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ANNUAL REPORT

2023







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2023: a starting point for many new projects



This year saw the launch of the feasibility study for the restoration of our very own modernist marvel, the emblematic building designed by the architect Lucien De Vestel. The study is a crucial first step in ensuring our collections and laboratories are housed for future generations.

2023 also marked the first adventure in Arctic waters of our formidable research vessel RV Belgica, the third to bear that name. Its work will support Belgium's candidacy for Arctic Council membership. At the opposite pole, we participated in the Marine Ecosystem Assessment for the Southern Ocean (MEASO), which highlights climate change as the principal motor for the development of species and ecosystems in the Southern Ocean and on the coast of Antarctica.

This year saw the finalisation of an agreement with the Ministry of Defence on our surveillance aircraft. The Ministry's expertise will help us replace our current plane, which will turn 50 in 2026.

Our Institute also published the conclusions of the HOME (Human Remains Origin(s) Multidisciplinary Evaluation) project, which we coordinated. This is a major step in the process of directing our society towards a paradigm shift: human remains are not to be regarded as just another specimen but must be treated with the respect owed to the individual and their culture.

Public engagement is one of our priorities and we are proud to have initiated, in 2023, a project to coordinate and highlight our participatory science activities. aims to develop our approaches to involve the public more closely in our research and observations as well as in collection management.

In cooperation with our partners in the Democratic Republic of the Congo, in March 2023 the CEBioS (Capacities for Biodiversity and Sustainable Development) programme

organised the 2nd International Conference on Biodiversity in the Congo Basin in Kisangani, in the heart of the DRC. Attracting more than 280 participants from 15 countries, this conference marks a major step in the search for solutions to prevent the loss of biodiversity while reducing poverty.

Our *GIANTS* exhibition was inaugurated in 2023. It is the first to be produced internally since *Baby Animals*, which was coproduced with Toulouse in 2013. The exhibition also marked the launch of our new graphic identity and logo. This ensures a strong identity that reflects our three pillars—museum, institute and collections—within a rich and diverse graphical landscape that reflects the nature we study and showcase. This identity is summed up in our new preferred name: Institute of Natural Sciences.

2023, like every year, came with an array of exciting scientific projects. These include *ROBOMINERS*, which explores the use of robotics for the sustainable exploitation of Europe's mines, the discovery of a giant whale skeleton in Peru, as well as the discovery of the oldest remains of hollyhocks in the centre of Brussels.

As I write these lines, on 15 March 2024, I am celebrating my first year as General Director of the Institute. With its exceptional collections, educational mission, expertise in the service of decision-makers and the public, and cutting-edge research pursued by approximately 170 scientists, the Institute plays a vital role in preserving and understanding biodiversity. We are also determined to contribute actively to the new Belgian Climate Centre by contributing our expertise and resources to better understand and combat climate change. Together, let us continue to pursue our core mission of understanding and protecting our planet.

Michel Van Camp
General Director

2023 at a glance



27.01
A night in the museum among the dinosaurs? It's another dream come true for kids at our sold-out Dino Night. And tickets disappear in just a few hours!

27.01
Europe's six major natural history museums gather in Brussels to discuss contributions to the EU Biodiversity Strategy post-COP15.



28.01
Our inclusion mission continues with "Tout petits Ateliers" in sign language for 2-4-year-olds now run every month, plus new programmes for people with visual impairments.



06.03
The 2nd International Conference on Biodiversity in the Congo Basin advocates for national and international authorities to preserve its unique fauna and flora.

15.03
Michel Van Camp becomes General Director of the Institute of Natural Sciences after 30 years at the Royal Observatory of Belgium.



04.04
Our work on the illegal animal trade is featured in a federal government TV clip in the series *La minute fédérale*, broadcast by Eén, VTM, La Une and RTL TVI.



11.05
A pop-up rhinoceros at the museum. *Freighted*, by the South African artist F. Langerman, puts the spotlight on our relationship with this protected species over 500 years.



16.05
For 30 years, our aerial surveillance of the North Sea, serving the Coast Guard, has significantly contributed to combating marine pollution, protecting marine environments, ensuring sustainable sea management, and enforcing maritime regulations.



05.06
The results of the EDEN2000 project are published, filling knowledge gaps for an environmentally friendly way to develop wind farms in a second zone in Belgian waters to generate renewable energy offshore, an area which overlaps with the Natura 2000 Special Area of Conservation.

13.06
Ahead of the European Parliament vote on this issue, the six largest natural history museums in Europe pen an [open letter](#) to policymakers urging them to protect and restore our continent's ecosystems.



14.06
Our former colleague, Baron Edgar Kesteloot, passes away at the age of 100. He will forever be remembered as one of the pioneers of nature conservation in Belgium and among the first science communicators on television.



26.06
The RV Belgica embarks on its first Arctic mission to study the consequences of climate change on marine ecosystems in the fjords of Iceland and Greenland, with an international team working to mitigate its effects.

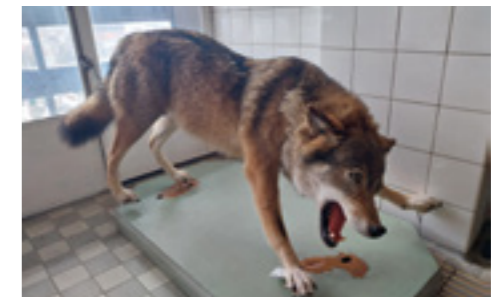


18.07
As part of the summit between the EU and Latin American and Caribbean countries, five new colourful murals are added to those already created in 2022 along our walls on the Chaussée de Wavre.

21.07
Nearly 8,300 visitors flock to our galleries, open free of charge for three days, to celebrate the 10-year reign of His Majesty King Philippe.



31.07
A report of over 2,400 pages, showcasing the achievements of the Archaeosciences team, marks five years of fruitful partnership between the Walloon Heritage Agency and our Institute, with a new collaboration underway.



02.08
A tiger, two Russian wolves, and a South African caracal, seized at customs under CITES, join our collections.

02.08

The largest whale ever known enters the Guinness Book of Records. In 2023, this specimen, discovered in 2013, was published in *Nature*: an article to which our Institute makes a contribution.



13.08

Lights go out on the *Luminopolis* exhibition, an innovative concept that captivated 145,672 visitors in our halls and nearly 59,000 on our website's dedicated exhibition page.

01.09

Rather than travelling exhibitions, our Nature Education Centre now offers Workshop Exhibitions at the museum, tailored for schools. And their success continues: over 500 students in three months!

13.09

Over 400 scientists and policymakers behind the OSPAR report for the protection of the North-East Atlantic marine environment, coordinated by our Institute, confirm that climate change and ocean acidification are major drivers of marine environmental change.



12.10

Franck Pé comes to the museum to present Volume 2 of his comic book *The Beast* to the press, which features our Institute.



19.10

The temporary exhibition *GIANTS* opens its doors, unveiling a lesser-known chapter of natural sciences and bringing 11 life-sized giant animals to our visitors!

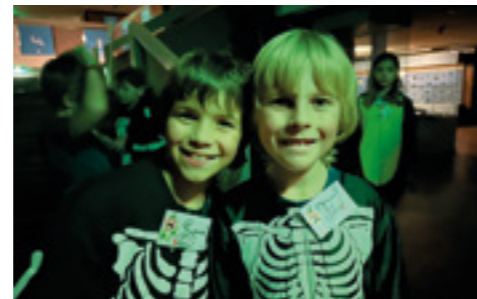


21.10

Nearly 4,100 visitors get in touch with their animal side, taking part in a fabulous journey through our halls for Museum Night Fever.

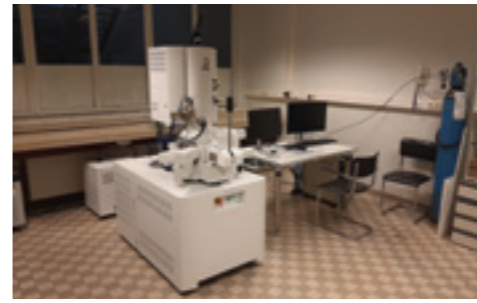
23.10

Initial tests of hydrogen injection and recovery begin at the Loenhout site, where we provide scientific oversight for the SPF Economy. This gas can play a crucial role in transitioning to a low-carbon society.



27.10

Doors slam and strange noises echo behind the scenes at the museum, much to the delight of children and guides, eager to share the knowledge, games, and thrills that make our Halloween Night a success every year.



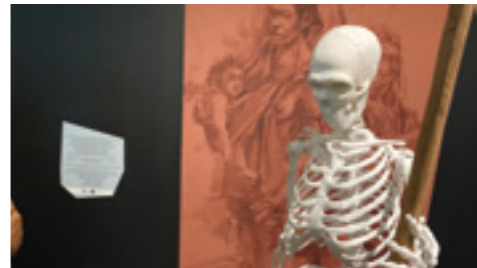
05.11

A new electron microscope replaces the old one at the Geological Service. Its equipment will enable our various services at our Institute to continue their chemical and structural analyses seamlessly.



07.11

Exciting prospects for the Walloon ecosystem are presented at the Geothermal and Heat Networks Day, attended by the Walloon Minister of Energy.



01.12

At the ARKEOS museum in Douai, France, our scientists reconstruct a Neanderthal skeleton. This work includes adjustments to 3D models to allow for the full printing of a foot, hand, and thorax.



16.12

Etienne Steurbaut, former head of our palaeontology department, receives the highest geological honour in Belgium: *the Gold Medal—Paul Fourmarier Prize for Geological Sciences* from the Royal Academy of Sciences of Belgium.

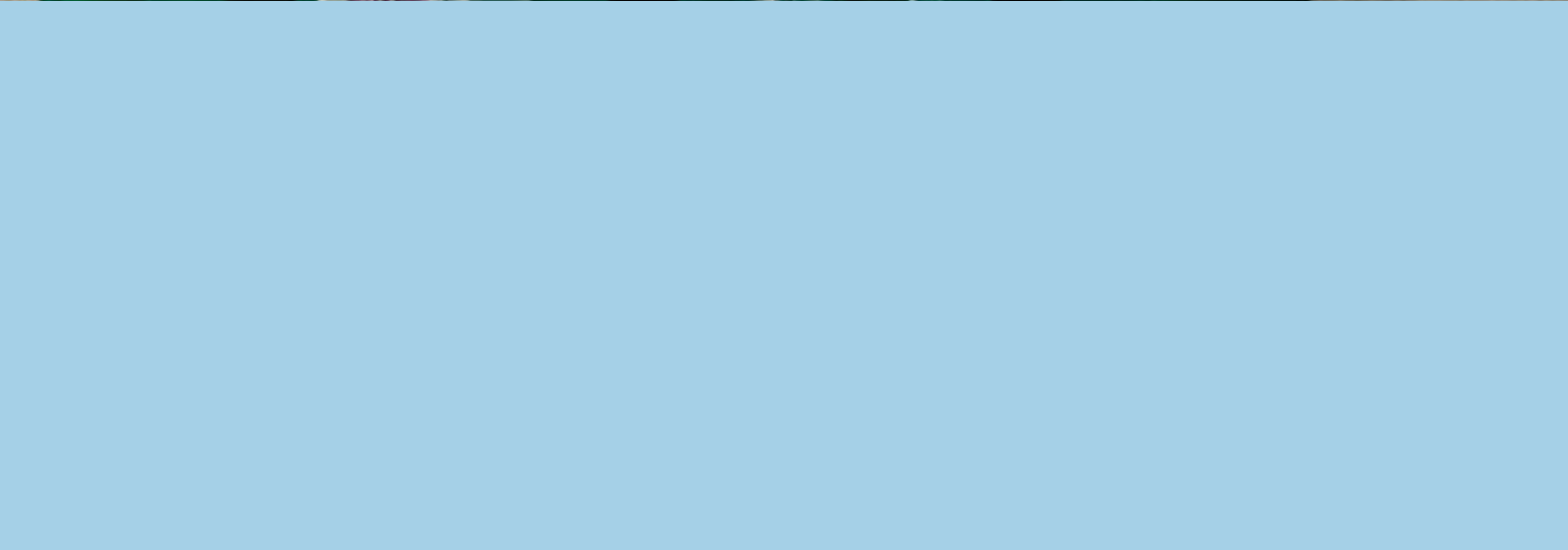
18.12

The results of the Citizen Rescuers for Collections project, conducted with the Royal Museum for Central Africa, demonstrate how certain collections, not accessible to the general public but crucial for research, benefit from the support of citizen scientists.



31.12

Thanks to the 397,923 visitors who came to explore our halls this year! This figure is a record for the last 30 years.



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Back to Galápagos

The Galápagos Islands, an extraordinary biological hotspot of the Pacific, hold a special place in the annals of science as the site of Charles Darwin's groundbreaking observations on natural selection. This year, our Institute's work on the archipelago shows there is still lots we can learn.



Darwinian riddles in the genes of a beetle

If you want to know how evolution happens in isolation, then islands are the place to be. Many great examples can be found on Galápagos, including *Calosoma*: caterpillar hunter beetles. They have adapted to the different altitudes of the mountainous islands with two morphs: one with long wings in lowland areas, and another with shorter wings in the highlands. So far, so good. But there are many islands in the archipelago, and we find similar patterns on multiple islands. Does that mean the beetles evolved in parallel? Or have the morphs migrated from island to island?

By studying *Calosoma*'s evolutionary history, researchers from our Institute were able to draw some striking conclusions, published on *bioRxiv*. And the answer? A little of both. They found that the genetic variants can all be traced back to a single adaptation event that took place on the oldest of the islands. These highland morphs then spread. But it was not only colonisation that shaped the species: on successive islands, the highland morphs mixed with the more common lowland type. This created varied populations that moved from place to place. The highland groups on the youngest islands evolved from these mixed populations. We see that the ability of organisms to adapt quickly depends on a genetic legacy of ancient evolutionary events. In our rapidly-changing world, this mechanism helps us understand how organisms will adapt.

