tanganyika in the eastern part of the Democratic Republic of Congo, one of the poorest regions in the world. The resulting study was published in the *Journal of Great Lakes Research*.

Fishing on the lake provides livelihoods for tens of thousands of fishers and is the main source of protein for more than one million people. The lake's fish populations are under a lot of pressure, mainly due to overexploitation. Interviews with fishers indeed revealed that their catches are declining. Fishmongers reported smaller fishes on the market. Surprisingly however, fishers do not see overfishing as an issue. Their main concern is a lack of safety. They reported high waves and strong winds, attacks from gangs and extortion by security officers among the dangers they faced, for which they want to see government action.

A stricter fishery policy has little chance of success if the local population is not in favour of it. On the Congolese side of Lake Tanganyika, regulation of fishing is limited to banning certain materials, limiting the number of boats and closing the fishery for a few days a month. However, rules are only enforced to a small degree. The results of the study were translated into clear language in a policy brief in Kiswahili, French and English. Researchers hope they will support policymakers in considering interests of the local population when adapting the regulations to the current situation.

WHAT'S ON THE MENU?

***How humans eat has changed over time in every region of the world**. This year our researchers found evidence in two locations that have also changed a lot over the years, from mountains in Libya to a lot closer to home.*

Fish, fresh from the Sahara

The red sands and rocky outcrops of the Tadrart Acacus Mountains in the Libyan Sahara might not seem like an ideal place to catch a fish these days. But 10,000 years ago, fish was the main source of food for hunter-gatherers there, back when the area was still teeming with lakes and rivers. A team led by our Institute studied thousands of fossil fish bones from the archaeological site of Takarkori and published their findings this year in *PLOS ONE*.

Between 10,000 and 5,000 years ago, the Sahara was a varied landscape, inhabited by many animal species. By identifying and dating over 17,000 animal remains, scientists were able to document shifts in fauna over time. The two fish species, identified as catfish and tilapia, were found in huge numbers and provide additional evidence that the area was home to numerous lakes and rivers capable of maintaining a large biomass of fish.

Over time, however, the proportion of fish remains declined considerably. The proportion of mammal remains, on the other hand, increased strongly, which illustrates that the inhabitants of Takarkori gradually focused more on hunting and, later on, animal husbandry. The study also reveals the ancient hydrographic network of the Sahara and its connection to the Nile, providing crucial information on the dramatic climate changes that have led to the formation of the world's largest hot desert.

Chronic diarrhoea in downtown Brussels

Fortunately, dysentery or severe diarrhoea is now a rarity in our country and limited to a few backpackers returning from tropical areas. In the not-so-distant past, however, this was not the case. While studying the archaeological remains of three cesspits from Brussels city centre, dating from the 14th to the 17th century, scientists from our Institute, in collaboration with the Ancient Parasites Laboratory of Cambridge University, found eggs of several parasitic worms, as well as traces of two species of protozoans known to cause dysentery: *Giardia duodenalis* and *Entamoeba histolytica*. The results of this study were published in the journal *Parasitology*.

In old cesspits, remains of plants and animals that were eaten but not completely digested can often still be identified: seeds and small bones, for example. They provide us with information about the diet and eating patterns of earlier populations. In these cesspits we often also find remains of intestinal parasites which infected the former population.

The presence of parasites tells a rather unpleasant story about hygiene and living conditions in Medieval and Renaissance Brussels. Roundworms and whipworms were most likely spread because the contents of cesspits were spread on market gardens, with human excrement serving as fertiliser for people's vegetables. Another source of infection was the river: cesspits were emptied into the Senne, which was an open sewer until the 20th century, regularly bursting its banks and flooding the streets.

TWISTS IN THE TALE OF OUR FOUR-LEGGED FRIENDS

***Across the Institute's work on past interactions between humans and nature, the topic of animal domestication was a particular focus for publications this year.** And as the results show, our relationship with "man's best friend" goes back a long way.*

10,000 years of canine diversity

The largest-ever study of ancient dog DNA, published in *Science*, tells the story of the relationship between humans and dogs over the centuries, revealing that the diversity we see in the dog world today originated back when humans were hunter-gatherers. The research team, which included our Institute sequenced ancient DNA from 27 dogs, some of which lived nearly 11,000 years ago, across Europe, the Near East and Siberia. This study of ancient genomics involves extracting and analysing DNA from skeletal material. It provides a window into the past, allowing researchers to uncover evolutionary changes that occurred many thousands of years ago.

The team showed that over the last 10,000 years, these early dog lineages mixed and moved to give rise to the dogs we know today. For example, early European dogs were initially diverse, appearing to originate from two highly distinct populations, one related to Near Eastern dogs and another to Siberian dogs. However, at some point this diversity was lost, as it is not present in European dogs today.

The researchers also compared the evolution in dog history to changes in human evolution, lifestyles and migrations. In many cases comparable changes took place, likely reflecting how humans would bring their dogs with them as they migrated across the world. But there are also cases when human and dog histories do not mirror each other. For example, the loss of diversity that existed in dogs in early Europe was caused by the spread of a single dog ancestry that replaced other populations. This dramatic event is not mirrored in human populations, and it remains to be determined what caused this twist in the tale of European dogs.

Tooth marks that tell an even older story

When did humans first tame wolves? Palaeontologists and geneticists have been arguing for years about the answer: 15,000 years ago? 40,000 years ago? The last estimate is partly due to a Belgian discovery: the Goyet dog. According to cranial features, the 36,000-year-old skull found in 1860 in the Goyet cave, near Namur, could be from the oldest dog in the world.
A new research technology called 'dental microwear texture analysis' suggests an early domestication. Even before the cold peak of the last glacial period, around 23,000 years ago, humans already interacted with wolves. In the study, published in the *Journal of Archaeological Sciences* and in which the Institute participated, scientists meticulously examined the wear marks on the molars of 19 mandibles. These specimens were excavated in Předmostí in the Czech Republic and were identified as coming from both dogs and wolves. Dogs have a shorter and more robust jaw, better adapted to gnaw on harder food. The analysis of wear marks on the molars – the second molar, to be precise – demonstrates the existence of two groups. The molars of dogs have deeper grooves, again, a sign that their diet was made up of harder food. As for wolves, their teeth have fewer wear marks.
This distinct diet could be related to domestication. Dogs were living with humans and were fed leftovers of reindeer and musk oxen: mostly bones and carcasses. But wolves were living further away from humans and were often scavenging corpses of mammoths and horses, feeding on meat and fat.

WHALE, WHALE, WHALE!

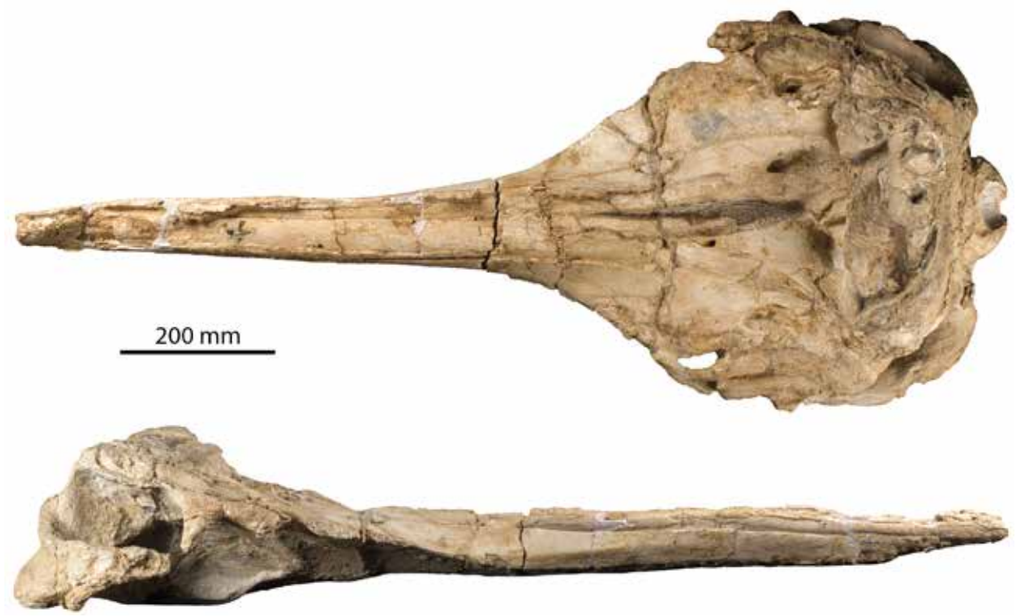
It is no coincidence that the Institute's new Living Planet gallery is presided over by our collection's magnificent blue whale and sperm whale skeletons, hanging from the ceiling. *Whales are a particular focus in our research, and this year uncovered three fascinating findings about their evolutionary history.*

An early sperm whale with a distinctive feature

In recent years an international team of palaeontologists has been making important discoveries in the Pisco Basin in southern Peru, a desert where erosion continuously exposes whale fossils. In the *Journal of Systematic Palaeontology*, the researchers, including the Institute, have described one of the oldest sperm whales ever, based on a newly excavated skeleton including the partial skull, ear bones, mandibles, teeth, vertebrae, sternum and ribs. This well-preserved skeleton makes *Rhaphicetus valenciae*, as this new species was named, one of the best-known extinct sperm whales to date.

Rhaphicetus lived in the Pacific Ocean near present-day Peru between 19 and 18 million years ago. This very early sperm whale may give us a good picture of what the common ancestor of all sperm whales looked like. And that image is quite different from that of today's sperm whale species.

Rhaphicetus valenciae was around 5 metres long, two to three times smaller than the modern sperm whale, with an extremely long and narrow snout, unlike the broad snout of today's sperm whale. This toothed whale had slender, pointed teeth in both upper and lower jaws, but none in the tip. This may have allowed the animal to stun its small, fast-swimming prey, before snapping them up with the teeth and swallowing them whole.



Antwerp's latest puzzle piece in whale evolution

In February 2013, a RBINS palaeontologist discovered a well-preserved fossil whale skeleton in the construction site of the world's largest lock: Kieldrecht Lock, in the Port of Antwerp. After an investigation by an international team led by the Institute, it turns out to be a completely new species of whale that swam the waters there some 3 million years ago, as published in the *Journal of Systematic Palaeontology*.

Right whales and the bowhead whale belong to the family Balaenidae, a group of whales that evolved about 20 million years ago. They are the oldest group of baleen whales known today. But due to a lack of well-documented fossil finds, little was known about their evolution. The skeleton of *Antwerpibalaena liberatlas* now provides new information. Their 'stiff neck', for example. In today's right whales, the neck vertebrae are completely fused, providing better support to their huge heads. *Antwerpibalaena* had a sturdy neck, but its atlas vertebra was still loose, hence the species name "liberatlas".

Antwerpibalaena was between 9.5 and 12 metres long. The new find is significantly smaller than the modern representatives of the family (15 to 20 metres), but also smaller than some older right whales. So the evolution of these whales involved a complex story of body size changes.

A new rorqual ancestor found in Wommelgem

Antwerp's "whale cemetery" was the scene for another discovery, published this year in the journal *PeerJ*. Researchers, including from our Institute, identified a distant relative of today's rorquals, based on a skull and a few bones that Antwerp local Wilfried Nees dug up in 2000 during sewage works in Wommelgem. They named the species after the resident who discovered it: *Protororqualus wilfriedneesi*.

The fossils were found in the Kattendijk Formation, a sandy layer dating from the early Pliocene, 5.3 to 3.6 million years ago. Based on a thorough study of the skull and the ear bones, *Protororqualus wilfriedneesi* appears to be a relative of present-day rorquals: a large group of baleen whales including the blue whale and the humpback whale.

A closely related species, *Protororqualus cuvieri*, is known from northern Italy and displays more archaic traits. This suggests that these fin whales spread from the Mediterranean Sea across the Atlantic as far as the United States where they have also been excavated from the Pliocene. The fossils of *Protororqualus wilfriedneesi* now have a home among the Institute's rich collection of extinct cetaceans.

KEEPING AN EYE ON OUR SEAS AND OCEANS

***Seas and oceans represent a vast potential for innovation and economic growth**, but gone is the idea that oceans are endless sources of riches for us to exploit – we know now that these environments are stressed and fragile. This year saw a number of milestones for our Institute's work on sustainable marine management.*

Protecting Antarctic species by following their predators

In a rapidly changing world, we need to know which areas are most in need of protection. This is hard to do objectively in remote areas like the Southern Ocean around Antarctica. A paper published in the journal *Nature*, together with a companion data paper in the journal *Scientific Data*, describes a novel solution to this problem: using electronic tracking data from birds and marine mammals. Our Antarctic Biodiversity Portal was closely involved in collecting, cleaning up and standardising these data as well as analysing the results.