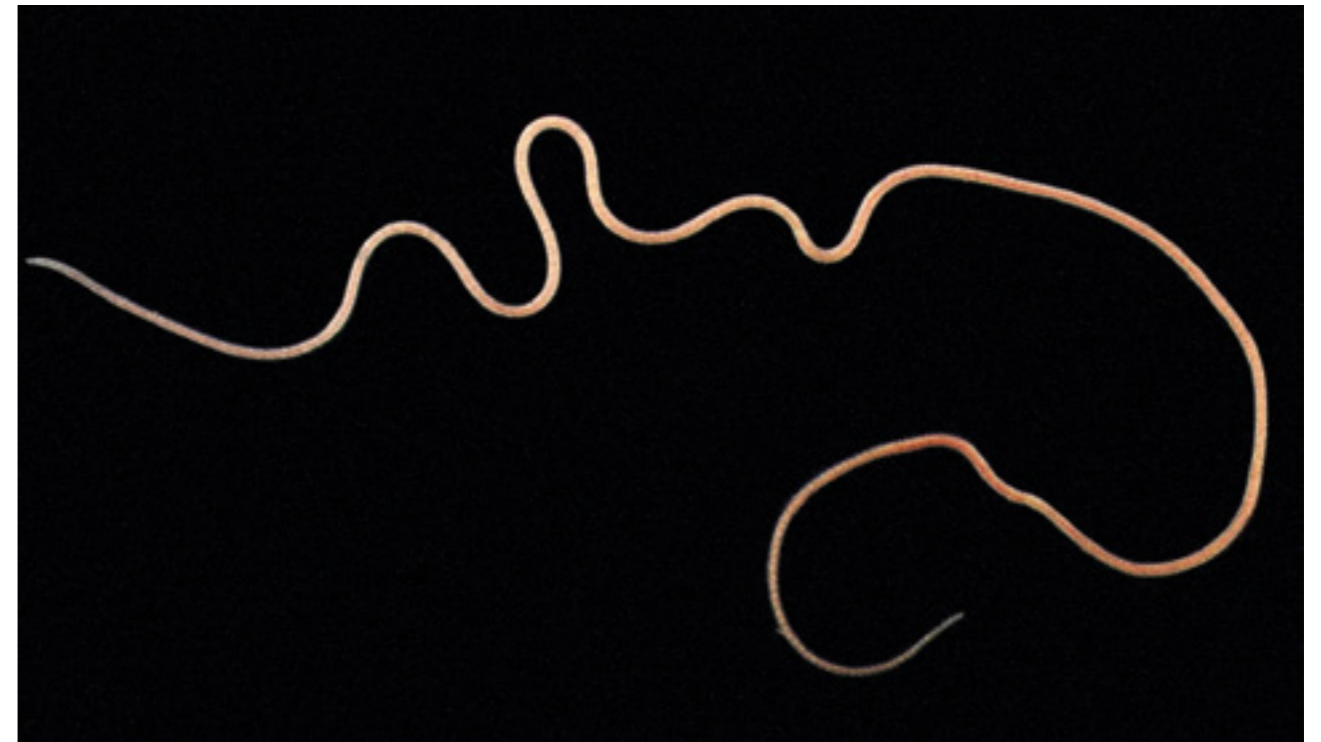
Spiders? Check!

Our Institute is a reference centre for expertise on invertebrates of the Galápagos islands. This year it was the islands' spider population that took centre stage thanks to a new checklist compiled by our researchers, published in the *Belgian Journal of Entomology*. The list details a massive 161 species of arachnid, captured across various expeditions by teams from our Institute. And while the Galápagos spider specimens can now be found in collections from New York to Oslo, as well as at the Charles Darwin Research Station at Santa Cruz, Galápagos, our Institute's collection remains the largest.

Notable Galápagos residents include numerous species of *Hogna*, wolf spiders, who ambush their prey rather than trapping them in webs. Several species have only been found on the Galápagos archipelago, including *Hogna jacquesbireli*, named by our researchers after the Belgian musical icon. And our checklist provides all the most relevant details: the distribution, whether they are native or introduced, and even illustrations of the genital organs which are particularly useful for identifying one species from the next. This checklist is pivotal for future arachnological studies, highlighting the work of our Institute in this iconic archipelago.

Going underground

When we think of the water beneath the earth's surface, we don't tend to picture rich biodiversity. And yet our research this year shows groundwater has its surprises: as a reservoir of species, it can play a crucial role.



Hidden diversity of a worldly worm

Haplotaxis is a genus of mysterious earthworms known as oligochaetes. It's a cosmopolitan genus, found in groundwater on all continents of our planet. It's a predator, feeding on other worms and larvae thanks to a unique muscular gizzard. And it's been around a while: this omnipresence suggests its origins date back 175 million years. But it is also rare. Within the genus, only eight species were known. This year, research from our Institute explored one of those species to find that all was not as it seemed.

In partnership with Swiss colleagues, a study was published in *Zoosymposia* with the findings. Researchers carried out DNA barcoding on numerous specimens of *Haplotaxis gordioides*, collected as part of a Switzerland-wide sampling campaign. We found that in Switzerland, *Haplotaxis gordioides* forms a complex of at least 6 distinct species. Knowing that the species is present across the world, we can suppose that the genus is much more diverse than first thought. And since our planet's surface water biodiversity is threatened by global climate change, groundwater becomes all the more significant as a reservoir of species that have adapted to this extreme environment.

A crustacean-shaped indicator of water quality in Benin

Groundwater ecosystems are important not only because of their role as a reservoir of species. The biodiversity there is also crucial to maintaining water quality. And the more we know about the species present, the better equipped we are to prevent pollution of our groundwater. Our Institute has long been working on this topic in subtropical Africa, where much is still unknown about groundwater biodiversity. This exploratory study has been focused on the biodiversity of village wells in Benin but also in Cameroon, in collaboration with the ULB and local African teams. Research published this year in *Subterranean Biology* focused on DNA analysis of specimens from the genus *Metastenasellus*, a tiny isopod crustacean found deep in the well water.

And the findings revealed a wealth of diversity. Our researchers found no fewer than 23 separate lineages, hinting at a broad spectrum of species. Initial results paint a picture of a genus marked by a plethora of species and unique to particular areas. This suggests that geographical isolation and limited dispersal play key roles in shaping *Metastenasellus* lineages, setting the stage for the possible identification of numerous new species within the genus. The study underscores the critical need for ongoing research to illuminate the full extent of the biodiversity in these little-known ecosystems.

Startling species

Throughout our planet's ecosystems lie rich tapestries of life. From the Peruvian shorelines to the Australian outback, our researchers this year made some particularly unexpected discoveries.



Aphid meets triceratops: new Australian leafhopper discovered

Fieldwork can be painstakingly slow. It can be days before any significant discovery. However, that certainly wasn't the case for our entomologists on a recent expedition to Australia's Chillagoe National Park. The team made a striking discovery on their day of arrival, at the bottom of a hill, a whole fifty metres from their campsite.

And what a discovery! Our team found several new species of hemipterans, including a remarkable leafhopper, lurking on young *Acacia* shrubs. One species in particular was most spectacular, measuring 7-9 millimetres in length. Discovered beneath ants feeding on its honeydew, it features three impressive horns on its head, prompting comparison to a combination of aphids and the extinct *Triceratops*. The taxonomists named the new species *Cornutipo chillagoensis* after the town of Chillagoe, where the specimens were found. Further research is ongoing, with dozens more species yet to be described from both Chillagoe and other locations explored during the expeditions. The findings underscore the vastness of species still awaiting discovery and documentation. The research, part of a project with the Leopold III Fund in collaboration with the Entomological Society of Queensland, was published in the *Belgian Journal of Entomology*.

A new genus where mates really hook up

An entomologist from our Institute has discovered a new genus of insects, *Kamabrachys*, in Australia, known for their unique mating behaviour. Nature photographer Colleen Foelz got in touch about an insect that she initially thought to have a 'false head' as a camouflage, distracting predators to the wrong end of the animal. But as she looked closer, she realised this was not just one insect. It was a mating pair, with the male hanging under the female, his head at the tip of her abdomen. This was an exceptional observation, as these insects usually mate side by side or back to back. Studying the genitalia, we identified ten new species within this genus. It was given the name *Kamabrachys*, inspired by the famous Sanskrit text, the Kama Sutra, alluding to the acrobatic nature of their mating.

Kamabrachys are masters of camouflage, blending in with the trunks of eucalyptus trees. They can move in all directions and retreat to the opposite side of the branch when threatened. One of the new species, *Kamabrachys waineri*, was found during an expedition in Chillagoe, along with the discovery of the "triceratops" leafhopper. The study, published in the *European Journal of Taxonomy*, suggests there may be even more undiscovered species within this family.

Giant jewel of a millipede found in Thailand

Our taxonomists have been working with Thai and Danish researchers for years, studying millipedes in Thailand. And they continue to make impressive discoveries. This year's finds included a new genus, *Siliquoboellus*, and a whole range of new species. One of the most surprising, deep in the forests of Thailand's Loei province, was a new species of millipede called *Sphaerobellum turcosa*, which gleams with a stunning blue-green colour and can measure 25 millimetres in length. Recounting their explorations from 2008 to 2021, a recently published study in *ZooKeys* reveals the journey that led to this unique find.

The researchers believe that the species' striking turquoise tone may be a warning to predators that this millipede is poisonous or venomous, and could leave a bad taste in the mouth. This discovery led the team to carry out further research on another giant Thai millipede, *Anurostreptus sculptus*, published in *Tropical Natural History*. They found that its defensive secretions have strong antimicrobial and fungicidal effects, which may be useful for medical research in the future. This is just another example of their work that shows the importance of taxonomy as the basis for applied research.

The sawfly whose chemical weapon makes quite a stink

A new article from our Institute in *The Science of Nature* unveils the secret weapon of the larva of sawfly *Susana cupressi*, which comes directly from its food: the cypress tree. In the leaves of this tree, terpenes can be found. This is a pungent mixture of compounds similar to the one that gives the pine tree its distinctive Christmassy smell. The sawfly larvae gather and keep terpenes in two foregut pouches, ready to discharge a small droplet when needed. They are then able to use it when harassed, to repel birds as well as ants and other invertebrates that might try to feed on the larvae. Predators don't even need to come into contact to be deterred: merely smelling the terpenes is enough to put them off their food. The sticky texture of the terpenes adds an additional layer of protection.

The study, which focused on specimens from California, highlights the chemical ecology of insects and how it plays into their ecological niche. Terpenes and other chemical components can help us identify species, alongside traditional morphological and genetic taxonomy, showcasing a remarkable example of how integrated approaches can advance our understanding of the natural world.



Absorbing work: over 30 new sponge species discovered in Peru

Before the 2000s, very little was known about the biodiversity of sponges along the coast of Peru. There were just a couple of coastal species described and fewer than ten abyssal species collected at the start of the century. Now, thanks to a cooperation between our Institute and the Federal University of Rio de Janeiro, with the help of local Peruvian students, and with substantial funding from the Belgian Global Taxonomy Focal Point based at the RBINS, more than 30 new sponge species have been discovered. These finds are the result of a massive 15-year-long endeavour and the publication of 11 research papers, adding to a total of 86 sponge species documented in Peru.

Sponges, known scientifically as *Porifera*, are fascinating creatures that lack organs such as a mouth, anus, or nervous system. They exhibit a remarkable filter-feeding mechanism that helps in water circulation and oxygenation. Besides their ecological importance, sponges also possess compounds of interest to the pharmaceutical industry. The team's work required multiple dives from 2007 to 2009, collecting nearly 900 specimens from various locations. The results have been compiled into a comprehensive manual, published in *Abc Taxa* both in English and Spanish, providing taxonomic information and instructions for *in situ* sampling and analysis, supporting future exploration of the sponge world by marine biologists. *Abc Taxa* is a series of open access taxonomic manuals published by CEBioS, the Capacities for Biodiversity and Sustainable Development programme which our Institute scientifically coordinates with Meise Botanic Garden and the Royal Museum for Central Africa.



Buzzworthy discovery: three new flies found in Brussels

From mosquitoes to crane flies, diptera is the order that contains the two-winged insects we find around us. And in Brussels, one hotspot for flies is our Jean Massart Botanical Garden, in the south east of the city close to Rouge-Cloitre. Our taxonomists last year described three previously undiscovered species of flies thriving within the bustling Jardin Massart: a testament to the resilience of our urban ecosystems. The findings were the result of a comprehensive inventory project from 2015 to 2018, which involved the participation of around thirty citizen scientists. The collaborative effort uncovered nearly 2,000 plant species and over 4,000 arthropod species, including 129 dipteran species newly recorded in Belgium. Among these, three were entirely new to science: *Drapetis bruscensis*, *Platypalpus massarti*, and *Platypalpus pictitarsoides*.

These tiny wonders, measuring just one and a half millimetres in wingspan, exhibit striking black bodies and vibrant yellow legs. Their habitat, amid the foliage of trees, provides an abundant supply of small insects and mites for them to feed on. This invaluable study, documented in an ebook published by the *Belgian Journal of Entomology*, highlights the indispensable role of citizen scientists in uncovering nature's hidden treasures within urban landscapes.

Intruder alert!

Our planet's ecosystems hang in the balance, and when a non-native species finds its way elsewhere, the consequences can be devastating. This year our Institute studied an example close to home, as well as playing a key role in global policy to combat the threat of invasive species.



A small frog with a big impact in Belgium

The *Xenopus laevis* may look relatively harmless. Commonly known as the African clawed frog, it is native to South Africa. It is often sold in pet shops and used in laboratories for animal testing. Over the years, through intentional or accidental releases, it has managed to establish populations across several continents. A recent discovery of *Xenopus* in Belgium, near the French border, prompted our Institute to launch a joint study to assess this exotic amphibian's impact.

The study, published in *Zookeys*, explores the morphology of adults and tadpoles, as well as their genetics and calls. It reveals that Belgian individuals are most closely related to those from the Cape region of South Africa. A large number of these frogs was found in the area studied, straddling Flanders and Wallonia, with evidence of the species occurring in surrounding areas, too. The rapid spread of this invasive species, soon to be added to Europe's [Union List](#) of species of concern, could have significant consequences for our native Belgian aquatic fauna: competition for food, direct predation on local species, or spreading of diseases or parasites. It will be essential to monitor and manage its spread to keep the ecological damage to a minimum.

A global call to action on invasive species

This year, the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) published a [report](#) highlighting the crucial threat of invasive alien species as part of the ongoing global biodiversity crisis. The report, discussed at the [10th session of the plenary of IPBES](#), emphasises the need for a multidisciplinary approach to tackle this challenge. IPBES, known as the "IPCC for biodiversity," operates in Belgium through the National Focal Point, facilitated by the Belgian Biodiversity Platform and hosted by five organisations including our Institute. Invasive alien species are one of the five main causes of global biodiversity loss, as acknowledged in the Kunming-Montreal Global Biodiversity Agreement. The IPBES report, authored by 86 experts from 49 countries, addresses the diversity, impact, and management of invasive species.