The solution relies on a simple principle: animals go to places where they find food. So by following predators, we can find the prey: for example, humpback whales go to places where they can feed on krill, whereas elephant seals go where they can find fish or squid. If all these predators and their diverse prey are found in the same place, then this area has both high diversity and abundance of species, indicating that it is of high ecological significance.

According to the study, the most important of these areas are scattered around the Antarctic continental shelf and in two wider oceanic regions: one projecting from the Antarctic Peninsula engulfing the Scotia Arc, and another surrounding the sub-Antarctic islands in the Indian sector of the Southern Ocean. The outcomes were presented to the Commission for the Conservation of Antarctic Marine Living Resources and can support future management of the Southern Ocean.

Did air pollution rules contribute to **North Sea acidification**?

When ships burn fuel, they emit sulphur oxides, known to be harmful to human and ecosystem health. Since January 1st, 2020, the International Maritime Organisation further lowered the limit for sulphur content in ship fuel, resulting in an increased number of exhaust gas cleaning systems installed on board ships. These scrubbers reduce the sulphur content in the air emissions, but some discharge the sulphur oxides directly into the water.

On behalf of the Federal Public Service Mobility and Transport, our Institute performed a study in which an advanced biogeochemical model was used to quantify the potential impact of sulphur oxide discharges from maritime traffic on water acidification in the southern North Sea.

The results showed that the discharge does indeed contribute to ocean acidification, potentially creating problems for a range of marine organisms. The largest changes occur in areas of high ship traffic density, such as along the Belgian and Dutch coasts and in the vicinity of large harbours, where the changes are sufficiently big to contribute to environmental degradation. Policy, science and industry will need to keep working together to find ways to reduce the impact of sulphur compounds in the emissions and wash water discharges of ships.

Towards a warning system for foam at sea

Five young surfers tragically died in May 2020 in Scheveningen, Netherlands, due to a biological phenomenon: a metre-high wall of algae foam. Our Institute co-authored a report on the cause of the foam formation, working to help ensure this type of accident can be avoided wherever possible in the future.

The reconstruction of the available data shows that warm weather in the previous weeks had resulted in exceptionally large amounts of algae in the sea. As waves picked up and the weather clouded over, the algal bloom began to release residues into the sea, which were whipped up into foam by waves and the wind. On the day of the accident, the wind drove the foam southwards into Scheveningen's Northern Harbour Head.

The Institute's Remote Sensing and Ecosystem Monitoring team has extensive expertise in the use of remote sensing instruments. It analysed and interpreted a combination of Sentinel-2 and Sentinel-3 satellite images from the period before the accident to show the bloom's course and concentration. Alongside use of cameras, satellite information can contribute to an automatic coastal foam alert system, although more information needs to be supplied to locals to help them evaluate risk.

Providing a satellite's-eye-view of our coastlines

Our Remote Sensing team's crucial work analysing the algal bloom in Scheveningen draws on its broader expertise on the interpretation and visualisation of satellite images for a wide range of end users. 2020 was a year of two key developments in this broader work.

Permanent surveillance of the coastal waters is essential to monitor algal blooms along the Belgian coastal zone and detect potentially critical situations like that of Scheveningen as quickly as possible. As part of the MULTI-SYNC project, financed by Belspo's STEREO programme, our researchers have developed an approach to map algal blooms at high resolution, using low-resolution ocean colour data together with high-resolution data from satellites like Sentinel-2.

2020 also saw the launch of the new Copernicus Marine High-Resolution Ocean Colour Service. Our team is part of the consortium selected by the EU's Copernicus Marine Service to provide high-resolution ocean colour products from the satellite Sentinel-2 for their Marine Portfolio. These data will support the EU Framework Directives, Marine Spatial Planning and many other applications for the effective management of coastal resources.

A North Sea atlas that looks beyond the waves

To support marine management, it is not enough to have great data. You have to have great data that is compatible with the data everyone else is collecting. This year saw the launch of MarineAtlas.be that works towards this objective by generating, collecting and maintaining geo-referenced information related to the sea. It is developed by teams at our Institute as part of a joint initiative of several Belgian federal administrations.

The atlas gives access to the geographical information contained in the Belgian marine spatial plans. It aims to become the marine node of Belgium's federal geo-platform implemented by the National Geographical Institute. This will also make it much easier for the Belgian federal administration to comply with its international obligations.

The Marine Atlas is published online, available for example for anyone who wants to display results of oceanographic measurements in their context – distance from wind farms, navigation routes or areas of sand extraction. The atlas even shows where the North Sea is used by the military, to defuse mines for example. The data is also available for "machine-to-machine" transfer through the data catalogue portal of the Institute.

Sniffing out even more **types of air pollution at sea**

The Belgian Coast Guard continues to invest in the international fight against air pollution over sea in cooperation with our Institute. Central to this work is our survey aircraft with its so-called 'sniffer' sensor. The sniffer makes it possible to measure sulphur compounds in the emissions from ships at sea, and to check to what extent these ships comply with the applicable sulphur standards.

In order to be prepared for new restrictions that apply on nitrogen emissions from ships in the North Sea from 2021 onwards, and to be able to monitor these, the sniffer technology was expanded in the spring of 2020 to detect nitrogen compounds as well as sulphur. In early July, the first test flights with the nitrogen sensor were a great success. The sensor was then extensively tested during the second half of 2020. In 25 flights, the team was able to successfully determine the nitrogen emissions of an impressive 394 ships in Belgian waters. Of the ships monitored, the vast majority were already in compliance with the 2021 standards, but some emissions showed nitrogen concentrations over double the limit.

COLD CASES REOPENED

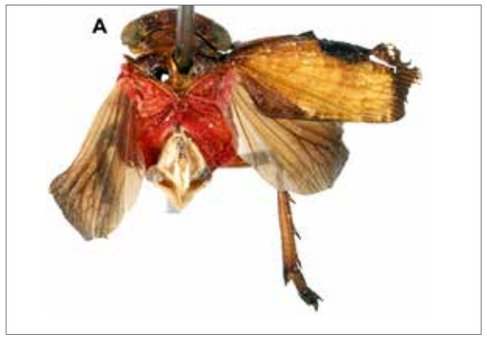
Scientific research is confronted with many unsolved mysteries. *There is often a piece of data that doesn't quite fit: a specimen out of place, or an unexplained detail. Some of these cases are worth dusting off and reopening, as many of our results this year showed.*

Long-awaited family reunion for a **lone planthopper**

A single specimen, when observed and compared to others, is sometimes taken as evidence of a new species. But what happens when 169 years go by, and you are still dependent on a single specimen for the type species of an entire genus? In 2020, additional specimens of *Olonia rubicunda* were finally collected and studied, allowing our researchers to confirm the genus *Olonia*, as published in the *Belgian Journal of Entomology*.

The family Eurybrachidae is a small, Old World family of planthoppers, well known in Australia for their egg masses covered in white wax, visible on eucalyptus and acacia trunks: a habitat hit hard in 2020 by the Australian bushfires. The type species of the genus *Olonia* however was only known from a single female collected in Fraser Island, off the Queensland coast.

The long-awaited additional specimens were collected not far from the island: just up the coast at Bargara. Our team was then able to completely redescribe and illustrate the genus, including a comparison to the most closely related species and data on its distribution range and biology. Since the original specimen was a female, this description also included the male genitalia for the first time: a particularly distinctive character that helps separate *Olonia* from related genera and distinguish between species within the genus.

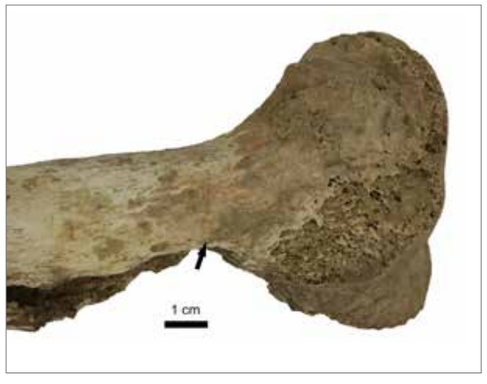


The Caverne X files: Waulsort revisited

Our collections are home to an estimated 38 million specimens, each of which holds a wealth of stories about our natural history. Some of the earliest collection items still have new tales to tell, and the remains that were excavated from the Caverne X in Waulsort, Namur province, are no exception, as revealed in a study looking back at the site, published in the journal *Mesolithic Miscellany*.

The second director of our Institute, Edouard Dupont, excavated dozens of sites including a number of Neolithic caves around the Meuse. Radiocarbon dating done in 1997 had suggested that Caverne X, however, was older than the others, dating from the early Mesolithic. As an outlier, this warranted further investigation.

The results confirmed the age of the site and showed it contained the remains of nine individuals, including a foetus and at least two children. The bones were mixed up, suggesting this was a collective tomb, and bite marks on the bones hinted that the bodies were not buried. Deposits of red ochre were found alongside a deer antler and flint axe, all of which fit with what we know about funeral rites at the time.



Blue mussels hold clues about climate change

Another strength of our collections is the consistency with which specimens and samples have been collected over the years. Where else could you find blue mussel shell samples collected from the Belgian coast almost every ten years between 1904 and 2016? And it was these samples that formed the basis for a study published in the journal *Global Change Biology* which revealed unexpected patterns over the years as the mussels responded to their changing environment.

Ocean acidification is one of the many serious consequences of our carbon dioxide emissions, which makes it more difficult for marine organisms to form calcium carbonate shells and skeletons. And so in view of the global ocean acidification process, you might imagine that North Sea mussels would show reduced calcification over the years.

Our study showed that in fact, along the Belgian coast, mussels show locally increased calcification rates. It seems that this is a protective response to changes in their environments: variations in predator communities over time, as well as other environmental stressors, climate change included. This shows why we have to take local effects into account, as well as global, when looking at the impact of environmental changes: the two can tell very different stories.

Reconstructing the skull of the **"little crocodile of Bernissart"**

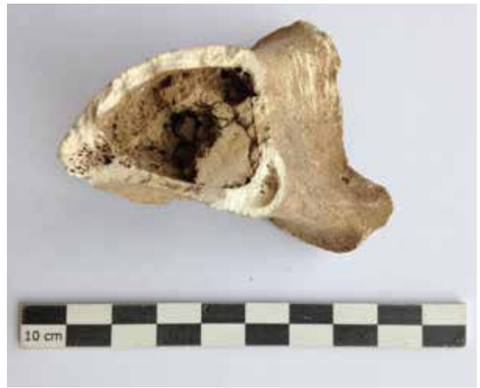
In the Dinosaur Gallery, below our famous iguanodons of Bernissart, lies another specimen from the same fossil site of Belgium: a tiny crocodile, *Bernissartia fagesii*. Described and named over 130 years ago by the famous palaeontologist Louis Dollo, a scan of its skull has revealed new details about its place in the evolutionary tree, published in the *Journal of Systematic Palaeontology*.

Belgian, French and Italian scientists used a micro-CT scanner to study the fossil through remains of sediment and thick protective glue. Comparing the details with other fossil crocodilians, the team places *Bernissartia fagesii* close to the beginning of the evolution of modern crocodilians (Eusuchia) some 145 million years ago, in the early Cretaceous. The scans showed a mixture of primitive and more derived characters: the internal nostrils, for example, resemble those of modern crocodiles.

New details on the teeth confirm that *Bernissartia* was not picky when it came to food. With its flattened rear teeth, it could crush shellfish such as freshwater snails and mussels, as well as insects and crayfish. With its sharp front teeth, it probably tore up small vertebrates like frogs and lizards.

A Roman fallow deer turns out to be a Herstal local

Before building works on an apartment block began in 2015 in Herstal, Liège, an archaeological dig revealed the remains of a fallow deer, *Dama dama*. Nothing too surprising there, you might think - after all, fallow deer were thought to be introduced to northwestern Europe in the Middle Ages from their native Mediterranean region. What was unexpected was the age of the remains: the study, published in the journal *Antiquity*, suggests it was bred and raised in Roman times.



Our Institute's expertise in ancient DNA was necessary to isolate and sequence fragments of genetic material from the bone samples. The results, along with the morphology of the specimen confirmed that this was indeed a fallow deer. Isotope analyses indicated that it dated from the Roman times and that its diet was typical of a temperate environment, suggesting that this deer was not brought north but grew up in the region.

Until now, most fallow deer bones found from the north-western Roman Empire were parts of antler or foot bone which had probably got there through trade, for craft production or supposed medicinal properties. The fact that the Herstal deer was found unbutchered near remains of Roman villas suggests that it had symbolic significance and was kept as a living trophy by the elite classes for prestige.

38 **OUR COLLECTION GETS DIGITAL**
A new handbook for the digital-minded
When UV meets DNA
Opening up our Institute's data

41 **THE ETHICAL QUESTIONS AROUND HUMAN REMAINS**

2 COLLECTIONS

OUR COLLECTION GETS DIGITAL

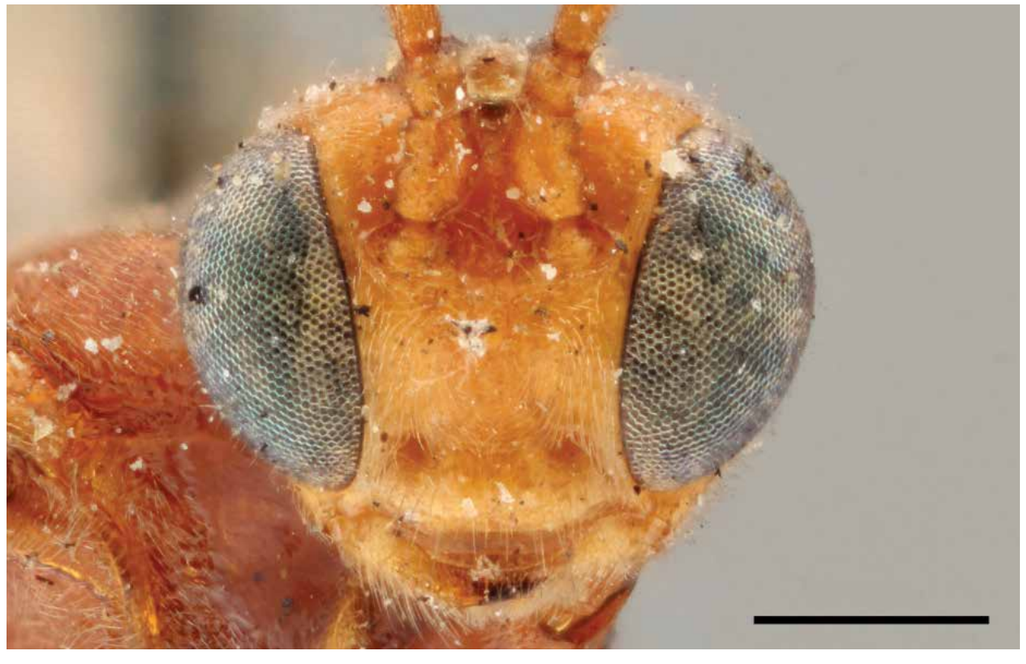
By digitising our collection's specimens and data and making them available online, we open them up to researchers all over the world. *Thanks to high-resolution images, the specimens are preserved digitally forever and no longer need to leave the ideal storage conditions of the Institute conservatory. And our datasets hold a wealth of information for analysis. In 2020 we continued our work to open up access to this valuable content.*

A new handbook for the digital-minded

Some natural history specimens are pinned. Some are found on a microscope slide or stored in ethanol. They can be colourful, translucent or shiny. How can we capture all this diversity in digital formats? Each type of object requires a tailor-made approach and our researchers wired with the AfricaMuseum team to publish a handbook on how to digitise natural history collections.

The manual is easily accessible and is also intended for readers without prior knowledge who want to start a digitisation project. It describes costs and suggests workflows that can help people in a very concrete way. How can focus stacking combine images to give a greater depth of field? Might a 3D model help to show spatial structures and calculate thicknesses? What about multispectral photography to see what can't be seen under normal, white light?

Many specimens from our collections - especially the type specimens (on which the description and name of a new species is based) - have already been brought to the lens by the digitisation team. They can be viewed online at virtualcollections.naturalsciences.be. The handbook itself is available free of charge and appeared in the Collection Management series of the open-access *European Journal of Taxonomy*, co-edited by our Institute.



When UV meets DNA

Could one of these methods for digitisation be actively damaging the Institute's specimens? More and more species are discovered to be fluorescent when exposed to ultraviolet (UV) wavelengths, especially around 365-395 nm. Just look at the detail that is revealed on the abdomen of our spider specimen *Storena formosa*. This makes 3D imaging using UV fluorescence an excellent way to bring out the morphological traits that can help identify those specimens. But UV light may also damage DNA. And that can be an issue when we count on DNA sequences to analyse evolutionary relationships among taxa. Our Joint Experimental Molecular Unit team set out to study the effects.

UV light comes in different wavelengths. There is no doubt that the wavelengths known as UV-C do degrade DNA: they are used as a disinfection method as they destroy the DNA of microorganisms. But this analysis concerned UV-A wavelengths, 315-400 nm, like those used in 3D imaging techniques. Our team used a powerful method called quantitative PCR to better estimate the differences in DNA fragmentation among the various samples tested: those exposed to UV-C, those exposed to UV-A and the control group that was not exposed to UV light at all.

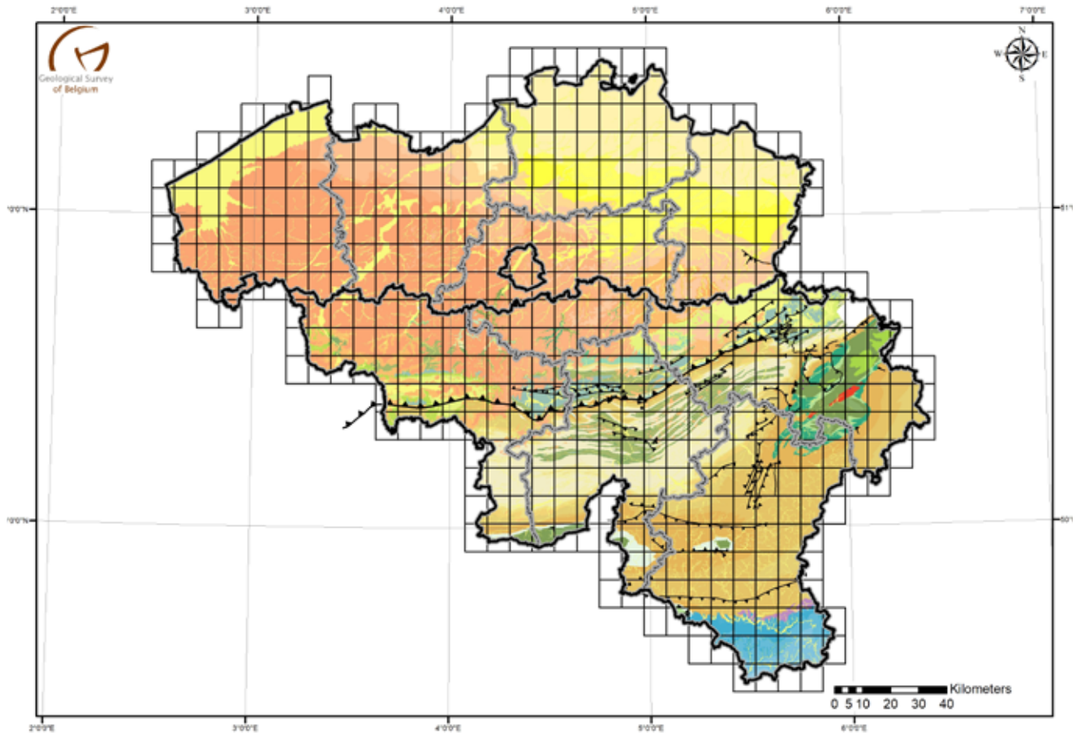
Our results suggest that UV-A does not damage the DNA, at least not to a point that would make molecular analysis of the DNA a problem. Even when the specimen is exposed to the UV light for a longer period, the UV-A light was not found to cause DNA fragmentation. These results come as reassurance to our team as the steady progress to digitise our collection continues.

Opening up our Institute's data

Digitisation is about more than just images. Our collection goes beyond the physical: data is a huge component of our work. In 2020 we gave our metadata catalogue a major update, ensuring access to researchers worldwide as well as significant visibility for our Institute. The metadata catalogue was first launched in 2018, aiming to host descriptions of all our Institute's datasets. This not only fulfills our legal obligations but goes beyond, providing material for researchers to work on worldwide.

To make the data even more useful, it makes use of international standards such as INSPIRE and ISO19115 to ensure compatibility. The catalogue is connected up to read internal resources like our Integrated Publishing Toolkit that disseminates our biodiversity data to the Global Biodiversity Information Facility. It also automatically disseminates all these datasets to national and international catalogues and creates a Digital Object Identifier for each dataset that can be referenced in publications.

Our catalogue now hosts 195 datasets and is permanently hosted on https://metadata.naturalsciences.be. Researchers can find links there to download datasets and a range of web services for online visualisation. The content is vast: you can find data on biodiversity such as our reference collection of ants from the Paraguayan dry Chaco. There is data on the North Sea, like the location of all wind turbines. Metadata is also present for the full geological map of Belgium, thanks to the work of our team at the Geological Survey.



THE ETHICAL QUESTIONS AROUND HUMAN REMAINS

2020 was a year that drew particular attention to ethical and legal issues around the work of research institutes like ours, where the collection includes human remains. *What steps do we need to take regarding specimens whose provenance is known to be unethical, and what challenges around repatriation lie ahead?*

Our collections tell a story of the history of humans as part of the natural world. It is a complex and sometimes disturbing story which raises a number of moral questions for us as the Belgian institution with the greatest number of specimens of human origin in our collection. What place do human remains have in our Institute? How could these remains be repatriated? And what challenges do we face in the process?

In recent decades, France, Germany and Switzerland are among the countries to return human remains to family members or to countries of origin. Some of these cases have started to set up regulations that make this restitution possible. One high-profile example is the remains of Sarah Baartman, a South African Khoikhoi woman who was exhibited as a freak show attraction in 19th-century Europe under the name "Hottentot Venus". After her death in 1815, her remains were displayed in French museums until the 1970s. Her body was returned to South Africa in 2002 after a formal request from Nelson Mandela and finally buried on Vergaderingskop, a hill overlooking her homeland.

And it is not only museums and research centres that face this issue. Belgian universities, public and private institutions, as well as private individuals house human remains from all over the world and from various time periods. Part of our country's public collections were established during the colonial period, another part was collected during archaeological excavations and some were offered to museums by private collectors. In Belgium, there are currently no guidelines for the conservation and management of human remains, nor a legal framework for the return of human remains to family members, institutions or countries of origin.

This was the starting point of the HOME project, launched by our Institute in 2020 and funded by Belspo as part of the BRAIN-be programme. Our team is coordinating a survey to make a full inventory of human remains in Belgian museums, research institutes and private collections. The project aims to discover the historical, scientific and ethical background of the human remains and investigate a legal framework for their repatriation.

Our team's legal experts and socio-anthropologists will analyse how European countries return human remains and what legal procedures are currently being followed. A range of stakeholders will be consulted on the restitution process to address some difficult and sensitive questions: what happens when more than one party requests restitution, for example?

To launch these discussions, a set of case studies will provide material for the project to examine, in dialogue with all stakeholders, including family members and experts from the countries of origin. So far, the project has received over 50 surveys filled in by organisations or institutional departments in Belgium whose collections house human remains and who are willing to participate: a promising first step in a challenging and complex process.

44 **A NEW GALLERY AND A "NEW NORMAL"**

48 **MAKING OURSELVES #ATHOME**

50 **A TIMELY RETHINK OF OUR EDUCATIONAL OFFER**
Levelling up our engagement activities
Virtual ways to bring the Museum to you

3 PUBLIC

A NEW GALLERY AND A "NEW NORMAL"

***Every year starts out with plans that eventually change**. But 2020 was the year where all our plans were turned on their heads completely, under the confinement that was necessary to tackle the COVID-19 pandemic. For the Museum, like all European cultural institutions, this meant some massive adaptations, some sacrifices and some unexpected opportunities.*

It was a moment we had been building up to for years: finally throwing the Museum doors open to our spectacular new Living Planet gallery, a decade in the making, the final section of our permanent galleries to open after a long period of renovation. And it was indeed an extremely memorable opening with a great deal of success, although in a very different way to anything we could have anticipated.

Living Planet takes shape

In 2004 the idea was first put forward that our historic convent wing should be devoted to telling the story of biodiversity on earth. We opened BiodiverCITY there in 2010. This left two floors for Living Planet: the spaces that housed our former Whales, Polar and Mammals galleries. It was an opportunity to open up windows in the roof and let daylight illuminate the space for the first time, completely transforming the experience of walking through. It also meant tackling some huge challenges, not least that of emptying the galleries and rehousing the hundreds of collection specimens they had contained, ensuring their maintenance.