The report urges strengthened preventive measures and coordinated efforts across sectors, echoing Belgium's 2019 cooperation agreement. It highlights the additional resources required to protect biodiversity from invasive species threats. And while the global impact of invasive species on biodiversity is urgent, there is optimism to be found. The report's call to action and roadmap offers feasible solutions: practical policy options and individual actions to combat the growing threat of invasive species and preserve our ecosystems.

Sacred species: new findings from Ancient Egypt

You might know that dogs and cats played a special role in people's lives in Ancient Egypt. But what about the significance of the crocodile, or the baboon? Our research this year unearthed fresh perspectives on age-old relationships between human and animal.



Unwrapping the story of ten mummified crocodiles

Spanish archaeologists have discovered a tomb in southern Egypt with ten undisturbed [crocodile mummies](#), a unique find shedding light on the ancient Egyptian practice of crocodile worship. And our archaeologists were able to study the mummies, publishing their research in the journal *PLOS ONE*. The crocodiles, likely sacrificed during rituals to Sobek, the god of water and fertility, were found in Qubbat al-Hawā, near Aswan. Thanks to the absence of significant pitch or bitumen on the crocodiles, our team could conduct a thorough examination. The mummies, from the pre-Ptolemaic era, varied in length from 1.8 to 3.5 metres and belonged to the Nile and West African crocodile species.

The crocodiles were likely dried naturally before burial, with remains wrapped and moved to the tomb. The study also found gastroliths: stones in the intestines, in one crocodile, suggesting it wasn't cut open. The discovery offers a unique insight into ancient Egyptian culture, showcasing their mummification techniques and the ritual significance of animals in their religious beliefs.

A less than luxurious life for baboons in Ancient Egypt

In Ancient Egypt, baboons were venerated as symbols of Thoth, the god of wisdom, and mummified after their death. You might imagine that they lived lives of luxury as a result. But new research published in *PLOS ONE* paints a very different picture. Our archaeozoologists studied skeletal remains from Gabbanat el-Qurud, finding that most baboons suffered from malnutrition and skeletal deformities, likely due to a lack of sunlight and poor nutrition. These findings suggest that baboons were raised in captivity under harsh conditions despite their revered status.

These baboons were not native to Egypt and were imported through trade routes. The study revealed that a small number of baboons were likely taken directly from the wild for breeding, notably the Olive baboons from Sudan and Hamadryas baboons from the Horn of Africa or the Arabian Peninsula. But importing baboons from afar was a real challenge: they had to be transported all the way through the desert and across the Red Sea, often leading to stress in captured baboons, visible in the stunted growth of their teeth. Further research on the teeth could provide more data on their exact diet, where they were captured and what the breeding practices of their keepers.

Piecing together our country's history

2023 was a year that many stories were unearthed thanks to archaeological digs in Belgium. From Brussels city centre to the mines of the Bois du Cazier, the results shed light on discovery as well as tragedy.



Ancient duck bones that came in handy

A study led by our Institute on 31,000-year-old bird remains has unearthed a fascinating aspect of ancient hunter-gatherer life. Discovered during canal excavation work in Maisières, in Wallonia, were wing bones that showed intricate human modifications. These were clues that hunter-gatherers at the time had a particular interest in them, that went beyond the need for a tasty meal.

Some of the bird remains found were clearly for meat consumption: snowy owls and ptarmigans, for example. But our researchers found that duck wing bones, specifically the radius, were often isolated and cleaned thoroughly, possibly for specific craftwork like bead making. These elements could also have been discarded during the production of dried wings for an unknown purpose. In collaboration with the TraceoLab of the University of Liege, colleagues performed experimental cutting of duck carcasses with flint tools that gather evidence for this. The results, published in the *International Journal of Osteoarchaeology*, expands our understanding of the culture at the time, showcasing not just utilitarian hunting practices but also evidence of advanced tool usage and creativity. This ancient culture, known as the Gravettian, navigating a cold and open environment, made complex decisions in how to allocate resources. We now see they had an advanced understanding of the natural world and how to use it to their advantage.

Our country's oldest known hollyhock

When you picture the Senne flowing through mediaeval Brussels, visions of roses and hollyhocks in bloom are not exactly the first thought that comes to mind. And yet, in the heart of our capital, a striking discovery beneath the Parking 58 site paints a somewhat different picture. In 2019, archaeological investigations exposed the mediaeval port and rich organic layers of the river, ripe for scientific analysis.

Leading this exploration, our researchers analysed 56 samples from 12 cross-sections. What emerged was the most extensive archaeobotanical study in Brussels to date, revealing over 170,000 plant remains from 282 distinct species. Among these was an unexpected treasure: a pericarp fragment of hollyhock. Originating from southwest China, the hollyhock's journey to Brussels remains a mystery. Dodoens' 16th-century herb book describes a variety of medicinal uses for the plant, including treatments for kidney ailments and insect bites. This rare find of hollyhock, along with traces of boxwood and roses, paints a vivid picture of mediaeval Brussels' horticultural and medicinal landscape. And our team is still analysing the outcomes of this dig, promising even more insights into our city's hidden past.

Two miners of the Bois du Cazier finally laid to rest

It was a disaster that shook Belgium to its core: on August 8, 1956, a fire in the Bois du Cazier mine claimed the lives of 262 miners, in Marcinelle, Charleroi. Now, nearly seven decades later, the identities of two of the 14 previously unidentified victims have been established. Thanks to a multidisciplinary team of researchers (including forensic scientists, odontologists, and anthropologists from our Institute), set up on the initiative of Michele Cicora, the son of one of the miners, two of the victims, Oscar Pellegrini and Dante Di Quilio were identified and could finally be laid to rest in a grave bearing their name.

Exhumation of the unidentified bodies in the Marcinelle graveyard began in 2021, where the challenging task began of establishing definitive links between the bodies and their families. Our team examined the bones for notable features or pathologies and deduced sex, age, and height where they could. DNA analysis and comparisons with living relatives helped to complete the picture.

The story of the analysis was told in a photo exhibition titled "Révélations," that opened in October 2023 at the Bois du Cazier. Our team contributed to panels explaining their scientific approaches throughout the entire process, both in the field and in the lab. The exhibition showcases moving images of the exhumation process, along with the reburial ceremony. It also shows us the mass that was held at the Saint-Louis church in Marcinelle-Haies, attended by miners who survived the disaster, paying a poignant tribute to their colleagues.

While the identification of two miners has brought relief to their families, challenges remain. Sadly, out of the 14 unidentified victims, four have been formally excluded due to lack of DNA matches, including Francesco Cicora, the father of the man who initiated the process. Five others yielded inconclusive results, and three are lacking relatives for comparison. Hope remains for families awaiting answers, as the investigation continues.



From the depths of time: Earth's ancient ecosystems

Fossil evidence tells the tale of climate shifts, species rise and fall, and how ecosystems function and have evolved. It holds the key to understanding how our planet has changed over the millennia. This year, findings came from Lebanon, Peru and Ireland, as well as closer to home.



Unlocking hidden treasures from the Cretaceous

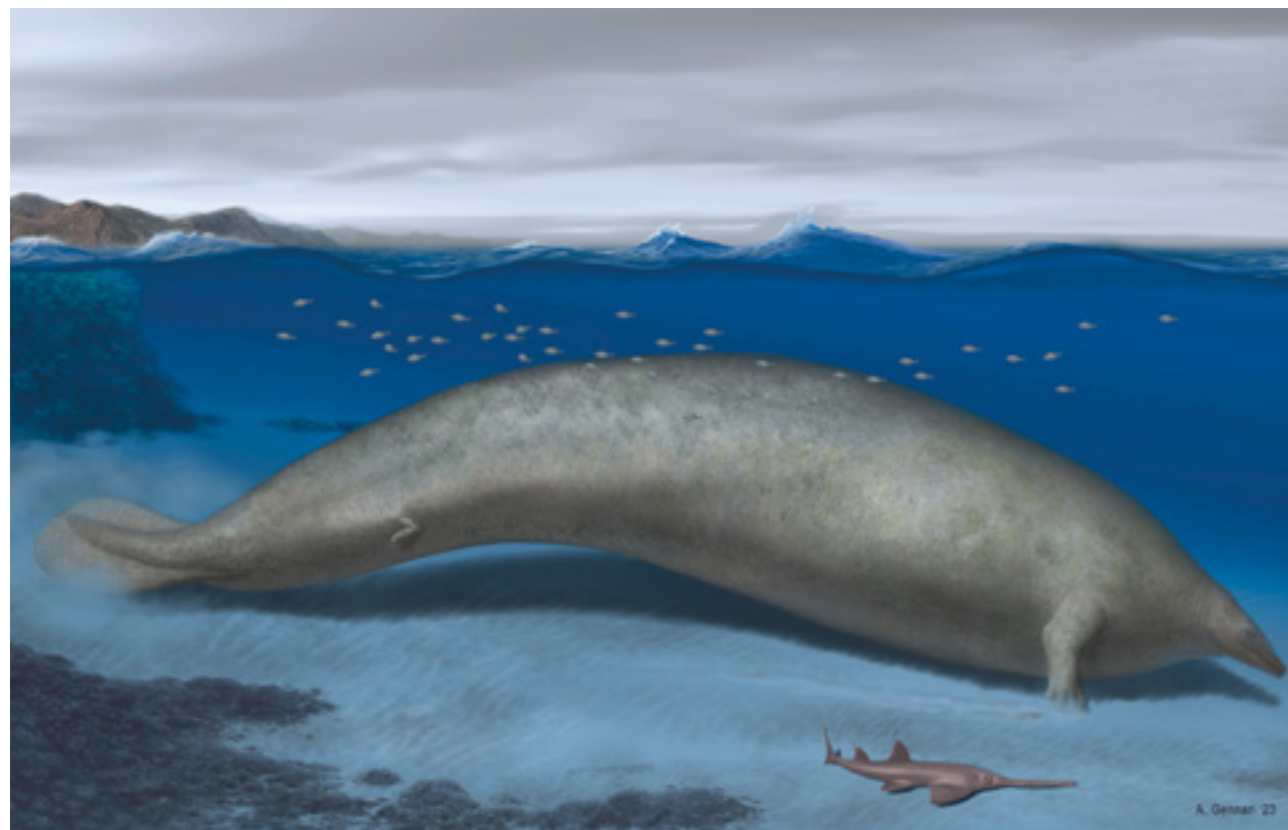
Our Institute was part of an international team of palaeontologists on a groundbreaking expedition, unearthing a plethora of ancient fossils from the Early Cretaceous era in Jezzine, South Lebanon. It was in the Bkassine oil shales, formed approximately 130 million years ago in a lake bed, that a staggering variety of fossils were found, ranging from fish to ferns and even ancient faeces. But also remarkable was the excellent shape in which the specimens have remained. A set of coelacanth fossils were particularly impressive, many with almost intact skeletons and even the promise of fossilised organs. This preservation is due to the unique properties of the shale, offering a rare glimpse into the terrestrial ecosystems of the Early Cretaceous period, the dynamic landscape that laid the foundation for the modern world.

Our team's meticulous work involved extracting, preparing, and studying the fossils, a process that can take several months. Upon completion, the fossils will be returned to Lebanon for conservation and public display, contributing to a deeper understanding of the region's ancient history. The findings from this excavation will be published in a special issue dedicated to Lebanon, offering a comprehensive look at the early terrestrial ecosystems that shaped the world millions of years ago.

Self-defence in the oldest known forests on Earth

Modern-day plants are relatively well equipped to deal with a dry spell or two. But a team including paleobotanical expertise from our Institute have discovered fossilised evidence in Ireland suggesting that these adaptations evolved much earlier than previously thought. The evidence would indicate plants developed methods to withstand drought as far back as 360 million years ago, during the Devonian period.

The team helped collect, date and study specimens of *Callixylon*, part of the now extinct archaeopteridales, one of the first groups to form large trees in the Devonian. They found what appears to be a primitive form of self-defence mechanism. These fossils contain intricate structures, known as tyloses, that can block the spread of air bubbles and pathogens, such as fungi, in wood tissues, protecting them. In this way, these first tall trees were already able to survive periods of drought. The findings, published in *Nature Plants*, illustrate how fossils can provide detailed information about certain physiological processes that are even hundreds of millions of years old. This type of information allows us to understand fossil plants as once-living organisms and to trace the deep origin of key biological processes that still exist today.



Historic heavyweight found in Peru

Perucetus colossus, a newly discovered whale species, is rewriting the history of whale evolution. This massive creature, which lived around 39 million years ago off the coast of what is now Peru, is estimated to have weighed between 85 and 340 tonnes, making it one of the two largest animals to have ever existed. Our Institute participated in palaeontological research on the specimen, published in *Nature*, which also received an entry in the *Guinness Book of World Records*.

The fossilised bones of *Perucetus colossus* were unearthed by Peruvian palaeontologist Mario Urbina in the middle Eocene sediments of the southern coast of Peru. And the discovery is a real game-changer in our understanding of whale evolution. Previously, the shift to gigantism in whales, when they evolved to become exceptionally large, was believed to have occurred relatively recently: around 5 million years ago, with open-sea filter-feeding baleen whales. The discovery of *Perucetus colossus* suggests that gigantism in whales began much earlier, and in a coastal context. The whale's massive size was likely an adaptation to its coastal environment. Its bones indicate an outstanding increase in mass that would have made the animal heavier than other cetaceans of similar size. This extra weight may have helped the whale navigate the turbulent waters of the coastal regions.

Awakening Belgium's oldest known trilobites

They were known to our researchers as sleeping beauties: 25 trilobite fossils in our collection, found in the Tremadocian strata of the Brabant Massif in the 1940s, close to Villers-la-Ville. They had been stored away in a drawer for decades. Now the subject of our Institute's first taxonomic work on Tremadocian trilobites, they reveal a fascinating glimpse into Belgium's Early Ordovician fauna. And these fossils, whose scientific names are *Platypeltoides* cf. *croftii*, *Macropyge*? sp., and *Asaphidae* indet., tell a story of when Belgium was part of Avalonia, a microcontinent in the Paleozoic era. The findings were published in *Geobios*.

Interestingly, these trilobites bear resemblance to species found in other regions of Avalonia, such as Wales and Shropshire, as well as in high-latitude Gondwana, like Morocco. The discovery of *P. cf. croftii* suggests that the Tangissart Member of the Mousty Formation, where these fossils were found, likely deposited in deep offshore environments on Avalonia's open shelf. Additionally, similarities between *P. cf. croftii* from Belgium, *P. croftii* from the UK, and *P. magrebiensis* from Morocco hint that species moved across the narrow Rheic Ocean, revealing crucial insights into Belgium's ancient geological history and its place within the larger context of Earth's paleogeography.

Navigating our North Sea's future

For millennia, Belgium's North Sea coast has been the stage for human endeavour, from trade and transport to more recent offshore industries like aquaculture and wind energy. Today, sustainable marine management is imperative, and teams at our Institute lead the way in ensuring the preservation of North Sea ecosystems for years to come.



A strategy for sustainable farming in the North Sea

The North Sea is a source of delicious seafood, and now brings us wind energy too. But how can Belgium plan for a sustainable future for its aquaculture and wind farms? The Marine Ecology and Management (MARECO) team at our Institute is leading a crucial initiative that brought together over 50 different organisations to shape a collective vision to inform future policy, with the support of the Minister for the North Sea.

The challenges are complex. Aquaculture needs sustainable practices and space optimisation, minimising the environmental impact while guaranteeing food safety. For offshore wind farms, we have to deal with the decommissioning of the first-generation turbines that started operating in 2009. How much do we remove, and how can new technologies support us in recycling their materials? By leveraging expertise and collaborative effort, we aim to set an example in Belgium for other nations navigating similar challenges in their marine environment.

And a new project this year will explore how European cooperation can help make this strategy a reality. 2023 sees the launch of a new Horizon Europe project ULTFARMS, where our Institute will lead a sustainability assessment and participate in a Belgian pilot to test how offshore wind farms can be used as sites to farm low-trophic species like seaweed and molluscs, ensuring profitable, sustainable, and ecological seafood production off our coastlines.

Minimising pollution from wind farms and shipwrecks

What humans do has an impact on ecosystems in the North Sea. But the effects of the chemical pollution they produce often goes unseen. This year our Marine Management team, MARIMA, launched the *Anemoi* project, funded by the EU's Interreg programme. Anemoi explores how chemicals emitted from offshore wind farms affect ecosystems and aquaculture, and how we can tackle this in policy. MARIMA leads in the investigation of particles and paint flakes. And the fieldwork has already begun, with seawater and sediment samples collected near turbines on our oceanographic ship RV Belgica.

This year also saw the launch of a new risk assessment tool for policymakers to tackle another type of chemical pollution: from shipwrecks. OSPAR, Europe's mechanism to protect the marine environment in all its aspects, has already embraced this tool for its work on the North Sea. It was developed as part of the *North Sea Wrecks* project, funded by the EU's Interreg programme: the first project to conduct detailed research into the impact of ammunition still present in war wrecks on Belgium's seafloor. Our Ecosystems Physico-Chemistry team, ECOCHEM, whose analysis work fed into the tool, is a full partner in the follow-up project, REMARCO, that started this year. And that same team celebrated a successful BELAC audit, completing 20 years as an ISO 17025 certified lab: a significant achievement that testifies to the high quality of our research and secures our position as a key player at international level.

Keeping one step ahead of oil spills

Our Marine Forecasting Centre doesn't just predict: it informs key policy on the North Sea. With 5-day forecasts issued twice daily, our forecasts support public, private, and scientific sectors, both locally and abroad, in making crucial decisions, for example, on how to manage oil spills, predicting their drift. But as the threats to our North Sea ecosystems change, our forecasts must adapt as well. In 2020, maritime fuel rules shifted, ushering in an era of low-sulphur fuel. This fuel behaves differently in spills. This transition has presented a big challenge, requiring new simulations to anticipate and mitigate potential problems.

This year our team rose to the challenge with the launch of OSERIT: an online tool that predicts the drift of marine pollution. To combat the issues of drift, our team has updated their services, extending the focus to not just hydrocarbons but also chemical pollution. This year's upgrade also includes a new graphic interface. The demand for these services is high, with an average of 300 users per day, including the coastguard, federal and regional agencies, and private companies. The scope has expanded from just oil and objects to encompass all marine pollution, marking a significant development in our environmental monitoring efforts. When samples of both spill and potential source can be collected, ECOCHEM can match the samples by comparative oil fingerprinting analysis.

A striking year for strandings

Teams from our Institute are regularly called out when a marine mammal is washed up on shore. Our Institute coordinates the scientific research on these mammals, focused on establishing causes of death, assessing trends and monitoring populations. And 2023 was notable for a number of particularly unusual species washing up on Belgian beaches. This meant we had our work cut out for us this year, with species including a common dolphin (*Delphinus delphis*), two unidentified dolphins, a 10.5-metre fin whale (*Balaenoptera physalus*) brought into the Port of Antwerp on the bulb of a vessel, and, for the first time in the 21st century, a killer whale (*Orcinus orca*), stranded in Koksijde. And it was not only mammals: a dead leatherback turtle (*Dermochelys coriacea*) washed up on the beach in Knokke and a live loggerhead turtle (*Caretta caretta*) was found on the beach of Bredene. The latter had never before been recorded in Belgium.

It is a little early to make inferences about the numbers of strandings and sightings, however. Our coastline is very short, so we cooperate with neighbouring countries: trends in strandings in a North Sea-wide context tell us so much more. Our annual report "Marine mammals in Belgium 2023" will give more details about strandings, looking back over this exciting time.



Digging the depths

The meticulous work of our team of geologists to map Belgium's subsoil has a wealth of applications that can reshape the way we think about the world around us: from geothermal energy, to drinking water, to mining for minerals.



A deep dive into Europe's geothermal energy potential

Deep geothermal energy could completely change the way we power Europe. This year, the results were published from a project that shows just how that possibility can become a reality in our region. DGE-ROLLOUT, funded by the EU's Interreg programme, launched a range of outcomes including a [web tool](#) for risk assessment and exploration support. The Institute's team at the Geological Survey of Belgium created a web application that combines baseline data to pinpoint geothermal hotspots in the area. It does this by aligning geological knowledge, resource potential, and investment possibilities across four countries. Our team was also very active on exploration. Seismic investigations in Wallonia helped us understand the structure of the main reservoir for geothermal energy in northwest Europe. Our team produced imaging of the underground to depths of 15 km—around half the Earth's crust!

The project's final workshop in Brussels was held at the Representation of the State of North Rhine-Westphalia to the European Union in Brussels with the contribution of Matthieu Ballu of the European Commission. The discussion provided stakeholders with a comprehensive overview of the project's achievements, marking a significant step towards a greener energy future.

Sparking new geothermal partnerships

As geothermal energy takes hold in Belgium, it is essential that the developments are grounded in solid research. As such, we were consulted to prepare a key 3-day stakeholder event evaluating market opportunities between Belgium and Germany, strengthening ties with our most important trading partner. The event, organised by the German-Belgian-Luxembourg Chamber of Commerce, was titled "Geothermal energy at the heart of the energy transition in Belgium and Germany." Experts and business representatives from both countries came together to learn about the current state of technology and construction projects, and to exchange viewpoints.

Our Institute presented the geothermal potential of Brussels and Wallonia, drawing on the outcomes of mapping conducted in various research projects funded at regional, federal and European level. For now, geothermal development is focused on the provinces of Antwerp and Limburg. There is therefore a great interest in technologies that can seize this opportunity in Belgium beyond these regions. The market is currently developing very quickly and Wallonia is launching an exploration campaign to scale up its activity significantly, coordinated by our Geological Service. As Belgium and Germany continue their commitment to transitioning to cleaner energy sources, geothermal energy is poised to play a pivotal role in shaping their sustainable energy landscape.

A new subsurface model for our border regions

The ground under our feet holds solutions not only for our energy supply, but also for the water we drink, and how we plan the way our land is used. Along our country's borders, the more closely we work with our neighbours to share what we know about our subsurface, the better prepared we are to address these societal challenges together. In 2023 the results of a 3-year collaboration between our Geological Survey of Belgium, the Geological Survey of the Netherlands and VITO, known as [H30-De Voorkempen](#), were published. This joint Dutch-Belgian project produced three-dimensional geological and hydrogeological layer models for the border area between the Northern Kempen and West-Brabant regions. These models were created using the latest data, knowledge, and insights to establish consistent and comprehensive reference models for the region.

The results were launched in a webinar and field excursion where 85 participants explored the 3D geological model of the Voorkempen and discussed the importance of a consistent subsurface model across borders for a range of stakeholders. Policy reflections came from a representative of the Flemish Ministry for Justice and Enforcement, Environment and Spatial Development, Energy and Tourism. The field excursion then brought the model to life, as participants examined the subsurface in the Kalmthoutse Heide border park and the Brabantse Wal.

Groundbreaking robots that are redefining mining

600 metres deep in a disused mine in Slovenia, our researchers are huddled around a sensor affectionately known as "The Frog". This sensor has a laser that briefly heats up a tiny spot on the rock's surface to over 10,000°C, analysing its composition using a technique known as Laser-Induced Breakdown Spectroscopy. It gives us a very detailed picture of what's in front of them, including the critical raw materials. And this is the technology behind [ROBOMINERS](#), a ground-breaking project to develop robots with the potential to revolutionise the mining industry.

In 2023 the project, funded by the EU's Horizon 2020 programme, launched its prototype robots and proved their efficiency with a series of test runs in Estonia and Slovenia. Currently, the smallest mining machines have a footprint of 2-3 metres, which limits their ability to dig small galleries. The project developed a robot with an 80-centimetre diameter, so it can create narrow galleries in mineral veins. That means much less waste production. Plus, the extracted ore is more concentrated, hence more valuable. For our geologists, this was an exciting opportunity to work with robotics on a technology that could mean miners will no longer need to set foot into a mine in Europe.



Climate crisis: from pole to pole

The climate emergency demands urgent, collective efforts to limit global heating. Our Institute strives to make a real difference: informing policy and working closely with structures like the [Federal Council for Sustainable Development](#) and the new [Belgian Climate Centre](#). Here we explore just two examples of our progress this year.



Scientists' call to action for the Southern Ocean

From emperor penguins to Antarctic krill, the Southern Ocean is home to unique wildlife, fundamental to biodiversity. It is also crucial to human welfare by providing us with food and helping to control our climate. But Antarctic waters are also absorbing most of the global temperature rise, and the ecosystems there are feeling the heat. Together with additional pressures from fisheries, tourism and pollution, this environment and its residents now face an uncertain future. Urgent global action is needed to address the climate crisis and ocean acidification.

In response to this threat, more than 200 scientists from 19 countries contributed to the first comprehensive assessment of trends in Southern Ocean ecosystems, including a summary [report](#) written specifically for policymakers. Our Institute was among the contributors to the Marine Ecosystem Assessment for the Southern Ocean (MEASO), which stresses that climate change is the most significant driver of species and ecosystem change in the Southern Ocean and coastal Antarctica.

The five-year MEASO process was modelled on a working group of the Intergovernmental Panel on Climate Change (IPCC). The open and participatory process involved 203 scientists in 19 countries from across the Antarctic and Southern Ocean scientific community, contributing to 24 research articles published in a special research topic in [Frontiers journals](#). It is the first circumpolar interdisciplinary assessment of status and trends in Southern Ocean ecosystems and drivers of change, for use by policymakers, scientists and the wider public.

The summary for policymakers was launched in Hobart, Tasmania, at the annual meeting of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the international body under the Antarctic Treaty System responsible for the conservation of marine ecosystems in the Southern Ocean, with membership of 26 nations, including Belgium, and the European Union.

The report sets out a number of key recommendations. First, it makes it clear that long-term maintenance of Southern Ocean ecosystems, particularly polar-adapted Antarctic species and coastal systems, can only be achieved by urgent global action to curb climate change and ocean acidification. And to make this happen, we need to be able to measure change. There is a need for investment in sustained and ocean-wide scientific assessment and monitoring of the health of the ocean by the international community. These measurements can feed into models to predict what future habitat changes and human impacts will mean to different ecosystems, communities and species.

The authors of the report also stress that the MEASO process should continue in this critical decade for climate action. For future assessments, we need to archive, curate and openly share data and algorithms. To this end, our Institute hosts the [SCAR Antarctic Biodiversity Portal](#), bringing the best available science together in a timely fashion and harmonising the information for policy makers.

RV Belgica heads north on a climate mission

In June 2023, a multinational team of scientists stepped onto the newly commissioned Belgian oceanographic research vessel RV Belgica for its inaugural Arctic mission. Departing from Galway, Ireland, they embarked on a 16-day exploration of the Icelandic fjords and continental shelf. Their focus? Investigating the potential for reducing atmospheric carbon dioxide by enhancing the weathering of silicates in the ocean, a process that could play a pivotal role in combating global heating. This technology is known as Enhanced Silicate Weathering, and it uses silicate minerals to absorb atmospheric carbon dioxide. These minerals are distributed onto coastal ocean floors so more carbon dioxide is taken up, reducing the concentration in the atmosphere.

But will the high weathering rates observed in experiments actually occur in natural environments? How efficient will the process be in drawing down carbon dioxide? These are the questions at the heart of the DEHEAT project: a collaborative endeavour among researchers from our Institute alongside the University of Antwerp and Université Libre de Bruxelles and funded by the Belgian Science Policy Office, Belspo. Led by our Institute, an international and interdisciplinary team of researchers not only sampled water and scanned the seafloor, but also deployed incubation chambers onto the seabed and drilled into the seafloor of Iceland to take undisturbed seafloor samples to determine weathering rates in the sediment. The collected data will then inform a large-scale virtual application of Enhanced Silicate Weathering in the Belgian North Sea using our Institute's COHERENS shelf sea model.

And this was not the only important climate-related mission for RV Belgica this year. The following month, our oceanographic vessel sailed west to the fjords of south-west Greenland. Fjords are the narrow inlets where glaciers end in the ocean. They play an incredibly important role in sustaining life in these ecosystems, but also in absorbing carbon dioxide from the atmosphere. With climate change, we see glaciers melting faster. How will this affect the way carbon moves through these fjords and how it impacts wildlife living there?

To explore this, our researchers, alongside UGent and Royal Netherlands Institute for Sea Research NIOZ, are leading a project known as CANOE, funded by Belspo. In Greenland they explored two different fjords: one where a glacier ends on land and another where some glaciers end on land and one ends in the ocean. This involved mapping and comparing the oceanography, biogeochemistry, ecology and food webs of the two fjords. This 21-day mission will shed light on the future of these fjords and their relationship to climate change.