Naturally, when it came to planning Living Planet, there was no shortage of specimens to exhibit. This was a fantastic opportunity to showcase the richness of the diversity in our collections. But the new gallery was also an opportunity to demonstrate the Museum's current identity. The team was keen to bring a fresh and contemporary feel to Living Planet, with immersive spaces and new ways to interact. They avoided glass cases where possible to allow visitors to come physically closer than ever before to the wonders of the natural world. In January 2020, as the opening date drew closer, the story of the making of the gallery was all over Belgian broadcast, print and digital media, with excitement and expectations building.

The first confinement

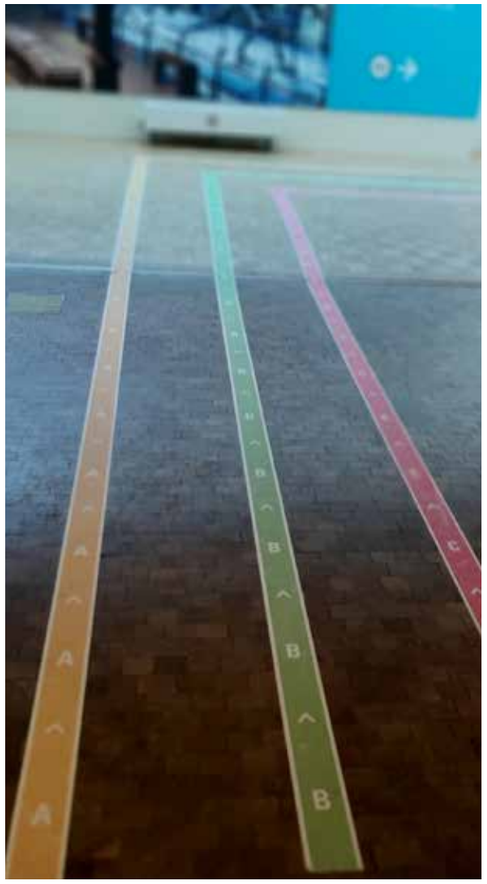
The next part of the story will not come as a surprise: as Europe went into lockdown to protect its population from the COVID-19 pandemic, everything changed. On March 13th our doors closed and Belgium's confinement began. Like all events planned for 2020, the opening went on hold. It was time for us to focus on ensuring the safety of our friends and colleagues. A hush fell over the Institute: under the lockdown in March and April, not a single member of the Museum team set foot in the building.

As the first confinement eased and it became clear that the Institute would be able to reopen, a shift in mindset was needed. What would the Museum experience look like from behind a mask? How could our visitors explore our halls while staying a metre and a half from each other? And most importantly: how could we ensure the safety of everyone who stepped through our doors, staff and visitors alike? A face mask even appeared on Iggy, the iguanodon that stands tall in front of our building: the symbol of all our efforts to ensure that people were protected but still able to experience the Museum in their social bubbles.

Rerouting the Museum

This shift in mindset required a shift in routes. Plans had already been underway to better signpost paths around the Museum once the renovation was complete. 10,000 square metres is a stretch for even the most enthusiastic of museum fans, so we wanted to guide people around loops to help them better organise their visits. But to minimise the risk of the coronavirus spreading among visitors, this signposting became a necessity: we had to ensure visitors followed a one-way system.

With the Museum closed, the team had the chance to do a lot of testing. First attempts, starting a loop with the temporary exhibition, resulted in a traffic jam as visitors had a lot more energy in the first half hour of their visit than we anticipated. Integrating feedback, the routes were finally complete: a long route through all galleries or three colour-coded shorter routes that could be combined. Brightly coloured stripes on the floor made navigation simple and effective.



New rules

Ticketing was another major logistical challenge. As with the signposting, the Museum had been working for some time on a future online ticketing system. This too became urgent as the new rules meant visitors could not arrive when they pleased: time slots needed to be booked to ensure the Museum did not exceed its new, smaller maximum capacity. The entire development process had to be sped up to allow us to reopen on May 19th. In the end, technical difficulties were dealt with swiftly and visitors adapted easily to the new system.

From the reopening onwards, tickets were paid for exclusively online and all our masked guests had to do was help themselves to hand sanitiser at the door and show their ticket through the plexiglass to our reception team. Our Dino Café, library and cloakrooms had to close but disinfected lockers were available as well as hand gel dispensers throughout the Museum. Communication was crucial, and our team made every effort to ensure the new system was explained loud and clear to our visitors with frequent updates.

Antarctica extended

With travel bans in place, our temporary exhibition Antarctica was the closest many of us could get to a trip to the other side of the world. The decision was made to extend the exhibition to allow visitors more time to experience this particularly popular exhibition. This meant that it reopened twice: first on the May 19th right up until the second confinement at the end of October, and again on the December 1st. Strong media coverage helped to ensure Antarctica's continued success in 2020, with promotion across electronic billboards, TV, radio, digital media and printed press.

Adapting to change

Meanwhile, work on Living Planet restarted and working from home brought a whole new set of challenges for our team. Our colleagues working on the gallery from the Netherlands and France were unable to travel due to national restrictions on crossing borders. Even working with our local team was not easy: we were right in the middle of developing our discovery rooms and spaces for group visits with schools, for example - how can you design a space as a team without being present and seeing each other?

When the moment finally arrived to open Living Planet to the public, the anticipation could not have been greater. And while the "new normal" meant that we could not celebrate its opening the way we normally would have, our team nonetheless ensured we did our best to mark the occasion. The press opening on the September 10th drew extensive coverage, with the presence of Deputy Prime Minister David Clarinval and other special guests, all carefully managed to ensure everyone's safety. Social media lit up too thanks to a series of teasers building up to an opening weekend with visits at a special price and opening hours extended into the evening.

A gallery opening like no other

And the end result? Stepping into the Living Planet gallery is an immersive experience, taking the visitor out of space and time to be confronted with the immensity of the biodiversity present on Earth. Confronted with the spectacle of over 850 specimens, we are reminded that we too are simply organisms, vastly outnumbered on this planet. Soaring arches take our eyes up to the magnificent whale skeletons that guide us from room to room as we explore biodiversity from every angle.

How can animals that look so different be so closely related? What adaptations to habitat do we see, from tundra to treetops? And why is there more to the relationship between the oxpecker and antelope than meets the eye? Playful hands-on exhibits and striking photos and videos uncover the science behind biodiversity, while the live specimens bring the gallery's messages to life quite literally. While the urgency of preserving our biodiversity is very clear, the exhibition nonetheless finds a positive note to end on as we see the sheer resilience of the natural environment and its ability to reestablish itself after a crisis. And resilience is a quality that the Museum and our incredible team have certainly demonstrated in this particularly challenging year.

MAKING OURSELVES #ATHOME

The way we all communicate changed in 2020, from the endless family Zoom quizzes to workout sessions on YouTube. *For our Institute's team, communicating under confinement was an enormous challenge but also a fantastic opportunity to find new ways to reach people in the comfort of their own homes.*

Seeing the Museum empty doesn't sit well with our team. For the people whose passion is to breathe life into our exhibition halls for hundreds of visitors every day, the thought of the exhibits standing in darkness, day in, day out, is a difficult prospect. But our mission is "bringing nature into everyone's lives", and in lockdown, people needed nature more than ever.

So if we couldn't bring people to the Museum, it made sense that we would bring the Museum to people. And the empty galleries made the perfect playground to start thinking about how we could communicate differently during this lockdown period. Brainstorms broke out to reflect on what could be done: from existing material that could easily be reused to great new ideas that would take some real work to develop.

One hashtag, many clicks

And so #NaturalsciencesAtHome was born: a social media hashtag for a whole set of new online activities and content launched under the first confinement, from mid-March to early June. "Bringing nature into locked-down lives", as our slogan put it. The campaign was a big success, with over 260,000 people reached on Facebook and an increase in followers of over 1000 bringing us to 15,000 in June. This achievement was reflected on other social media too: 65,000 impressions on Twitter, 34,500 people reached on Instagram and another 12,500 viewing our Insta stories. And we joined a broader campaign to extend our reach: Brussels Museum Council's #MuseumAtHome.

Iggy is reborn

One of our simplest ideas that turned out to be one of the most promising experiments was a video series for toddlers starring Iggy the iguanodon. Our iconic mascot came to life in puppet form thanks to an idea from our education team. And the empty Museum became a makeshift film set, but no film crew was allowed in. The team started out low-tech, using simple smartphones to experiment, before upgrading equipment as the series grew. Our Museum guides proved to be talented voice actors, putting words in the mouths of Iggy and friends in French, Dutch and English. 10.544 viewers tuned in to watch "the Iggy videos. The video "watch "Iggy learns to draw a T-rex" was particularly well received by primary school students, many of whom sent in their Iggy-inspired drawings to be exhibited in our halls.

Taking flight through the galleries

Our biggest viral hit this year showed just how keen people were to get back into the Museum. It was a 360° video recorded by a drone weaving in and out of the residents of our Dinosaur Gallery, created by a fan of the Museum. The lockdown was a chance for our team to work on the footage, making the names of each dinosaur pop up as they appear in the video. Viewers could scroll around to see the video from different angles as it played, or watch it in virtual reality on YouTube with Google Cardboard glasses. And the reactions were particularly enthusiastic, as the video reached over 50,000 people.

Changing the way we reach out

Space to experiment allowed us to catch our audiences' attention in different ways more broadly. And it wasn't just online that we brought communication directly into people's homes. For the reopening of the Museum, and particularly for the opening of the Living Planet gallery, we wanted to make sure the word got out as much as possible. Our eyecatching poster campaigns brightened up people's walls as well as the streets, thanks to supplements in *Bruzz*, the local magazine for Brussels region.

New concepts in video included our Science News Flash: a new way of communicating news from the Institute, summarising each news item for the general public with a catchy minute-long video illustrated with infographics, diagrams, video and animated text. Our new Science Vlogs are also designed to be picked up on social media,

taking you behind the scenes of work in progress: join a dig at the whale cemetery in Deurne, find out about our falcons' nest in Etterbeek or what happens after dark with the caretakers at the Museum, for example. New this year too was our involvement in audio formats: one of our palaeontologists made an episode about dinosaurs for 'Wetenschapje', a podcast by Het Geluidshuis. It turned out to be the most popular of the season, with 10,303 downloads.

This experimentation in our communications work over the year is very much in line with our broader strategic move towards audiovisual storytelling. As people change the way they access news and content, we have to adapt accordingly. Online channels and social media are a source of huge potential for the Institute and it is a challenge to which our team continues to rise.

A TIMELY RETHINK OF OUR EDUCATIONAL OFFER

The impending opening of the Living Planet gallery combined with the confinement meant a double opportunity for our educational team to come up with new ideas, in line with our strategy to improve our online work. *The result is a fresh set of activities that find new ways to engage our visitors face-to-face as well as reaching out to families and children at home and in schools.*

Levelling up our engagement activities

As school groups began to cancel their visits and the Museum finally closed its doors, our educational team had an opportunity to come together and reflect on how to take advantage of this time away from the Museum floor. It was a time for reading up on the latest advances in our field as well as updating our teachers' packs and educational documents, but especially to rethink what shape our face-to-face activities would take.

The first step was getting to grips with Teams as a working platform: a challenge for colleagues who are so used to working side by side in daily life. But some work needed to continue urgently, such as the finalisation of the educational activities that would accompany the new Living Planet gallery. Four guides worked to help choose the specimens to be included in the two discovery rooms, the Tetrapodium and the Arthropodium, as well as scripting the dolphin animation for the Tetrapodium and checking the various videos that the gallery includes.

With no school groups visiting, the team took advantage of the additional time to rethink certain activities such as those on Dinosaurs, on Classification and, to integrate the brand new Arthropodium, on Insects. Our team also got to work on the redevelopment of our birthday workshops, with a series of games and activities using magnetic boards where children could win puzzle pieces to build a huge iguanodon.

And even in 2020, we still managed to bring exhibition workshops outside of the Museum walls. Thanks to regional financing from Bruxelles Environnement, our exhibition workshop on taxonomy, Classific'Action, was still able to tour schools in French and Dutch, wherever they could be implemented in conformity with the COVID-19 rules in application at the time.

Virtual ways to bring the Museum to you

Confinement was a crisis for the education sector too. Determined to ensure that a generation of children were not deprived of opportunities due to the confinement, it was our guides who took the initiative to bring their workshops to the schools, at least until school groups could return to the Museum.

Our team studied good practices in digital engagement from across the museum sector, taking inspiration and matching it up with the strengths of the Museum. One clear finding was that for digital activities to be successful, the quality of the content must be excellent. The time needed to develop these activities would therefore prove to be key.

What about simply streaming the Museum visit and allowing people to interact on Zoom, for example? It soon became clear this was not a feasible option: the lighting, sound and WiFi infrastructure in the galleries would require some significant adaptations which were beyond the realms of possibility in the short term. And we wanted to ensure more than just a streaming tour - we wanted to be able to let people engage in dialogue and interact, keeping eye contact despite the interface. What did prove successful was the transformation of one of our office spaces into a full video recording studio, complete with sound insulation and a lighting rig.

In terms of content, Iggy the iguanodon was a starting point. As well as starring in the Museum's communications activities as we saw on page 48, Iggy also turned out to be an engaging protagonist for our dinosaur workshops, adding a playful twist that children responded to very positively in our tests.

The end result was a brand new set of Zoom workshops ready to be launched, including two on dinosaurs for primary and early secondary school students. We also developed a new version of our "Raconte-Nous" storytelling workshops based on the Japanese street theatre format. Known as *kamishibai*, it brings our science stories to life using a series of boards that adapt very well to a virtual format.

With our strategic plan in mind as we develop our online educational activities, we are thinking far beyond the confinement context under COVID-19. There are many other barriers that prevent schools and other visitors getting into the Museum: financial, socio-cultural and those related to accessibility. And we already start to see early signs of increasing demand: even schools in Mexico and Switzerland have requested a virtual visit.

54 **FINANCES**
Breakdown of expenses
Sources of income
Breakdown of specific grants
Breakdown of income of the Museum
Breakdown of research income

56 **STAFF**
Staff breakdown by statute
Age distribution
Sources of financing of the staff
Percentage of female staff
Absenteeism and work accidents
Volunteers

59 **ENVIRONMENT**
Environmental indicators

60 **RESEARCH**
Funding of current scientific projects
Publications
Average number of publications per scientist
Supervision of students

62 **LIBRARY AND COLLECTIONS**
Consultations
Size
Digitisation

64 **MUSEUM**
Museum visitor activities
Profile of the Museum user

66 **PRESS AND INTERNET**
In the media
Online and social media

4 FIGURES

FINANCES

Drawing up the 2020 budget was something of a unique exercise given the conditions of the confinement under the COVID-19 pandemic. The RBINS nevertheless closed the year with a positive result. This was not attributable to any increase in revenue but rather the consequence of a downturn in activities due to the pandemic. This slowdown meant that staff credits were underused, due to a delay in implementing the staff plan. It also led to underuse of operational and investment credits for a number of reasons including delays in the implementation of public contracts. In 2020, the positive balance of around €1.7 million is partly attributable to this underuse of credits and partly due to the intervention by the Federal State (through the Interdepartmental provision of €733,000) to compensate for the loss of earnings from Museum activities.

RBINS revenue fell by 3.7% compared to 2019 and continues to come primarily (63.4%), and in a relatively stable manner, from the structural funding of €21 million. It was primarily earnings linked to the Museum's activities that saw the most marked fall, down from 12% to 5% of total earnings. This was despite the opening of the new Living Planet gallery with sizeable financing from Beliris. Thanks to Living Planet and the reopening of museums, albeit with a limited capacity, we were able to limit the damage in terms of admissions and sales at the MuseumShop.

Funds from research grants stood up well overall compared to 2019, at 29% of total revenue. The effective start-up of new federal funding programmes such as BRAIN-be 2.0 and FED-tWIN guaranteed new financing, but we also saw the signing of important contracts with the ESA that had a positive impact on the share of intra-European grants.

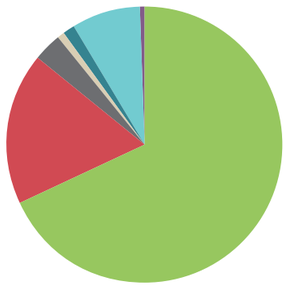
On the expenditure side, the total annual amount fell by €2.7 million, a drop of 8% compared to 2019, but the RBINS is an institution that is human capital intensive. Staff costs represent 68.2% of total expenditure and these fell by 5% compared to 2019 (a fall of €1 million). Operational costs (17.8% in 2020) remained under control and largely followed the same trend as staff costs. It was principally investments in equipment and acquisitions for the library and collections (4.1% of total expenditure) that failed to rise (as they had in 2019), falling back to 2018 levels (down 52% compared to 2019).

Transfers to the Ministry of Defence covering the operating costs of the Belgica continued to increase (€2.6 million, up 6% on 2019) but work on the new Belgica II is coming to an end. The new vessel dedicated to research will also change the cost model since the Ministry will no longer be the principal user.

Despite the unfavourable context, the RBINS closed the year with a positive result in terms of budgetary execution and general accounting. This situation cannot be regarded as normal. As the RBINS is a human capital intensive institution, the greatest challenge remains that of continuing to finance the staff plan in the coming years.

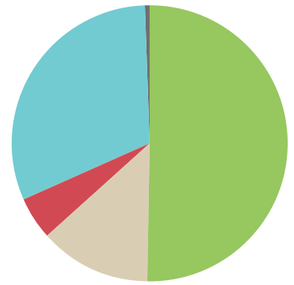
BREAKDOWN OF EXPENSES (IN €)

	2018	2019	2020
Staff	**21,631,365**	**22,476,880**	**21,397,830**
Ordinary operational expenses	**6,590,608**	**5,851,529**	**5,592,824**
Investment	**1,057,306**	**2,122,178**	**1,013,198**
Scientific	194,234	455,530	309,589
Museum	233,734	1,043,964	141,328
Others	629,338	622,684	562,281
Library and collections	**222,771**	**176,388**	**269,486**
Transfers to research partners	**2,639,276**	**814,963**	**403,489**
Transfer to Defence for the Belgica	**1,310,326**	**2,434,422**	**2,580,951**
Other transfer		**156,323**	**113,469**
Total	**33,451,652**	**34,032,683**	**31,371,247**



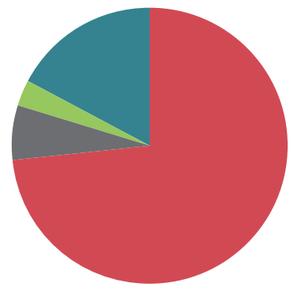
SOURCES OF INCOME (IN €)

	2018	2019	2020
General grant	**16,509,000**	**16,580,000**	**16,681,872**
Specific Grant	**3,592,000**	**3,542,000**	**4,327,436**
Museum: own income	**2,916,035**	**4,194,040**	**1,665,010**
Research: own income	**11,679,764**	**9,890,284**	**10,301,587**
Various: own income	**44,503**	**197,340**	**140,820**
Total	**34,741,302**	**34,403,664**	**33,116,725**



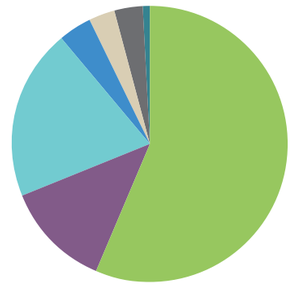
BREAKDOWN OF SPECIFIC GRANTS (IN €)

	2018	2019	2020
Belgica	3,134,000	3,134,000	3,177,876
JEMU	274,000	274,000	279,252
Public Observatory (all federal Museums)	134,000	134,000	137,000
Interdepartemental provision	50,000	0	733,308
Total	**3,592,000**	**3,542, 000**	**4,327,436**



BREAKDOWN OF INCOME OF THE MUSEUM (IN €)

	2018	2019	2020
Museum renovation grant	343,891	1,027,492	0
Ticket sales	1,600,279	1,660,993	943,012
Exhibition hire and sales	80,510	77,000	205,043
Museumshop	418,195	502,847	334,345
Donations - sponsorship - grants	4,240	483,510	65,869
Education	157,804	178,535	49,741
Events	248,009	218,063	54,106
Dinocafé	63,107	45,600	12,894
Total	**2,916,035**	**4,194,040**	**1,665,010**



BREAKDOWN OF RESEARCH INCOME (IN €)

	2018	2019	2020
Belspo	3,183,643	1,669,539	2,125,139
Federal administrations (excl. Belspo)	198,760	1,313,552	2,070,856
European Union	3,810,546	2,305,683	1,279,106
Belgian federated entities	1,579,670	2,051,345	1,822,422
Private sector	2,746,322	2,156,868	2,418,989
Outside the EU	160,823	393,297	585,075
Total	**11,679,764**	**9,890,284**	**10,301,587**

STAFF

In 2020 we saw limited variation in the total staff numbers, due to the delays in recruitment processes at Selor as a result of COVID-19. Because of this, we can see a slight decrease in the numbers of statutory staff members, and a more pronounced drop in the number of administrative and technical staff, where positions became vacant and we were unable to fill them. There is, however, an increase in the number of contractual scientists, with Selor not involved in this particular recruitment process.

Like last year, absenteeism figures declined this year both within the RBNIS and generally among federal government employees. 2020 saw a fall from 5.3% to 4.2%. Compared to 2019 we saw a sharp rise in workplace accidents. This rise is attributable to a single incident following which as a precautionary measure an occupational accident declaration was drawn up for eight people. As regards accidents when commuting to and from the workplace, we have seen a sharp fall, attributable to remote working during the COVID crisis.

In 2020, we see that 46.41% of our total staff numbers are women, which is similar to previous years.

For our volunteers, 2020 regrettably did not offer the same opportunities for supporting our activities as the previous year had done, as the lockdown and mandatory remote work meant that our premises were mostly or entirely inaccessible for them.

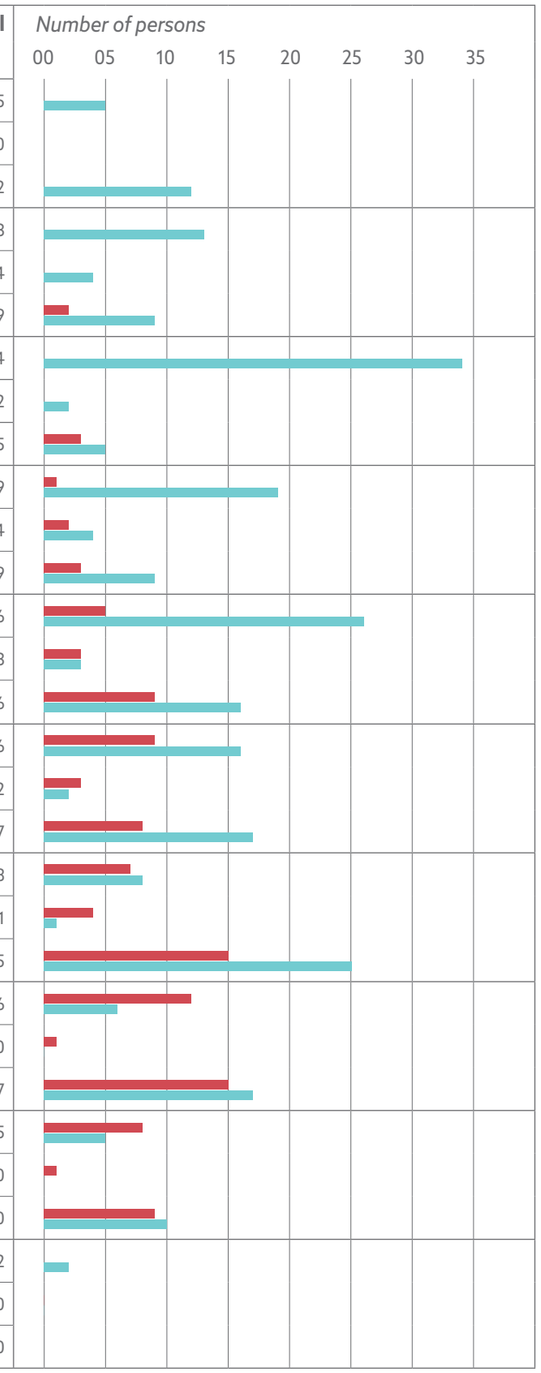
STAFF BREAKDOWN BY STATUTE

	2018	2019	**2020**
Statutory scientists	43 / 41.4	43 / 41.4	42 / 39.2
Statutory administrative and technical staff	85 / 78.16	80 / 72	78 / 70.86
Contractual scientists	133 / 120.6	124 / 113.1	134 / 123.95
Contractual administrative and technical staff	150 / 130.25	146 / 129.35	136 / 121.1
Total	**411 / 370.41**	**393 / 355.85**	**390 / 355.11**

The first number refers to the number of employees, the second to the number of full-time equivalents (FTE).