It is thanks to the new RV Belgica that this type of mission is possible. Our three-year-old research vessel Belgica is particularly well-equipped for interdisciplinary research and can remain at sea for long periods of time. This brings Arctic waters within the scope of Belgian and European research, meaning our Institute is even better equipped to document and research climate change. As a result, we can do even more to support policymakers in ensuring an evidence-based approach to address our global climate crisis.



Lab to legislation: policy support at sea

Solid, evidence-based policy is crucial to protect our marine ecosystems. This year the teams at our Institute made significant progress in our policy support work, from Nieuwpoort to New York.



Fishing casts a shadow on North Sea reefs

Stony reefs in the Belgian North Sea harbour a unique and fragile ecosystem that is heavily threatened by fishing. This urgent conservation concern has spurred researchers to investigate the impact of bottom trawling on these habitats, which are critical for a diverse and specialised marine fauna, and provide irreplaceable ecosystem services. Over a seven-year period, our researchers utilised minimally invasive technologies to analyse the ecological status of two key stony reef areas in the North Sea: the Northwest and the Hinder Banks. The investigation was led by our MARECO (Marine Ecology and Management) group and its results were presented in *Frontiers in Environmental Science*.

The study revealed alarming levels of fishing disturbing the sea floor, with 86% and 89% of the reef areas disturbed respectively, correlating to observed shifts in the composition of these stony reef communities. The study advocates for stronger marine spatial planning regulations to restrict bottom-disturbing fishing practices and ensure the preservation of these invaluable marine habitats. These results will inform Belgium's next Marine Spatial Plan.

Sands of time: a sustainable approach

Sand is a crucial resource. We use it for construction materials, to reclaim land or increase coastal safety levels. But how can we minimise the impact on our marine waters? Our Suspended Matter & Seabed Monitoring & Modelling group, SUMO, works hard to address this through their monitoring programmes. Last year, they also supported the United Nations Environment Programme's new platform, *Marine Sand Watch*. Our Institute contributed to the research report behind the platform and took part in the debate at the launch event during the World Resources Forum in Geneva, Switzerland. The platform monitors dredging activities, increasing transparency and pushing for more sustainable management of sand resources.

Our SUMO group also conducts research to explore how sand can protect our coast against sea level rise, a key concern in the face of climate change. One such solution is to build dunes in front of dikes, which act as a barrier against flooding and provide various ecosystem services. The SUSANA project, launched this year, focuses on the reuse of lower-quality sandy material and minimising the impacts of sand extraction, to inform a long-term strategy for the sustainable use of sand in nature-based solutions. The project is funded by VLAIO and The Blue Cluster and brings together three Belgian universities and ILVO, the Research Institute for Agriculture, Fisheries and Food alongside our Institute.

A landmark agreement amid high stakes for the high seas

This year, a groundbreaking new treaty to safeguard the biodiversity of the high seas was ratified in New York after nearly two decades of negotiations at the United Nations. Our Institute represented Belgium's position as a staunch advocate for ocean conservation and a founding member of the Blue Leaders, playing an active role in shaping and finalising this landmark agreement. The treaty, known as [BBNJ](#), the agreement on Biodiversity Beyond National Jurisdiction, enables the establishment of marine protected areas in the open ocean, areas previously beyond the reach of conservation efforts. These protected zones, expected to encompass 30% of the high seas by 2030, will regulate shipping, tourism and resource extraction, ensuring a sustainable approach.

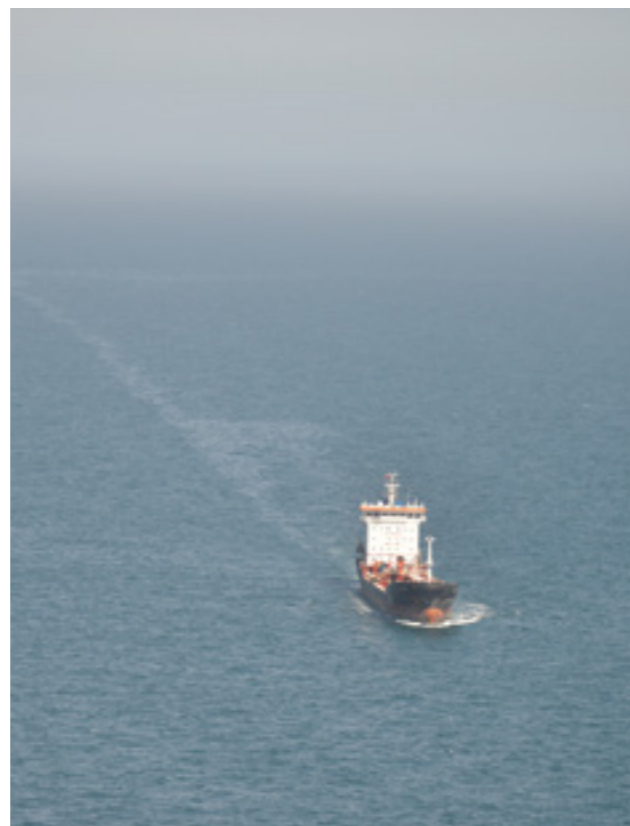
Our Institute's role was intensive: as a member of the Belgian delegation as well as the EU team, our team was involved in drafting their positions, and was responsible for aspects concerning marine genetic resources. The importance of finalising the treaty was also underlined during the Blue Leaders event that Belgian Minister for the North Sea Vincent Van Quickenborne co-organised on the eve of the Our Ocean Conference 2023 in Panama. The establishment of a separate secretariat for the treaty in Brussels was proposed, which would further secure our role as a global leader in marine conservation.



An eye from the sky monitoring ship emissions

Air pollution from ships in the North Sea is regulated. But what use are the regulations, if ships don't comply with them? Our Institute manages surveillance aircraft that can monitor this pollution, and new research has demonstrated that our work can significantly contribute to the enforcement of these regulations. The results were published in a [PhD thesis](#) from a member of our team who became the very first person to obtain the title of Doctor of Maritime Sciences at Ghent University. The findings of this research indicate that compliance with sulphur dioxide emissions regulations is relatively high, but nitrogen oxide emissions regulations are not well respected.

2023 also saw the launch of a report looking back across 30 years of our Institute's aerial surveillance work. "[30 years of Belgian North Sea aerial surveillance: evolution, trends and developments](#)" presents a comprehensive overview of the programme's missions, results, and the changing landscape of the North Sea. The report was presented in cooperation with the federal cabinets of Thomas Dermine, Secretary of State for Economic Recovery and Strategic Investments, in charge of Science Policy, and Vincent Van Quickenborne, Deputy Prime Minister and Minister of Justice and the North Sea, and with the support of Bruges-Ostend International Airport.



Monitoring Brussels' ponds with eDNA

You might welcome the presence of a crayfish on your plate at a restaurant. But in Belgian ponds, some species of this crustacean are much less welcome. Our Institute is working with the Brussels government to take action.



Invasive crayfish species can have devastating effects on local aquatic ecosystems. They are known for their ability to rapidly spread in streams, lakes and ponds, where they can alter the habitat, prey on native species, and introduce diseases, threatening the delicate balance of local ecosystems. One species, *Procambarus virginalis*, can even reproduce entirely asexually, effectively cloning itself, accelerating its spread. By monitoring the presence and distribution of these species, scientists and nature managers can better understand and manage the risks they pose.

BopCo, our Institute's DNA-based identification service, has been pioneering research in environmental DNA (eDNA) in the Brussels-Capital Region as part of the [LIFE RIPARIAS](#) project (LIFE19 NAT/BE/000953), co-funded by the EU's LIFE Programme and coordinated by Brussels Environment. The project aims to provide valuable insights into the presence and distribution of four invasive crayfish species: *Procambarus clarkii*, *Procambarus virginalis*, *Faxonius limosus*, and *Pontastacus leptodactylus*, across fifty ponds in the Brussels-Capital Region.

To explore this further, BopCo has been analysing DNA fragments in the water to detect the presence of invasive crayfish species. This method offers several advantages over traditional live captures, which are time-consuming and can be biased.

The results of this analysis were compared to data obtained from live captures to assess how effectively they could be detected.

The study found that for three of the four crayfish species, the eDNA results were highly consistent with the live capture data. It demonstrated the potential of eDNA sampling as a valuable tool for monitoring invasive species. By providing a quick and efficient method for detecting species presence, eDNA sampling can help scientists, field managers and policymakers to make more informed decisions about how to manage and protect local ecosystems. For *P. leptodactylus*, only a limited amount of the eDNA results matched the live capture data, showing the importance of understanding both the strengths and limitations of the eDNA method.

This research represents a significant step forward in the field of invasive species monitoring and highlights the importance of integrating innovative technologies, such as eDNA sampling, into management and conservation efforts. By leveraging the power of eDNA, researchers can gain valuable insights into the presence and distribution of invasive species. These results are essential to inform policymakers on the best action to take to protect and preserve our fragile aquatic ecosystems.

Endangered species? No entry, no exit

CITES is the global treaty that protects endangered plants and animals from the threat of international trade. And in Belgium, our Institute works closely with authorities to ensure that protected species are neither imported, nor exported.



Combating the illicit trade in eels

The European eel (*Anguilla anguilla*) is at the heart of a concerning trade issue in Europe. These young eels migrate from the Sargasso Sea to freshwater habitats in Europe, a journey that is vital for the species' survival. The demand for these creatures has led to illegal trafficking, severely endangering the already declining European eel population. That means that when customs officers at our airports find European eels in a shipment, they need to take action. But distinguishing European eels from other eel species can be difficult, making enforcement of regulations complicated.

BopCo, our DNA identification service, is tasked with identifying the species in impounded shipments, working in collaboration with Belgium's Federal Public Service for Health, Food Safety and Environment. When European eels are identified, INBO, the Research Institute for Nature and Forest, then runs tests for potential diseases. Healthy eels are released back into the wild, as illustrated by three batches intercepted last year. This collaborative effort demonstrates an ongoing commitment to combat illegal eel trade and conserve the European eel population.

A meaty challenge: the import of protected species

For years, our Institute has been supporting customs officers in identifying illegal imports of wild meat from protected species. In 2023, we stepped up our activities with the launch of INTERCEPT, a new project funded by Belspo and led by our Vertebrates group in collaboration with BopCo, the Royal Museum for Central Africa, and Sciensano. This project aims to trace the routes through which exotic animals and animal products enter Belgium, legally and illegally.

One of the most notable activities of the project is the sampling of intercepted meat at Brussels International Airport during baggage control actions, regularly organised by Belgian customs and the Federal Agency for the Safety of the Food Chain. So far, 250 samples from meat seized in passengers' luggage from non-EU countries have been taken. One such example this year was smoked meat that turned out to be from a Colobus monkey. This meat, banned from importation into Belgium by European regulations, had to undergo DNA-based identification since it was already processed. Other species found include pangolins, African palm civets and monitor lizards. This initiative will establish a sustainable monitoring system to quantify and assess the risk to public, domestic animals, and wildlife health.



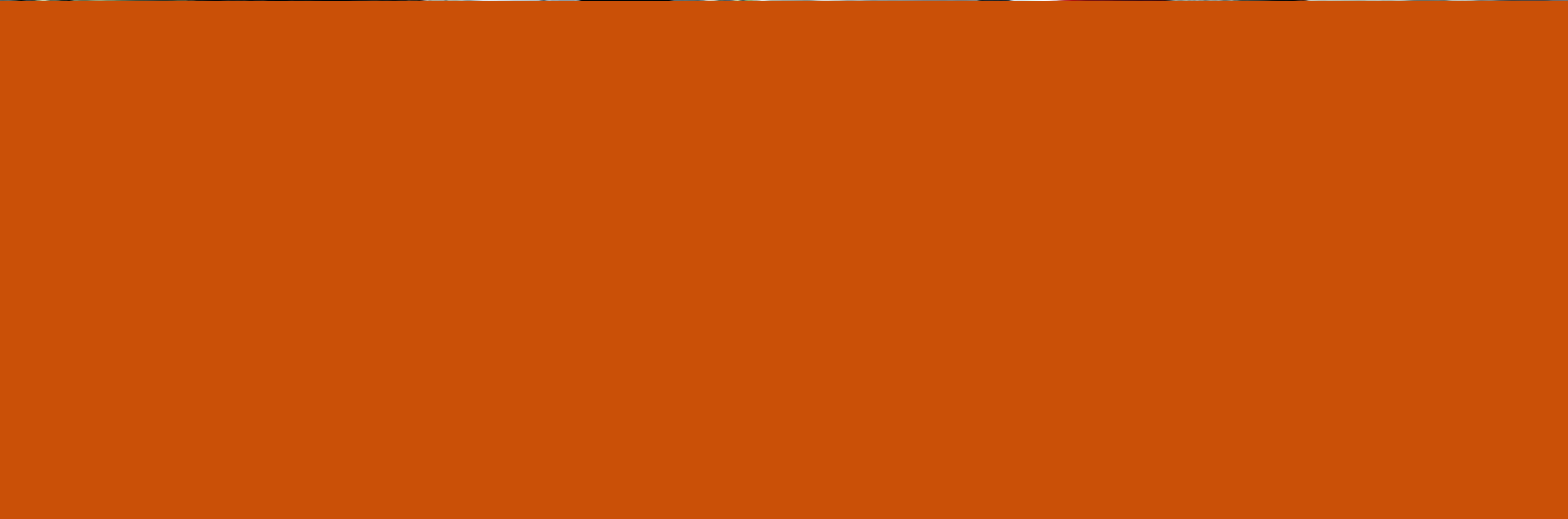
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What's in a name? Introducing the Institute of Natural Sciences

This year we launched our new identity that brings together our research, our collections and our museum under one name: the Institute of Natural Sciences. And it brought with it a striking new graphic identity and website.



A fresh identity for our Institute

You know us. But maybe you don't all know us by the same name. For our visitors we've been the Royal Belgian Museum of Natural Sciences, the Natural History Museum or even the Dino Museum. Researchers call us KBIN, RBINS or IRSNB. These multiple identities are a reflection of our uniqueness as an institution. But we have always been aware of the need for a single name that brings our expertises to the forefront.

Our rebranding is the latest step in a long transformation to unite our Institute and its strengths, including reorganisations of our departments and campuses, as well as a new [strategic plan](#) and [research strategy](#). And the rebranding itself was a lengthy process, working as a team to bring all opinions together and ensuring constant dialogue.