AGE DISTRIBUTION

		Statutory	Contractual
18 - 25	SW	0	5
	A	0	0
	BCD	0	12
26 - 29	SW	0	13
	A	0	4
	BCD	2	9
30 - 34	SW	0	34
	A	0	2
	BCD	3	5
35 - 39	SW	1	19
	A	2	4
	BCD	3	9
40 - 44	SW	5	26
	A	3	3
	BCD	9	16
45 - 49	SW	9	16
	A	3	2
	BCD	8	17
50 - 54	SW	7	8
	A	4	1
	BCD	15	25
55 - 59	SW	12	6
	A	1	0
	BCD	15	17
60 - 64	SW	8	5
	A	1	0
	BCD	9	10
65 +	SW	0	2
	A	0	0
	BCD	0	0



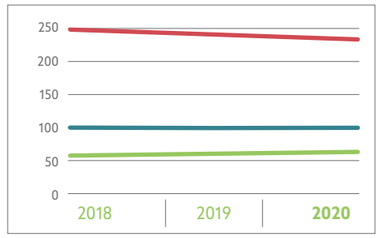
SW = Scientists

A = Level A (Master)

BCD = Levels B (Bachelor), C (secondary education) and D (no degree)

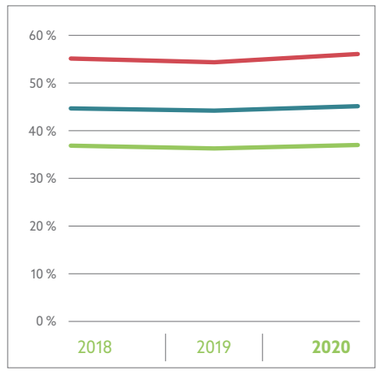
SOURCES OF **STAFF FINANCING** (NUMBER OF PERSONS / IN FTE)

	2018	2019	**2020**
Staff budget	250 / 228.21	239 / 217.60	228 / 207.36
General grant			
Ordinary income	57 / 47.9	59 / 52.65	61 / 54.9
External projects	104 / 94.3	96 / 85.60	101 / 92.85
Total	**411 / 370.41**	**394 / 355.85**	**390 / 355.11**



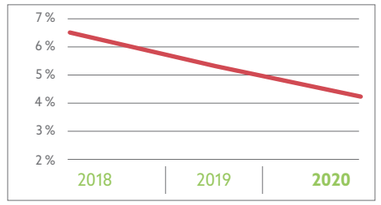
PERCENTAGE OF **FEMALE STAFF** (%)

	2018	2019	**2020**
Statutory staff	**33.59**	**30.08**	**30.83**
Scientists	27.91	25.58	26.19
Level A	38.46	41.67	50.00
Levels B, C and D	36.11	30.88	32.20
Contractual staff	**50.53**	**52.96**	**53.33**
Scientists	45.86	46.77	48.51
Level A	71.43	66.67	62.50
Levels B, C and D	52.94	57.25	57.50
Total	**45.26**	**45.80**	**46.41**



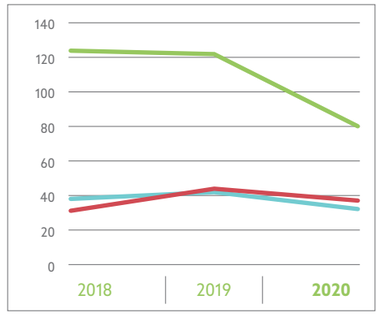
ABSENTEEISM AND **WORK ACCIDENTS**

	2018	2019	**2020**
Work accidents	5	5	16
Accidents on the way to **work**	9	7	2
Absenteeism RBINS	6.51%	5.30%	4.20%
Absenteeism federal level	6.61%	6.52%	6.23%



VOLUNTEERS

	2018	2019	**2020**
Research volunteers	124	122	80
Collections volunteers	31	44	37
Museum volunteers	38	42	32
Total	**193**	**208**	**149**



ENVIRONMENT

The year 2020 started in the same spirit as 2019, with plans for starting a city garden in our own greenhouse and new ideas for workshops around biodiversity. But, as for so many things in 2020, the coronavirus decided otherwise. With obligatory teleworking, workshops could no longer be organised, and the daily care of a city garden could not be maintained.

Moreover, without the short and spontaneous chats during coffee breaks and lunches, our focus remained on daily work. New ideas about our internal environmental behaviour were put on the back burner.

Fortunately, due to online collaboration tools, our new intranet and related virtual communication tools, we were able to stay connected and spread information. The internal 'climate group' for example stayed active by disseminating about online events, publications and news items on their Yammer page.

Changes in our lifestyle during the COVID-19 crisis have also boosted an increased interest in mobility and energy consumption on European, federal and regional levels and will support us to improve our environmental performance in the near future. For example, from January 2021 a general speed limit of 30 km/h is in force in Brussels. Additionally, budget is allocated for the construction of bicycle tracks in all regions, to ensure a better connection between and within cities. Furthermore, European legislation has been translated to the level of the Brussels region, with the obligatory assignment of an energy coordinator (PLAGE). The energy coordinator will be responsible for investigating the possibility of small and medium investments to reduce our energy consumption.

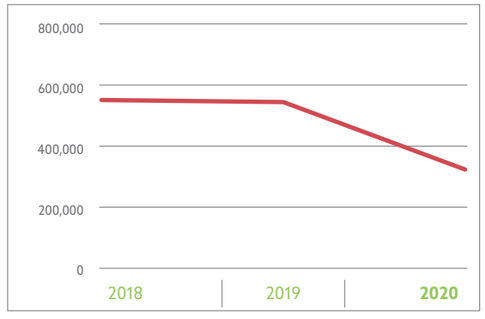
Meanwhile, we have been monitoring our environmental indicators. Due to prolonged teleworking, the numbers are very different to previous years. However, because the Museum stayed open during the main part of the semi-lockdown, the reduction of energy consumption is, with 18%, less pronounced than expected. Following the new PLAGE legislation, our energy consumption will again come under scrutiny. Looking to mobility, the planned poll on our main means of transport was not considered relevant during the COVID-19 crisis and is postponed to 2021. Nevertheless, this has not inhibited us to further formalise our plans to relocate and enlarge our bicycle parking space.

In our yearly paper consumption we see a reduction of 40%. This reduction is probably an exaggeration, as many of us will have printed at home during the lockdown periods.

ENVIRONMENTAL INDICATORS

	2018	2019	**2020**
Electricity consumption in equivalent tonnes of CO_2 emissions	454.7	464.3	382.4
Electricity consumption in kWh	2,008,987	2,054,497	1,692,023
Gas consumption in equivalent tonnes of CO_2 emissions	941.8	Currently not available	827.6
Pages of paper printed	558,705	551,937	328,734
Percentage of commutes using public transport	Survey postponed to the first semester of 2019, in combination with action about mobility	65%	Survey posponed to 2021 due to COVID-19-crisis

PAGES OF PAPER PRINTED



RESEARCH

There was a sharp decline in the total number of RBINS publications in 2020 as compared to 2019 (around 120 titles fewer), and this is mostly visible in the scientific publications, which dropped from 499 in 2019 to 378 in 2020. Most of this decline is owing to a significant drop in the category 'abstracts' (from 187 in 2016 to only 42 in 2020). As such abstracts are nearly always related to presentations or poster sessions at scientific meetings, this drop is clearly due to the fact that many such meetings were cancelled or postponed because of the pandemic. We expected that the COVID-19-associated compulsory teleworking might have caused an increase in A1 papers (published in journals with an impact factor), and there is indeed a slight increase from 190 in 2019 to 197 in 2020. We expect that an increase could also appear in 2021, as several papers written and submitted in 2020 will only be published in 2021.

In 2020 the number of our Institute's contracts financed by Belspo return to the levels seen in 2017 and 2018. The main drop (10) is due to the start of the first contracts coming from the call for BRAIN-be 2.0 projects. Another difference in 2020 is the relatively low level of EU financing. This difficult period can be explained by COVID-19 circumstances, with few expenses reported since missions abroad are limited and less EU-funded activity could take place. A certain number of projects have been contractually delayed as a result.

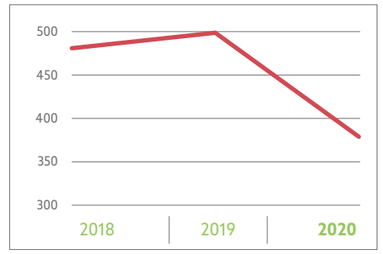
The increase in funding coming from outside the EU is because of a remarkable contract coordinated by the Institute with the European Space Agency: Hypernet-OC. The number of projects financed by the private sector in 2020 is limited. This is due to the fact that one main group of activities on the monitoring of the North Sea is consolidated under one single line, but it represents an annual value of around €2 million per year.

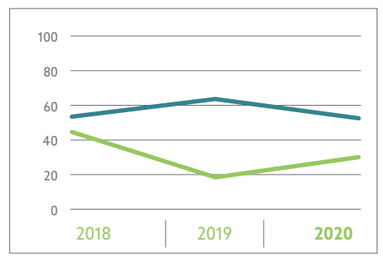
FUNDING OF CURRENT SCIENTIFIC PROJECTS

	2018	2019	2020	2020
	Number	Number	Number	Amount (in €)
Belspo Number of projects coordinated by RBINS	**60** 40	**46** 33	**58** **42**	2,125,139
Federal funding from other sources Number of projects coordinated by RBINS	**14** 14	**9** 9	**11** 11	2,070,856
European Union Number of projects coordinated by RBINS	**27** 4	**30** 2	**34** **1**	1,279,106
Federated entities Number of projects coordinated by RBINS	**25** 14	**23** 8	**25** 15	1,822,422
Private sector Number of projects coordinated by RBINS	**9** 9	**5** 5	**9** 9	2,418,989
Outside the EU Number of projects coordinated by RBINS	**9** 9	**9** 9	**8** 8	585,075
Total projects coordinated by RBINS	**144** 90	**124** 66	**145** 96	**10,301,587**

PUBLICATIONS

	2018	2019	2020
Scientific publications	481	499	378
of which Open Access	63	99	109
of which journals with impact factor	139	190	197
Popular works	45	18	30
Expert reports	53	64	52
Total	**579**	**581**	**460**

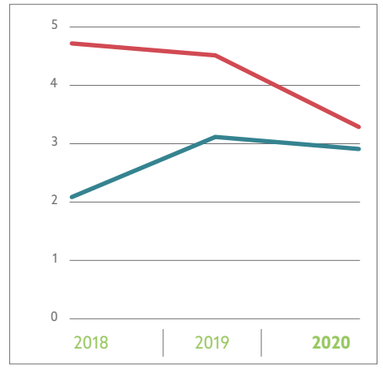




AVERAGE NUMBER OF PUBLICATIONS PER SCIENTIST (IN FTE)

	2018	2019	2020
All publications per scientist	4.7	4.5	3.3
All publications with impact factor per researcher	2.1	3.1	2.9

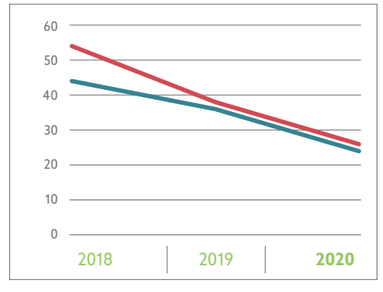
Average number of publications per FTE scientists: using all types of publications, and FTE of all RBINS scientists, both those actively publishing primary research (Type I) and those working for scientific services (Type II). Average number of A1 papers per FTE researchers: using only A1 type papers (=published in journals with Impact Factor) and FTE of RBINS researchers who are actively publishing primary research (Type I). Individual scientists can be, for example, 70% of Type I and 30% of Type II, which is why we use cumulative FTE.



SUPERVISION OF STUDENTS

	2018	2019	2020
PhD	54	38	26
Master	44	36	24
Total	**98**	**74**	**50**

The decrease in the number of supervised students is probably due to the temporary closure of the buildings in 2020, including the labs.



LIBRARY AND COLLECTIONS

Our scientific collections comprise approximately 38 million specimens. The collection activities were impacted by the COVID-19 pandemic. Only 46,408 new specimens arrived in 2020, mainly during the first two months. The number of visitors to our collections for the purpose of scientific research was only 193, with an average visit of 1.5 days. The number of loans from the collection has also been affected by the limitations of physical visits and the delay in the exhibition programs. We recorded 229 loans in 2020, which amounts to about 15,885 specimens loaned out.

The digitisation of the specimens was impacted less heavily in terms of the introduction of metadata on the specimens and the digitisation of the specimens themselves – with the exception of high-resolution digitisation, which requires someone to be present on site. As in 2019, priority was given to the type specimens, i.e. the specimens that describe or help describe a species, or unusually illustrated specimens. In 2020, metadata for approximately 20,676 new specimens were added to the main DaRWIN database (total 47,889). No metadata were imported from the former databases in 2020 but metadata for more than 25,000 specimens were prepared for import in 2021. In addition, 13,600 specimens from the palaeontology collections were added to an Access databank so that they could also be imported into our DaRWIN collection tool in 2021.