The Institute's new identity reflects our dynamic spirit. A balanced logo, comprising three distinct shapes, symbolises the pillars of research, collections, and museum experiences. These shapes merge to form the letter N, representing the unity of the Institute's multifaceted endeavours, with the dot of the "i" for Institute always visible. Our new identity conveys the vibrancy of nature, inviting visitors to dive into the wonders of science.

Clean and clear: our new website

The launch of our new identity wouldn't be complete without our newly revamped [website](#). Embracing the clean, modern style of our new graphic identity, we've put useability front and centre. The new design has been implemented with the needs of our diverse audiences in mind. It introduces several novel features that make it cleaner and simpler to navigate.

Visitors keen to explore our exhibitions will find our planning and personalisation tool comes in handy. By using filters based on profile, interests, age, and time availability, you can curate your visit, ensuring a bespoke experience tailored to your preferences.

For our fellow scientists, our research is now presented in a dynamic and engaging manner, organised around the key themes outlined in our strategic vision. This approach not only provides a comprehensive overview of our work but also allows for easy navigation and discovery of the latest news from our labs. We've also taken steps to highlight the individuals behind our groundbreaking research, making our researchers more visible through the addition of new photographs and profiles.

We're particularly proud of the simplicity that underlines the new site, from the spacious page layouts to the bold texts and images. And we are happy to see that more of you are joining us online, with visits to our website rising to over 150,000 in 2023. It started, as it often does, with our collection. When it comes to giant species, our Institute is home to a particularly rich variety of specimens: from the giant shark *Otodus megalodon* to the woolly mammoth *Mammuthus primigenius*. But we don't

Our enormously creative new exhibition *GIANTS*

There is nothing like an in-house production to bring a team together. *GIANTS* showcases huge stars from our collection, huge achievements by our researchers and the huge talent of the colleagues that made it happen.



always have such a complete skeleton. How can we convey the huge scale of extinct species where only fragments remain? The solution came to our team in a flash: it was the lifesize 3D reproductions that would show just how huge these creatures once were, as well as housing the specimens, screens and panels to let the visitors explore the details of how they lived, and more. An original concept, but a real challenge.

To bring these specimens to life, a real team effort was essential. Close cooperation between the museologists, the scientific committee, the collection department, the educational team and the communications office meant that the exhibition was a true collaborative vision, right across the Institute. And for each massive specimen, there was giant expertise among our researchers that we could bring straight into the exhibition. It's hard to understate just how much of this exhibition was created by our talented in-house team. The story, the concept, the museography, the graphic design, the texts, the illustrations, the explanatory films, the 3D prints, the lighting: all designed by our internal experts and produced with the help of a great team of external builders.

We couldn't be prouder of the result. There is a real wow factor as the visitor turns the first corner and looks straight into the open jaws of *Titanoboa cerrejonensis*, the largest snake known to science. How impressive, that all this could be reconstructed from just a single fossil vertebra, and how unsettling to walk beside it, picturing

it slithering past the ten other giants that surround us. And the exhibition leaves us with thoughts about today's giants on earth: how their size makes them more vulnerable to the changes caused by humans on earth. How can we ensure the giant species of today don't suffer the same fate as the eleven we met in the exhibition?

To promote *GIANTS*, we needed to bring a giant somewhere it had never been before. Soon enough, our lifesize inflatable *Paraceratherium* was popping up all over the country, from Nerdland in Wachtebeke to the Galleries St Lambert shopping centre in Liège. What better ambassador for our exhibition than this curious beast? And the other giants are set to hit the road as well, as the exhibition will go on tour. The next stop: Muséum de Toulouse, France, in October 2024.

Our educational team seized the opportunity of *GIANTS* to launch a beautiful new teacher's guide to the exhibition in three languages, but also a brand new workshop: 'Later I'll be a Palaeontologist'. It's a chance for families to work together as amateur scientists, rolling up their sleeves and excavating fossils. Our guides provide hands-on support, igniting their curiosity. And even when our giants have left the building, the workshop will continue, as part of our monthly programme of activities.

Let's talk science

From fieldwork missions to Instagram reels, there is one team that knows how to get our researchers talking. This year we take the opportunity to shine the spotlight on the work of our science communication unit.



Bringing the people to the research, and the research to the people

Our new name, the Institute of Natural Sciences, unites our two main roles: as a place where the public can engage with science and a leading research institution. One team that has been straddling those double identities for some time now is our science communication unit, whose focus is engaging the public in our Institute's research, beyond our exhibitions and workshops. Their focus? News, education and training as ways to inform, educate and engage a diverse range of audiences.

When it comes to science news, our scicomm team's greatest strength is that they are essentially in-house journalists. So they relish the opportunity to explore the winding corridors of the Institute, knock on a colleague's door and sit them down for a cup of tea and a chat about their latest findings. Every press release they produce is a ready-made article, in multiple languages, complete with images, catchy copy and quotes from our scientists, making journalists' lives as easy as possible. And when our team gets the chance, they join our researchers on their fieldwork too. The video team's skills means they can really bring the public with them as they disappear down mines in Slovenia with geologists or bake in the sizzling heat at a palaeontological dig. Their hard work on news has been paying off too, with increasing numbers of stories and features published across the country. Without science communication, it would be easy to lose sight of the human beings behind the research. But with our team's social media presence, there's no escaping the talented scientists at our Institute. The short videos they post let

the research speak for itself, with clear, engaging infographics to capture the viewers' imagination. And when we're first with world news, their social-media-friendly format makes it easy to go viral, as we showed again this year with our films about our research on the heaviest known ancient whale, *Perucetus colossus*, and the crocodile mummies discovered in Egypt, both of which were viewed tens of thousands of times.

Thanks to our capacity building work, the skills needed for science communication are spreading. We offer our researchers training in scicomm: how to produce infographics and video, what makes great science writing, and even how to produce your own podcast. You can see them in action on the Science Figured Out website. Last year, 27 researchers had the chance to get trained up, thanks to our partnership with nonprofit SciMingo. For early stage researchers in particular, this can be an inspiring experience that equips them with the expertise to engage not only the general public but also colleagues, policymakers and stakeholders. And with our Institute's regular Science Squad meetings, researchers interested in science communication have a chance to come together to bounce ideas off each other and find inspiration. This teamwork is building a passionate community within our walls and ensuring that we continue to innovate in finding new ways to engage.



Send in the nerds!

The biggest date in our public engagement calendar this year came in the shape of Belgium's biggest open air science festival: Nerdland. Over 20,000 participants embraced their inner nerd and joined us there, with a chance to meet our scicomm and educational team, our researchers and exclusive specimens.

Long lines soon formed at our digging stations, where enthusiastic wannabe palaeontologists uncovered microfossils over 500 million years old. It was real precision work, requiring concentration and magnifying glasses—a little moment of zen in the middle of the chaos of the festival. Several young visitors even found teeth from an early mammal, perhaps from our own primate ancestors. Our palaeontologists also gave visitors a taste of the real Jurassic Park, with live preparation of *Diplodocus* fossils from Wyoming, uncovered during our Institute's series of digs there. Participants had the chance to hold a real fossil bone and hear countless stories about the excavations.

Our entomologists and volunteers were on hand to take people on safari: an insect safari of course, with some spectacular species, including from our own giant insect collections. And our education team labelled their tent "No Parents Allowed", giving youngsters a chance to explore the topic of sexual reproduction in the animal world in a playful way, without the embarrassment of having to look their parents in the face. Presiding over proceedings was our scale model inflatable *Paraceratherium*, 5 metres high, inviting visitors to join us at the new exhibition *GIANTS* that was just about to open at the Institute.



Collections

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The need for change: repatriating human remains

How can we address the crucial ethical questions around the human remains housed in Belgian institutions? The Institute of Natural Sciences coordinated the HOME project that sought to shine a light on this challenging topic.



Over 30,000 human remains are currently housed in 56 different institutions in Belgium. These findings were the outcome of a survey undertaken during HOME, Human remains Origin(s) Multidisciplinary Evaluation, a project led by our Institute. We worked with several Federal Scientific Institutions, including the Royal Museum for Central Africa, Royal Museums of Art and History, National Institute for Criminalistics and Criminology, as well as the Université Saint-Louis, Université Libre de Bruxelles, and Université de Montréal.

Most of these 30,000 remains are of Belgian (pre) historical origin. The Institute of Natural Sciences houses the majority of them, including remains from pre-colonial and colonial contexts. There are over 500 historical remains from the Democratic Republic of Congo, Rwanda and Burundi which were collected in a highly problematic colonial context, highlighting the ongoing consequences of Belgium's colonial past.

Human remains must be treated with the respect they deserve. For certain communities, the repatriation of their ancestral remains is of clear importance. Nonetheless, only one instance of repatriation of human remains between Belgium and DR Congo has taken place in recent years, namely the return of the tooth of Patrice Lumumba to family members after a judge's decision. The Université Libre de Bruxelles also transferred the associated rights of 10 skulls of Congolese origin to the University of Lubumbashi in 2020 with a view to repatriation at a later date.

What steps should be taken? The HOME project made a series of recommendations. These included proposals to change the law to better respect human remains, limit their trade and facilitate their repatriation. Repatriation should be seen as a part of the healing process, fostering reconciliation within and between countries and communities. A further recommendation calls for the creation of a focal point to manage the information related to human remains collections in Belgium. This would serve as a centralised resource for institutions, administrations, communities, and private individuals seeking guidance on the status and best practices regarding human remains. The three directors

of the Federal Scientific Institutions in the project with human remains also asked the Belgian Advisory Committee on Bioethics their advice on the status of human remains, which the Committee formally published in 2023, advancing Belgium's ethical position on the topic.

The project further emphasises the importance of detailed research in the repatriation process. This includes the collaborative exchange of knowledge, archives, and information between Belgium and the countries of origin, as well as funding for community-based projects focusing on healing and repatriation. The project also recommends that Federal Scientific Institutions adopt an open policy towards repatriation of human remains, particularly those which are directly linked to the colonial past of Belgium. Repatriation should be pursued without conditions imposed by the Belgian State, fostering a spirit of cooperation and reconciliation.

The HOME project did not merely call for change; it presented a comprehensive roadmap for the future. As the global conversation continues, our Institute continues its engagement for a more ethical, respectful, and informed approach to the management of human remains.

Legacies that last, thanks to donations

Our collection grows in many ways. Sometimes it is through our researchers' fieldwork that new specimens enter our Institute. Less often we make purchases. But the most touching moment is undoubtedly when a collector leaves a collection in our hands, ensuring their tireless efforts to document the natural world will live on thanks to the work of our Institute.



In 2023, the widow of Mr. Lucien Genot donated a particularly beautiful and scientifically valuable collection of over 1,000 pieces of minerals and more than 300 fossils. This remarkable gift reflects Mr. Genot's lifelong passion for geological treasures, as an amateur mineralogist. He began his collection through his involvement in the scouting movement and potholing. In 1948, he began his apprenticeship in jewellery at Etablissements Coosemans in Brussels, where he discovered the world of gemology. Ten years later, he opened a boutique in Etterbeek where he sold jewellery and minerals. Gradually, his business expanded, and he retired at the age of 77 but continued his passion for collecting minerals.

What is notable about his collection is the exceptional quality and condition of the minerals and fossils. From shimmering green malachite to the deep oranges and purples of wulfenite and sphaerocobaltite—even nuggets of gold—each is carefully documented. Our researchers have confirmed that his data

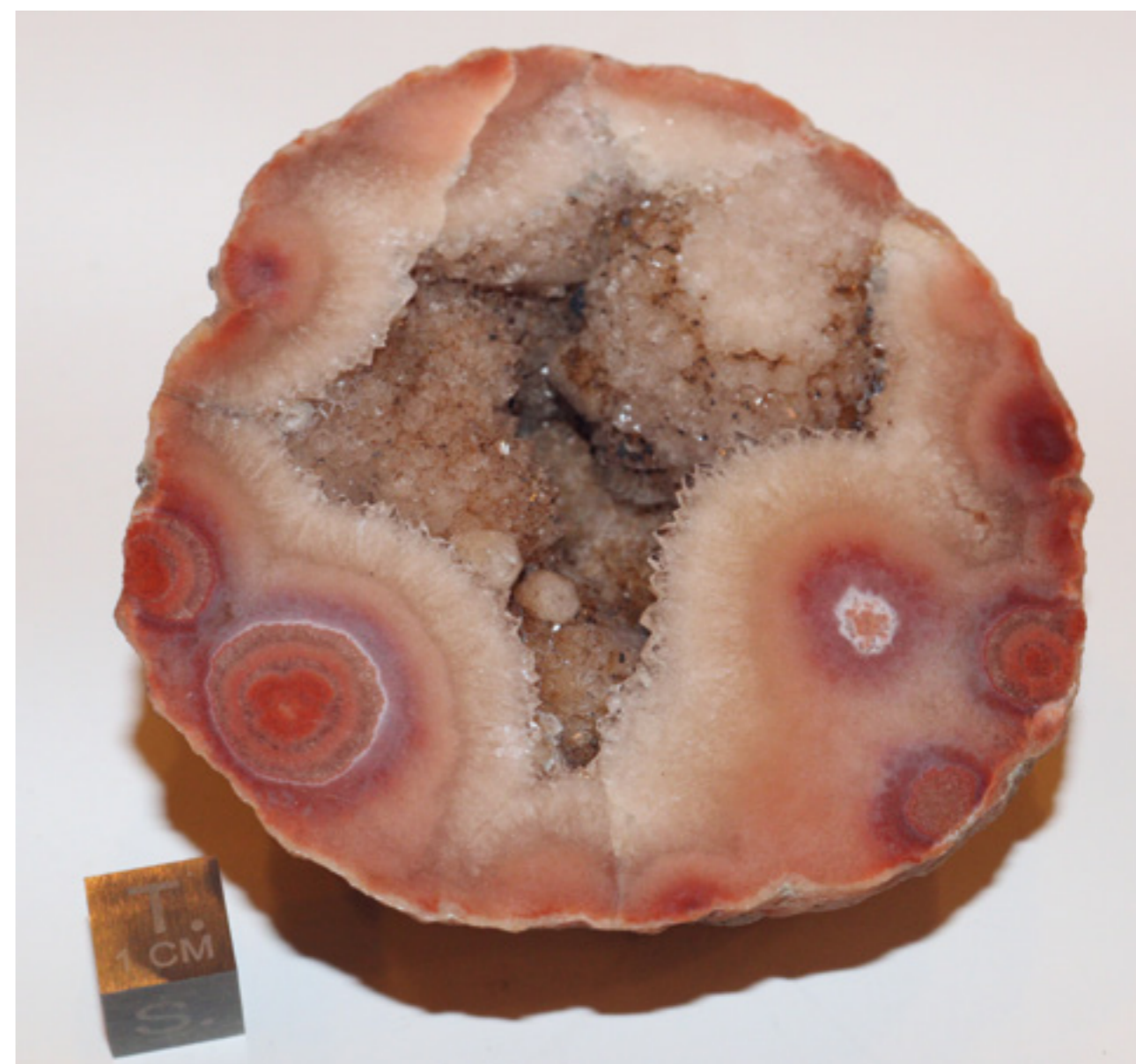
shows excellent knowledge of the field, with an eye for detail and accuracy. Plus, there are 240 fossils in the collection, including a complete turtle shell from South Dakota dating back to the Oligocene, and a complete crab from the Eocene, found in Italy. They are all now part of the Institute's collection, where they will be digitised and carefully conserved as valuable resources for future research.

A second remarkable donation to our collection this year came from a close collaborator of our Institute: Guy Boosten. And what a collection: 500 boxes containing at least 100,000 insect specimens, mostly collected in Belgium, all identified to species level and taxonomically organised. What's more, Boosten had contact with collectors who were active over a hundred years ago, meaning he received a lot of interesting old specimens from them which now join our collection. Some are very rare, including several only ever found once in Belgium.

From Ath, Guy Boosten is known in Belgian entomology circles for his advocacy for the conservation of the natural world. He is one of the key players that pushed for the first ever Belgian law protecting insects: the royal decree of 22 September 1980 on the protection of certain indigenous species of wild animals. Thanks to his excellent work in maintaining his specimens, it is relatively straightforward to integrate these boxes into our collection despite their huge quantity.

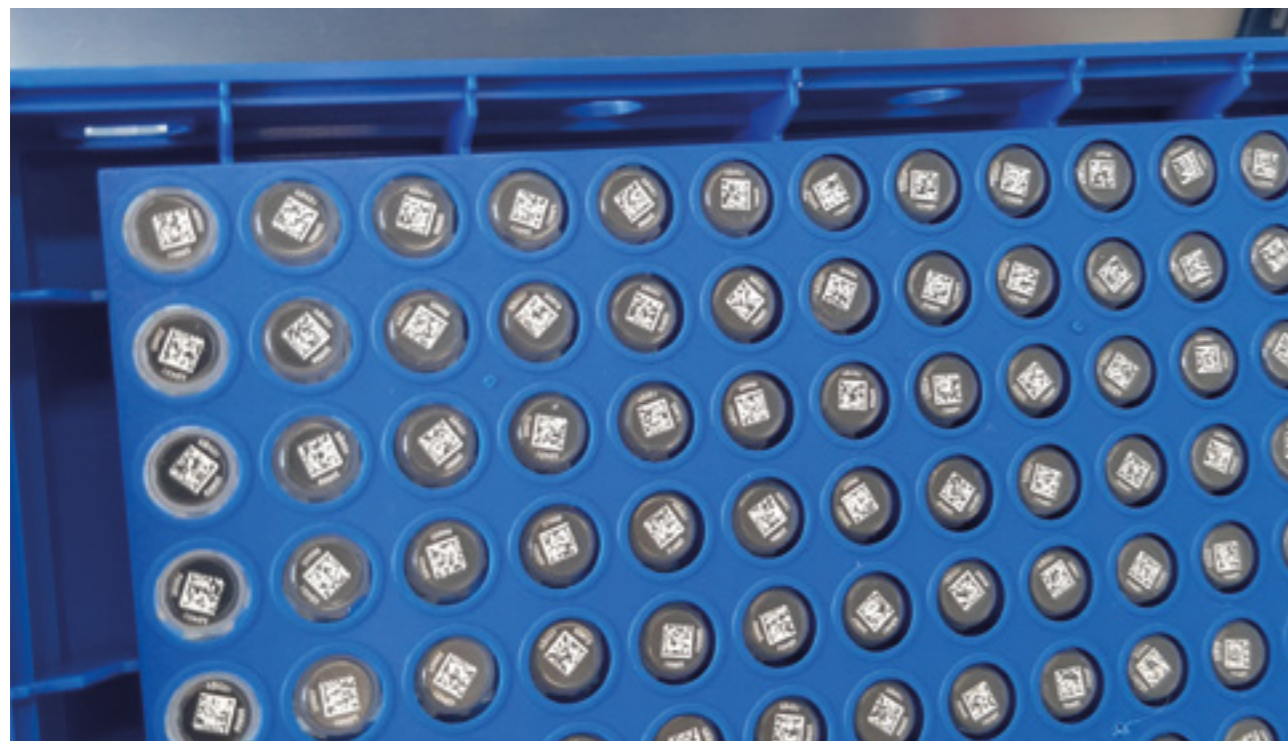
And that was not the only entomological treasure to find its way to our Institute this year. The insect collection of Agnes Van Grimberge was retrieved in Lokeren and donated to our Institute after her sudden passing. This collection, accumulated over 30 years, reflects her dedication to entomology. Her involvement in studies of moths, a recent interest, is also well represented. Our Institute now houses her collection of 57 boxes

containing 10,799 specimens, 8,558 of which are Carabidae: a clear indication of her passion for beetles. The accompanying database is a valuable addition, with 4,464 entries for Carabidae, including 2,516 from Belgium, and 4,693 Belgian specimens, encompassing 229 different beetle species. Notably, some species are well-represented despite limited Belgian data, particularly certain *Dromius* species. The collection also includes specimens used in recent studies that updated distribution maps of rare beetles in Belgium. This donation adds a significant resource to Belgium's entomological heritage, exemplifying Van Grimberge's contribution to the field.



Unlocking the data buried in our collections

Within the drawers, jars and cabinets of our collection lie 38 million objects from the natural world. And within those specimens, a wealth of tissue samples and DNA data to be explored. In 2023 we took some key steps to opening our collections up for endless research possibilities.



Frozen in time: our new biobank

This year, our Institute formally established its new biobank, a vital asset for researchers worldwide. It houses collections of biological tissues and DNA extracts that have been meticulously gathered since the 1990s and analysed in our Laboratory of Molecular Systematics. The samples, originating from as far afield as the Antarctic Ocean, African tropical forests, and Lake Baikal, represent a wide array of species, including many that are rare, extinct, or newly described.

The biobank became fully operational with the recruitment of a permanent technical staff member in 2023, supported by essential equipment acquired through the National Lottery and an earlier *Agora* project funded by Belspo. These resources enable us to store tissues at ultra-low temperatures, -70°C to -80°C , and DNA extracts at room temperature, ensuring biomolecules can be preserved in the long term. Our Institute is pioneering an innovative storage method for DNA extracts using a dry mineral matrix, meaning it doesn't require constant refrigeration. Currently, around 12,000 tissue and DNA specimens have been transferred to our biobank. They serve as a repository for potential future studies, ensuring that our Institute remains at the forefront of molecular research.

DNA on demand!

Natural history collections worldwide encompass over a billion specimens from approximately two million species, those known and those yet to be described. Studying their DNA is critical for understanding their biology and evolution. But how can we best extract DNA from museum specimens, considering their age and variable quality? In a collaborative effort, researchers from Belgium, Germany, and the UK have authored a review that discusses the challenges and shares insights for more efficient DNA data recovery. Part of the *Synthesys+* European funded project, their aim is to make DNA sequencing more accessible. Through six case studies, they explore various methodologies for sequencing DNA from museum specimens, published in the *Biodiversity Data Journal*.

DNA sequencing isn't cheap, and it doesn't always work, particularly on older specimens. One of the case studies used bird specimens from museums to demonstrate that by screening DNA fragment profiles from specimens, researchers can predict whether or not the DNA sequencing will be successful. This makes the whole process more efficient and cost-effective. With this type of promising advancement, these findings pave the way for broader utilisation of DNA sequencing, removing barriers to research on our collections across Europe and the world.

Our collections, reexamined

Specimens in our vertebrate collections date back tens thousands of years. And yet they always have something new to tell us. This year, our researchers' work turned the spotlight back on our collections to uncover stories about humans and snakes.



Charting the movements of Ice Age hunter-gatherers

Where did hunter-gatherers go to escape the freezing temperatures of the Ice Age? Researchers from our Institute have shed new light on Europe's prehistoric human history using the largest dataset of European hunter-gatherer genomes ever generated. Our team was among the 125 scientists that worked to analyse the genomes of 356 hunter-gatherers, known as Gravettians, from 14 countries, dating from 35,000 to 5,000 years ago. Among them are specimens from our collection from ancient burial grounds in Namur province: Malonne-Petit Ri, Caverne X in Waulsort and the Goyet Caves. These remains helped to show a continuity in Western European genetics before, during, and after the last glacial maximum at the peak of the Ice Age.

The study, published in *Nature*, found that Gravettians in various regions before the last Ice Age weren't actually closely related. But they did have similar weapons, art, and ways of burying the dead. In populations in the west of Europe, hunter-gatherers' genetic makeup was shown to have been fairly stable for around 20,000 years. Those westerners' descendants remained in southwestern Europe during the harshest part of the Ice Age before eventually spreading back across the rest of Europe.

A new family of snakes lurking in our collection

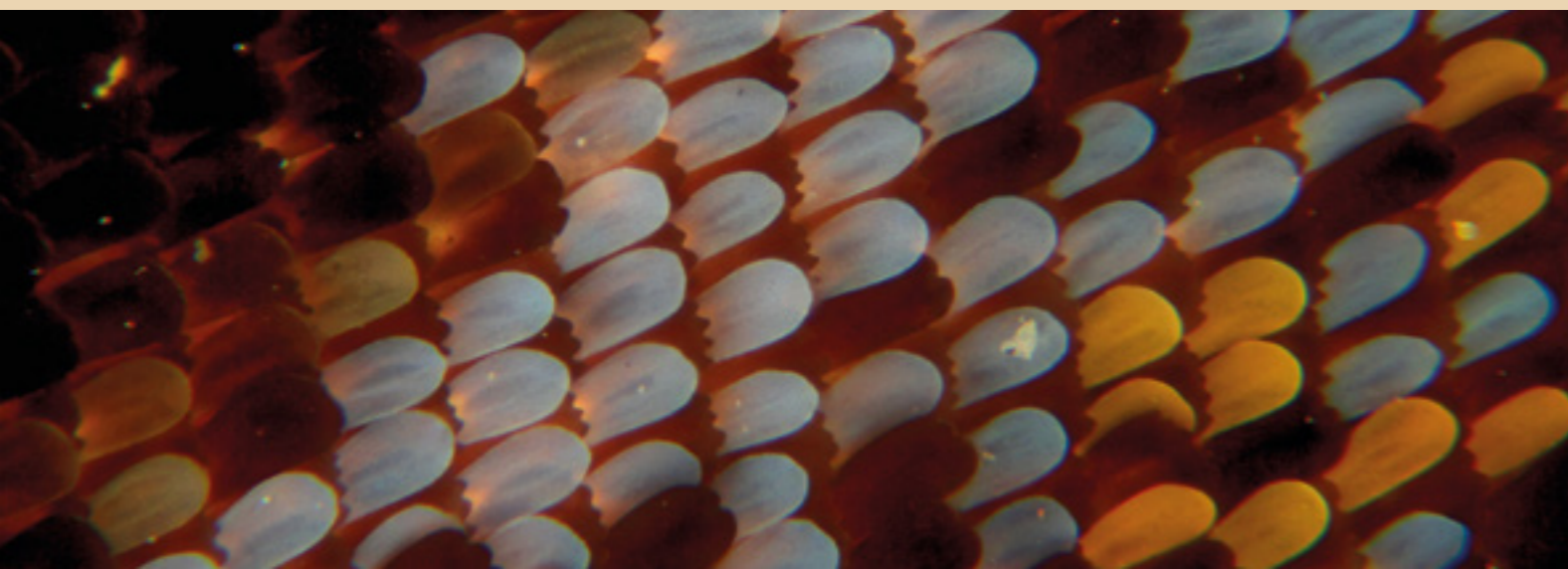
It's not every day a new vertebrate family is discovered. When our team joined researchers from the University of Helsinki and the Royal Museum for Central Africa, opening up access to some of the 20,000 snake specimens in our collection, they were hoping to gain fresh insight into the evolutionary history of the *Elapioidea* superfamily that includes cobras and mambas. The *Elapioidea* appeared about 50 to 45 million years ago and is an extremely diverse group. It is a classic example of evolutionary radiation, whereby a large number of species appear in a short period of time.

Using the advanced nanoCT and microCT scans in our labs, together with a genetic dataset from over 4600 genes relationships could be established with extreme precision. This combination is how the new discovery was made, called the *Micrelapidae*: a family of rear-fanged, mildly venomous snakes, including four species living in East and North-East Africa and the Near East. Yet another sign that our collections and expertise remain vital for research, showcasing the importance of our work to maintain them and open them up for research. The study was published in *Molecular Phylogenetics and Evolution*.

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Finances

The 2023 budget shows income of 50,739,786 euros, with expenditure of 50,544,769. As a result, the organisation closed the year with a slightly positive balance of 195,017 euros.

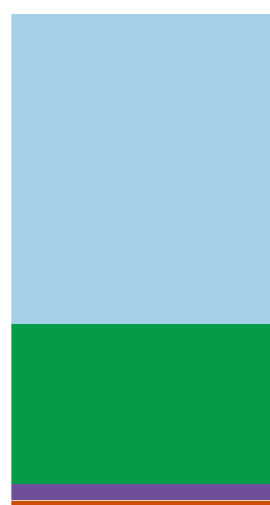
The principal sources of income continue to be federal. Approximately 18% of our income is in the form of a general grant and approximately 19% in the form of research grants from the federal government. The number of scientific projects that gave rise to this revenue is considerably higher than in previous years. The European Union financed our research for a total of 5% of our revenue.

Donations, sponsorship and grants from abroad represented approximately 2% of income, while our own revenue, including from the sale of museum tickets, represented approximately 21% of total income in 2023. The number of museum visitors was very high in 2023 and this is reflected in our revenue.

On the expenditure side, staff costs represented approximately 62% of total expenditure. Ordinary operational costs represented approximately 33%.