Data is now available for 104,819 type specimens (CMS DaRWIN) from an approximate total of 200,000. In addition, 43,303 type specimens from the palaeontology collections are already encoded in the Access database, ahead of being imported into DaRWIN.

Data is available for 3,098,726 type/non-type specimens in DaRWIN and 95,500 in the Palaeontology Access database (total 3,194,226) from an approximate total of 38 million, or roughly 8.5%.

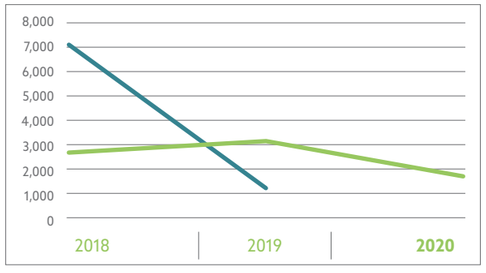
The library was closed to the public from 16 March 2020 and remote services were put into place. From 31 March home access was possible to resources such as the Web of Science & Zoological Record, Elsevier "Science Direct" and Springer & Current Anthropology. From 25 May it was possible to resume some of the library services (inter-library loans, loans/returns via the lockers at the reception, etc.). The book ordering service was not affected and was able to operate without interruption.

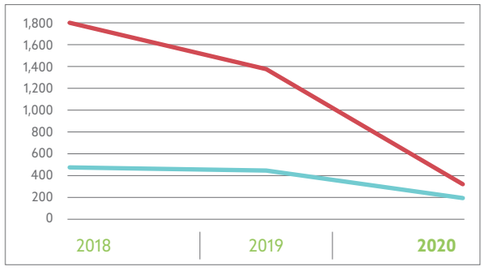
In 2020, before the lockdown, 304 publications were consulted externally in the reading room. In total, 1,687 loans were registered, 1,383 of those internally. During the period of remote working, 2,045 more entries were back catalogued compared to 2019. By the end of 2020, the library contained over 430,222 digital resources.

CONSULTATIONS

	2018	2019	**2020**
Library			
Paper documents	2,676	3,154	1,687
Electronic documents	7,121	1,203 *	/
Collections			
Number of scientist visits	477	448	193
Duration of scientific visits (days)	1,800	1,375	320
Number of loans from the collections	398	406	229
Number of loaned specimens	35,479	100,955	15,885

* Only the figures from Web of Sciences and Zoological Record are available for 2019.
As we no longer use a paid tool such as AtoZ, an overview of the use of the e-journals in OA and/or free with the print edition is not consultable.





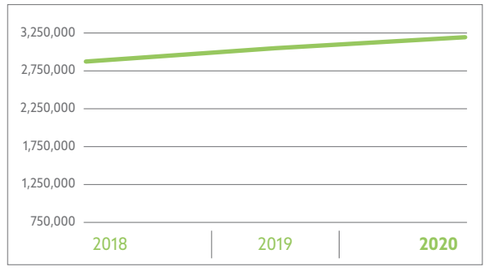
SIZE

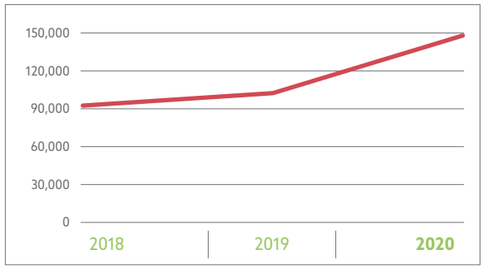
	2018	2019	**2020**
Library			
Size of the library	414,320 items*	419,839 items*	430,222 items*
Growth of the library	Total growth of 1.0%	Total growth of 1.3%	Total growth of 2.4%
Collections			
Number of collections acquisitions	+129,636	+162,035	+46,408

* item = physical unit

DIGITISATION

	2018	2019	**2020**
Library			
Back-cataloguing	3,891	6,960	9,005
Digitisation of the catalogue of the library	380,000	47,859	0
Number of digitised pages	18,249	6,414	32,010
Collections			
Type specimens	2,270	2,602	4,332
Non-type specimens	2,900	1,191	800
Boxes & Drawers	154 + 991	264 + 5,133	251 + 980
The new registrations in the databases	23,496	20,556 (DaRWIN) 55,152 (Import DaRWIN) 6,669 (Pal Access)	47,889
The number of new types	1,039	3,609 records 9,478 specimens (DaRWIN) 3,421 (Pal Access)	5,633
The total of digitised specimens (metadata)	2,874,685	3,050,211	3,194,226
The total of digitised type specimens	90,753	100,944	148,122
The total of digitised species (all specimens)	81,823	85,289	112,189
Scientific archives	70,693	51,878	72,061
Pictures	/	11,853	21,747





MUSEUM

It was of course the Museum activities in particular, and more generally all public activities that were hardest hit by the COVID-19 pandemic. The Museum was completely closed for 14 weeks, and the reopening of rooms was staggered, with limited visitor numbers. This had a clear impact on the total number of Museum admissions (207,000 visitors), which dropped by 41% compared to 2019. 2020 could have and should have been a record year, with the opening of the long-awaited Living Planet gallery which, after a series of delays, was finally inaugurated unceremoniously without the crowds it deserved, as well as Antarctica, a temporary exhibition whose first months gave every reason to look forward to an exceptional success. From the first easing of lockdown, a single combined ticket was introduced for the Museum and the temporary exhibition. This means we were no longer able to count specific visitors for Antarctica, as the exhibition was accessible to all. This explains the very high visitor numbers, which cannot be compared to previous years.

The figures show that some sectors of activity were hit harder than others. Educational and cultural activities were only able to continue anything like normally during three months of the year and were down 60%, while events organised within our facilities fell by 80%!

Despite this sad story it was not all doom and gloom. Compared to other major museums and tourist attractions, the Museum did succeed in "damage limitation" and above all showed, at the time of the two sudden closures and reopenings, a remarkable ability to adapt and an equally remarkable agility in responding. At the end of the first lockdown, the Reception and Exhibitions services, in close cooperation with our caretaking, ensured that the very strict hygiene measures to protect the public were respected: signage, disinfection, clearly marked and signposted routes and above all the last-minute launch of our online box office with allocated slots. The communication service ensured that the information on our website was continuously updated and supplied this website and the social networks with numerous digital productions brought together on #NaturalsciencesAtHome. The Education service developed a temporary range of activities at schools but above all embarked on the production of various digital formats with podcasts, video capsules (starring our iguanodon Iggy!) and genuine in-studio productions that are destined to enrich our offering permanently. Special mention must be made of our MuseumShop: in part thanks to its "pop-up" shop, it achieved sales figures which, in proportion to visitor numbers, are up on those of previous years!

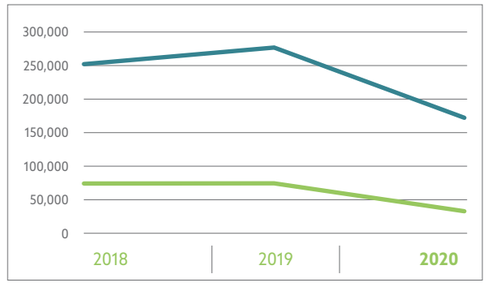
MUSEUM VISITOR ACTIVITIES

	2018	2019	**2020**
Total Museum visitors	**328,183**	**353,054**	**206,657**
Permanent galleries	209,802	234,161	47,951
Temporary exhibitions indoor	118,381	118,893	158,706
Museumshop customers	26,166	30,462	17,533
Expenses per customer	€15.94	€16.26	€18.90
Participants in educational and cultural activities	**54,068**	**50,341**	**20,562**
Participant per activity (global)	21.3	20.4	21.8
Guided tours	15,156	11,934	4,068
Workshops	15,408	13,908	4,870
Other indoor activities	9,190	9,917	3,232
Outdoor activities	14,314	14,582	8,392

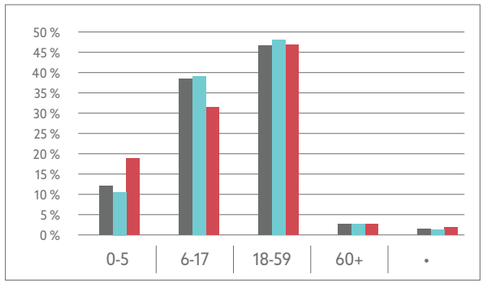
PROFILE OF THE MUSEUM USER

	2018	2019	**2020**
By type	**328,183**	**353,054**	**206,657**
Visitors in groups	77,631	77,915	35,445
Individuals and families	250,552	275,139	171,212
By age			
Small children (0-5 years)	11.96%	10.42%	18.53%
Young people (6-17 years)	37.88%	38.36%	30.88%
Adults (18-59 years)	45.90%	47.33%	46.04%
Senior citizens (60+)	2.72%	2.62%	2.73%
Not known •	1.54%	1.27%	1.82%
Participants in educational and cultural activities	**54,068**	**50,341**	**20,562**
Visitors in groups	46,840	42,524	17,849
Individuals and families	7,228	7,817	2,713
Average participants per activity	21.3	20.4	21.8

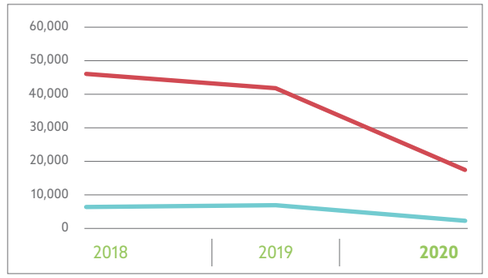
MUSEUM VISITORS: VISITORS IN GROUPS VERSUS INDIVIDUALS AND FAMILIES



MUSEUM VISITORS: AGE



PARTICIPANTS IN EDUCATIONAL AND CULTURAL ACTIVITIES



PRESS AND INTERNET

The Museum had to close its doors for an extended period on two occasions due to COVID-19. Despite this, we were in the media more than four times a day - more than in previous years.

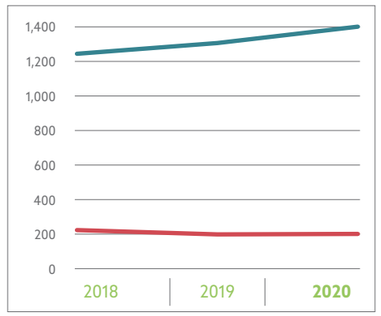
COVID-19 put a stop to a lot of things, but not the publication of our research results, and the media were eager to pick up on the science news. Nature news received good coverage (including on marine mammals, bird ringing and insects) while reporting of archaeological and paleontological news was as popular as ever. The Living Planet opening also attracted press attention. Linked to this was the #TogetherForBiodiversity campaign that was launched on 22 May and then relaunched in September when the new gallery opened.

The press reported on the various periods of closing and reopening but also on how we responded to the lockdown with our digital activities (#NaturalsciencesAtHome). Journalists also reported extensively on the large number of visitors at weekends and during the holiday periods.

Taken together, all the RBINS websites – about 50 – reached 749,304 visitors in 2020. This is slightly up on the figures for the previous four years. Our corporate website naturalsciences.be saw 437,448 visits, with alternating low figures during the lockdowns and then high peaks (a rush on tickets) after the reopening and especially during the winter holiday. Our Facebook followers grew notably to 16,700 (up 3,679 compared to 2019), in part due to the COVID-19 lockdowns and our efforts to inspire people through #NaturalsciencesAtHome. Our Facebook page reached about 2.3 million people this year which is a record since we have been active on this particular social network. We now have 13,283 followers on Twitter (up 783) and 3,681 (up 1,029) on Instagram.

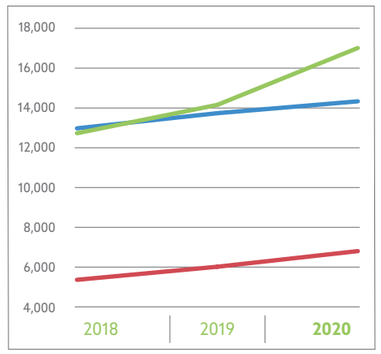
IN THE MEDIA

	2018	2019	**2020**
Printed press	**1,242**	**1,305**	**1,401**
Of which research	858	906	903
Of which Museum	384	399	498
Radio and TV	**224**	**197**	**200**
Of which research	178	138	104
Of which Museum	46	59	96
Total	**1,466**	**1,502**	**1,601**

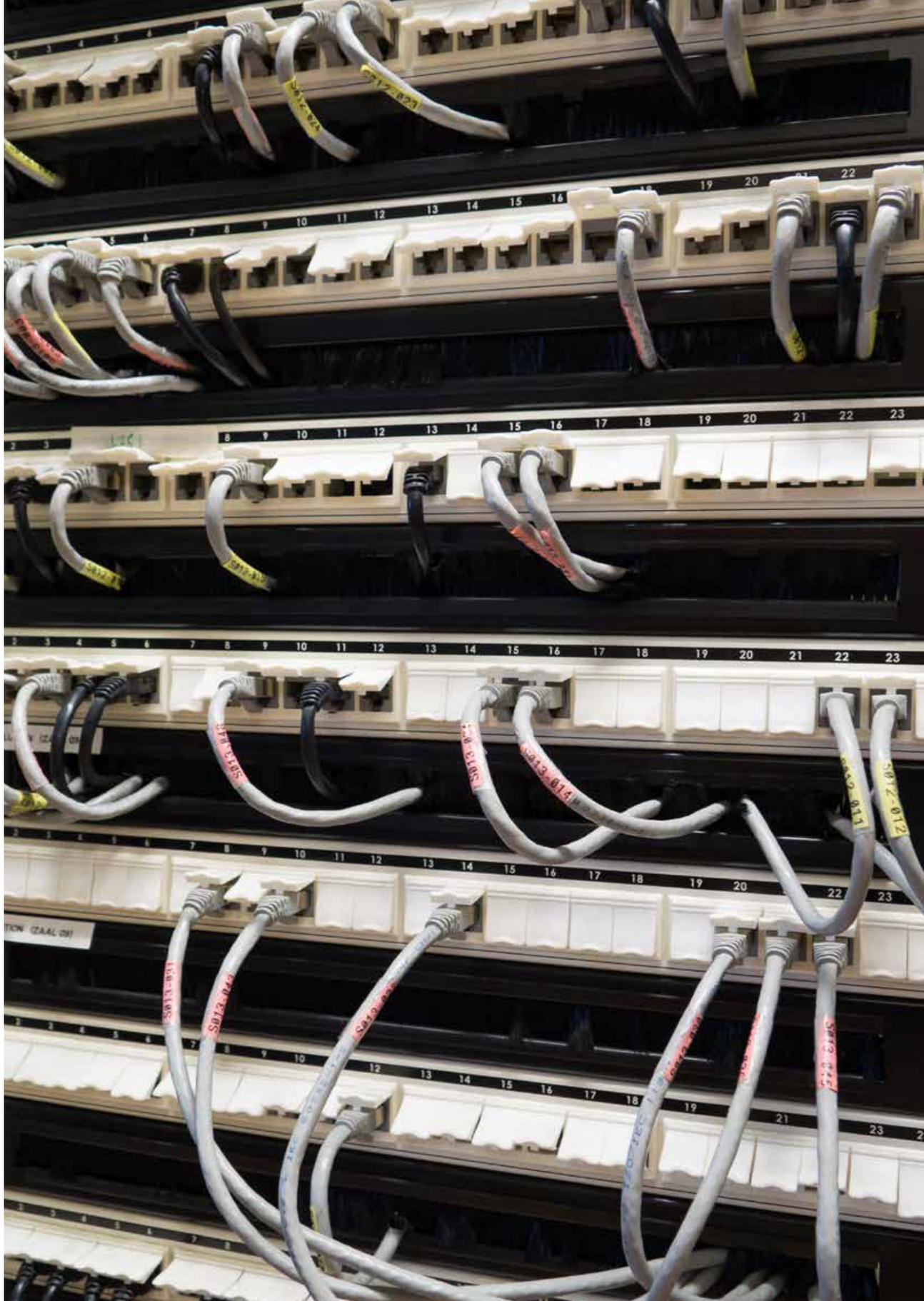


ONLINE AND SOCIAL MEDIA

	2018	2019	**2020**
Websites			
Website visitors	720,139	736,401	749,304
Website visits	1,296,689	1,223,801	1,324,252
Visited pages	3,630,910	3,442,154	3,394,558
Social media			
Facebook followers	11,187	13,021	16,700
Twitter followers	11,500	12,500	13,283
Instagram followers	1,790	2,652	3,681



* For technical reasons, we have no figures available for the streaming of Falcons for Everyone (7.4 million pages in 2018). We estimate that there were more than 3.7 million visits to the streaming pages in 2019, based on the number of pages visited on the website falconsforeveryone.be There was no streaming of the peregrine falcons in the Brussels cathedral, as the nest was abandoned.



THE RBINS IN BRIEF

Missions

RBINS has been entrusted with four major missions:
- Scientific research into natural sciences;
- Scientific expertise at the service of the public authorities;
- Conservation and management of scientific and heritage collections;
- Dissemination of scientific knowledge in society.

Research & expertise

One out of every three people at the RBINS is a scientist. The scientific personnel includes mainly biologists, palaeontologists and geologists, but also oceanographers, anthropologists, prehistorians and archaeologists, as well as geographers, physicists, bio-engineers and mathematicians, which enables it to conduct multidisciplinary research.

Lines of Research;
- Biodiversity and geodiversity;
- Biological evolution and the history of life;
- Marine and freshwater ecosystems' management;
- History of the human/environment relationship;
- Applied geology.

Service Provision
- The RBINS provides scientific expertise under Belgium's international commitments in relation to environmental protection.
- It develops tools and methods for monitoring natural land or marine environments.
- It also offers useful advice for the development of national
- and European policies for the protection and conservation of biotopes and biodiversity and the use of natural resources.

Collections

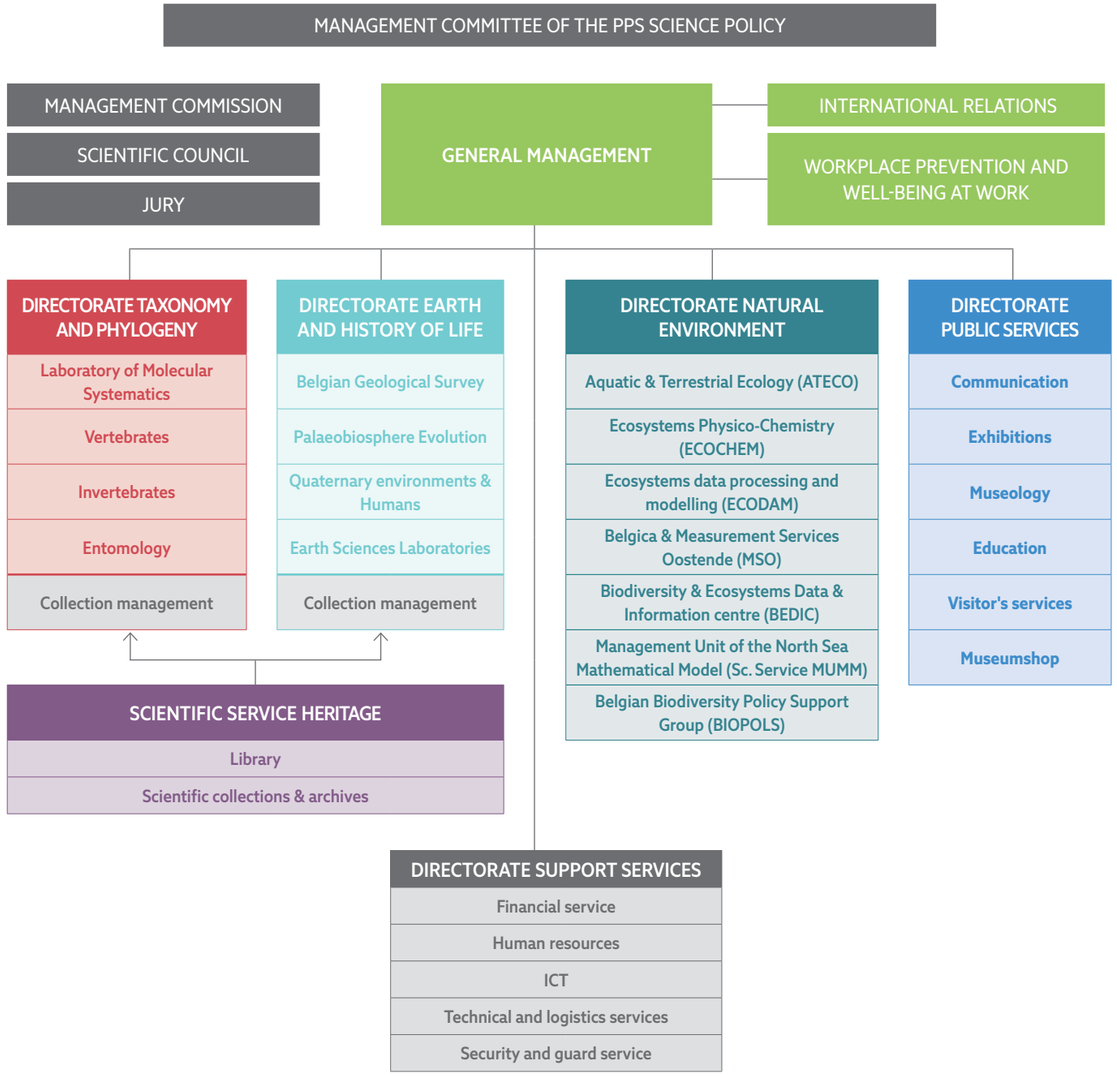
With their 38 million specimens conserved as Belgian heritage of universal significance, the RBINS's collections come just after London and Paris in the European classification, and belong to the top 10 largest collection in the world. They serve above all as reference and research tools and as such belong to the European 'major research infrastructure'. In this respect they are constantly being visited and studied by researchers from around the world. For several years now, the RBINS has been committed to an ambitious programme to digitise its collections and to do so has developed an open-source software, DaRWIN, which has made it possible to encode all the data on any collection of specimens, whatever their taxonomic group.

Museum

For the general public, the Natural Science Museum is the visible part of the RBINS. It has 16,000 m^2 of permanent galleries, temporary exhibition rooms and educational workshops, public spaces of all kind, enabling it to welcome more or less 300,000 visitors each year, approximately 25 % of whom are school groups. Its *Dinosaur Gallery* is world famous and the largest in Europe.

It plays a leading role in the promotion and dissemination of scientific culture, both within and beyond its walls, notably through travelling exhibitions and events. The RBINS is pursuing ambitious efforts to gradually renovate the premises, to make the Museum more convivial and better adapted to people's expectations. The Museum also takes a resolute position promoting a more respectful approach to nature.

ORGANISATION



The Royal Belgian Institute of Natural Sciences is one of the ten federal scientific institutions that are governed by the Belgian Science Policy Office (Belspo).

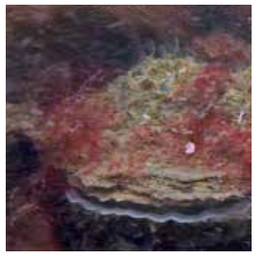
The RBINS is a State service.
It is managed by **three independent entities:**
- The **Scientific Council** offers advice on issues of a scientific nature that have an impact on the accomplishment of the tasks of the Institute.
- The **Management Commission** is responsible for the financial and practical management of the RBINS. It is the same body for the RBINS and the Royal Museum for Central Africa.
- The **General Director** is responsible for the day-to-day Institute's management. She is assisted by the **Management Board.**

Moreover the **Jury for recruitment and promotion** is responsible for recruiting the permanent scientific employees and monitoring their carreers.

The Institute's General Director is also a full member of the Management Committee of the Belgian Science Policy Office.

p.3
© Freire-Shipyard

p.4
© M. Woodbury-AWaP



p.5 © W.-Lengkeek-Bureau-Waardenburg

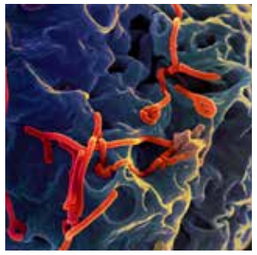
p.8
© Merlin D. Tuttle SPL

p.9
© Derek Keats from Flickr

p.9 & 25
© Nathan Rupert

p.9 & 28
© Clive McMahon

p.13
© Gilles San Martin



p.16
© NIAID

p.19
© Gilles San Martin

p.23
© Charlotte Huyghe

p.24
© Sapienza University of Rome

p.30
© ANP

p.31
© European Union

p.47
© Instagram-David Clarinval

Copywriting: Michael Creek, Ken De Smedt, Kareen Goldfeder, Patricia Supply

Translation: Iso-translation

Proofreading: Noémie Delzenne, Jacqueline Verheyen

Graphic Design: Freya Vlerick (RBINS)

Coordination: Kareen Goldfeder (RBINS)

Photos: © RBINS

Websites and publications: All websites and publications mentioned in this report can be accessed via links within the PDF version of the document, available on our website: **www.naturalsciences.be/en/about-us/mission/annual-report**