Breakdown of expenses (in €)

	2021	2022	2023
● Staff	21,668,610	24,141,778	31,414,405
● Ordinary operational expenses	8,253,932	13,659,311	16,244,683
● Investment	1,483,314	1,581,410	1,625,954
Scientific	698,664	880,016	898,256
Museum	460,027	109,908	84,266
Others	324,623	591,486	643,432
● Library and collections	249,846	158,146	128,828
● Transfers to research partners	1,545,156	675,424	1,130,899
● Other transfer	101,883	134,351	
Total	33,302,741	40,350,421	50,544,769



2023

Sources of income (in €)

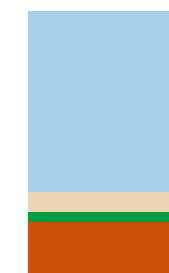
	2021	2022	2023
● General grant	16,764,000	18,706,351	19,620,173
● Specific grant	4,859,323	4,672,046	4,816,000
● Museum: own income	2,665,665	3,505,589	4,216,748
● Research: own income	12,793,633	13,610,455	22,028,048
● Various: own income	182,166	113,458	58,817
Total	37,264,787	40,607,899	50,739,786



2023

Breakdown of specific grants (in €)

	2021	2022	2023
● Belgica	2,998,000	3,060,000	3,293,000
● JEMU	279,252	284,362	357,197
● Public Observatory (all federal Museums)	138,748	141,287	179,305
● Interdepartmental provision	1,443,323	1,186,397	986,498
Total	4,859,323	4,672,046	4,816,000



2023

Breakdown of income of the museum (in €)

	2021	2022	2023
● Museum renovation grant	304,678	0	0
● Ticket sales	1,486,772	2,341,992	2,648,318
● Exhibition hire and sales	0	64,388	125,000
● MuseumShop	522,393	506,818	525,184
● Donations - sponsorship - grants	95,462	29,225	163,500
● Education	177,133	216,789	260,513
● Events	79,227	296,276	403,109
● Dinocafé	0	50,100	91,124
Total	2,665,665	3,505,589	4,216,748



2023

Breakdown of research income (in €)

	2021	2022	2023
● Belspo	3,258,427	3,255,160	4,617,248
● Federal administrations (excl. Belspo)	1,391,668	2,226,130	5,299,469
● European Union	2,500,467	1,800,911	2,548,349
● Belgian federated entities	1,625,160	1,530,705	1,807,589
● Private sector	0	0	41,877
● Outside the EU	557,362	749,730	995,184
Services			
Public sector	1,332,163	1,594,087	4,315,441
Private sector	1,988,121	2,392,712	2,300,073
Outside the EU	140,265	61,021	102,818
Total	12,793,633	13,610,455	22,028,048



2023

Staff

2023 was a year of stabilisation, after previous years brought COVID and a number of changes in our way of working following the introduction of new regulations and changed procedures.

There was a slight fall in staff numbers, to 373.66 full-time equivalents, but in the longer term the figure is quite stable. The biggest fall was in contractual administrative and technical staff. This is only logical as staff who leave us are no longer automatically being replaced. An increase in scientific projects

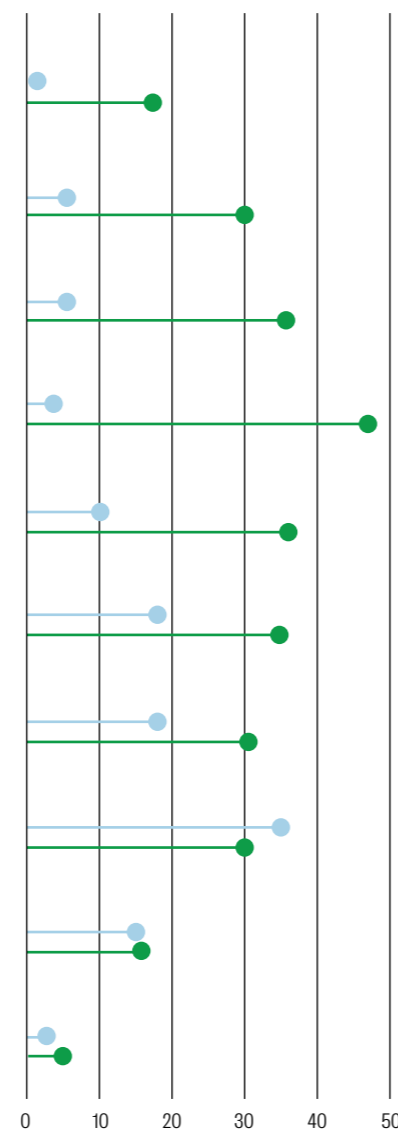
resulted in increased staff numbers for the category of contractual scientists.

The number of volunteers, engaged in museum or scientific activities, rose again.

There was a slight increase in absenteeism, in line with the increase seen in general among federal government employees.

Age distribution

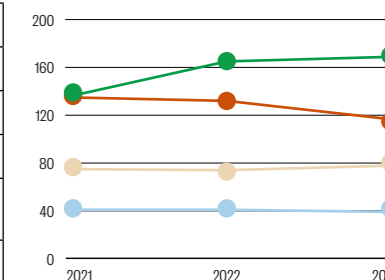
Age group	Category	Statutory	Contractual
18-25	SW	0	6
	A	0	1
	BCD	1	11
26-29	SW	0	20
	A	1	0
	BCD	5	10
30-34	SW	0	27
	A	0	3
	BCD	6	6
35-39	SW	0	41
	A	1	3
	BCD	3	3
40-44	SW	3	25
	A	3	3
	BCD	4	9
45-49	SW	4	20
	A	1	1
	BCD	13	14
50-54	SW	8	12
	A	4	2
	BCD	6	17
55-59	SW	13	10
	A	5	1
	BCD	18	19
60-64	SW	9	6
	A	1	0
	BCD	5	10
65+	SW	2	2
	A	0	0
	BCD	1	3



SW = Scientists | A = Level A (Master) | BCD = Levels B (Bachelor), C (secondary education) and D (no degree)

Staff breakdown by statute

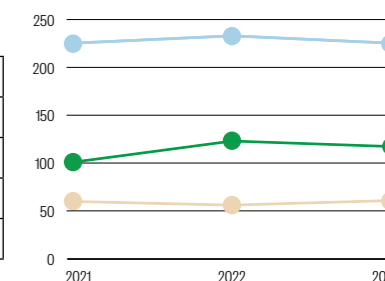
	2021	2022	2023
Statutory scientists	41 / 39.50	41 / 38.10	39 / 36.30
Statutory administrative and technical staff	75 / 71.60	74 / 69.10	78 / 75.10
Contractual scientists	135 / 120.25	165 / 151.63	169 / 156.44
Contractual administrative and technical staff	135 / 122.40	132 / 118.05	116 / 105.82
Total	386 / 353.75	412 / 376.88	402 / 373.66



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

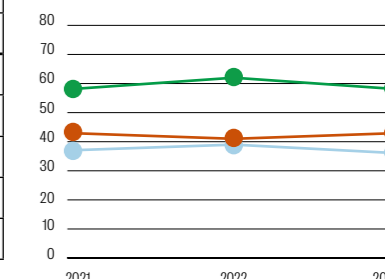
Sources of staff financing (number of persons / in FTE)

	2021	2022	2023
General grant	225 / 270.70	233 / 213.63	224 / 210.36
Ordinary income	60.50 / 54.40	56 / 51.10	61 / 56.10
External projects	100.50 / 88.65	123 / 112.15	117 / 107.20
Total	386 / 353.75	412 / 376.88	402 / 373.66



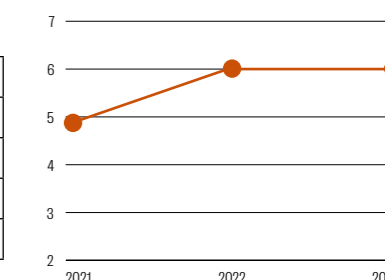
Percentage of female staff (%)

	2021	2022	2023
Statutory staff	31.03	31.30	31.62
Scientists	26.83	26.83	25.64
Level A	53.33	56.25	43.75
Levels B, C and D	28.33	27.59	32.26
Contractual staff	53.70	53.54	50.88
Scientists	48.15	50.91	47.34
Level A	62.50	68.75	71.43
Levels B, C and D	57.14	55.17	53.92
Total	46.89	47.33	45.27



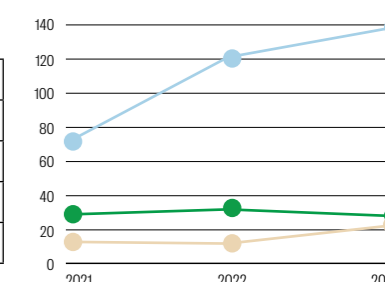
Absenteeism and work accidents

	2021	2022	2023
Work accidents	3	3	6
Accidents on the way to work	8	7	3
Absenteeism RBINS	4.84%	5.85%	6.01%
Absenteeism federal level	5.93%	6.92%	6.81%



Volunteers

	2021	2022	2023
Research volunteers	71	121	139
Collections volunteers	13	12	23
Museum volunteers	29	32	28
Total	113	165	190



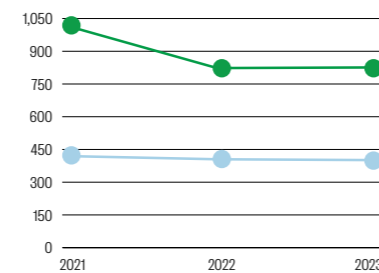
Environment

2023 saw a return in full to normal operations. The indicators show that reduced gas consumption remained stable due to the continued application of the existing energy savings plan. Electricity consumption was at the same level as in previous years and printing showed no major change.

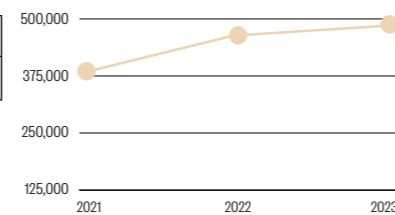
A number of awareness raising campaigns took place in 2023, concerning energy consumption, use of public transport and waste reduction.

Environmental indicators

	2021	2022	2023
● Electricity consumption in equivalent tonnes of CO ₂ emissions	420.4	404.5	400.5
Electricity consumption in kWh	1,860,318	1,789,793	1,772,363
● Gas consumption in equivalent tonnes of CO ₂ emissions	1,020.8	823.2	826.0



	2021	2022	2023
● Pages of paper printed	380,459	463,456	486,478



	2021	2022	2023
Percentage of commutes using public transport	63%	63%	NA*

* Not Available

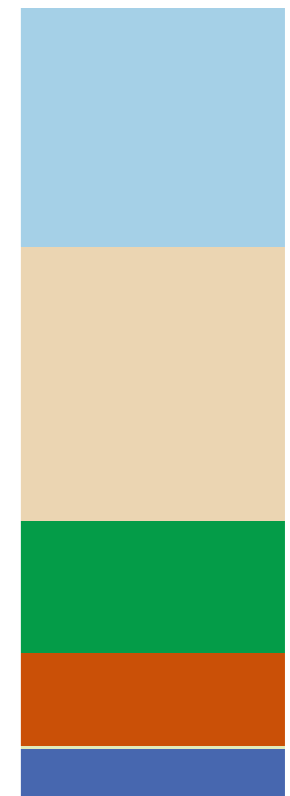
Research

There was a significant increase in the number of scientific projects. In 2023 there were 196 ongoing projects, 30 of which we coordinated. We see the sharpest increase in projects funded by Belspo. The associated income also increased sharply: from 9,562,636 euros in 2022 to 15,309,716 euros in 2023.

The total number of publications per full-time equivalent was in line with previous years. The total number of A1 publications per full-time equivalent decreased slightly compared to previous years, which is mostly attributable to a drop in the number of A1 publications, and a greater number of new researchers in 2023.

Funding of current scientific projects

	2021	2022	2023	2023
	Number	Number	Number	Amount (in €)
● Belspo	44	88	96	4,617,248
Number of projects coordinated by RBINS	28	27	22	
● Federal funding from other sources	3	16	17	5,299,469
Number of projects coordinated by RBINS	0	4	4	
● European Union	30	38	39	2,548,349
Number of projects coordinated by RBINS	1	3	4	
● Federated entities	20	19	25	1,807,589
Number of projects coordinated by RBINS	10	2	0	
● Private sector	0	0	4	41,877
Number of projects coordinated by RBINS	0	0	0	
● Outside the EU	8	13	15	995,184
Number of projects coordinated by RBINS	8	2		
Total	105	174	196	15,309,716
projects coordinated by RBINS	47	38	30	



2023

Publications

	2021	2022	2023
Scientific publications	490	543	480
● in Open Access	152	132	191
● in journals with impact factor	179	183	145
● Popular works	20	31	24
● Expert reports	37	67	57

As the Biblio4Plone database, where all RBINS publications are collected, is a living database, people can add papers at any time, also after the publication of the annual reports. Therefore, numbers of publications for 2021 and 2022 might differ from those in previous annual reports. / * Total of scientific publications (first row) is not the sum of the next four rows, as rows 2 and 3 have some overlap (some papers in journals with Impact Factor can also be in Open Access), while several other types of papers (abstracts,...) are not listed here.

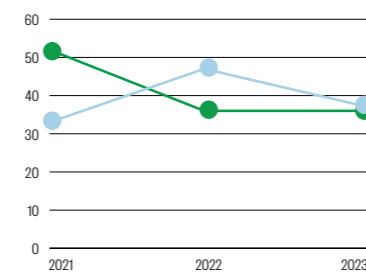
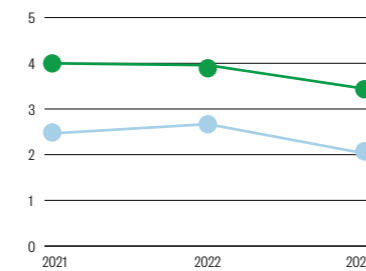
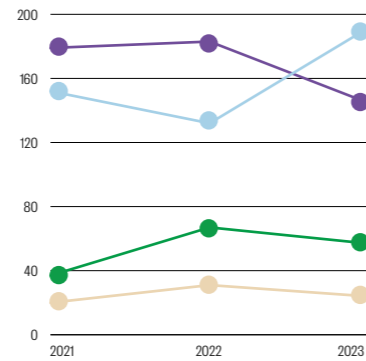
Average number of publications per scientist (in FTE)

	2021	2022	2023
● All publications per scientist	4.0	3.9	3.4
● All publications with impact factor per researcher	2.5	2.6	2.0

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

	2021	2022	2023
● PhD	33	47	37
● Master	52	36	36
Total	85	83	73



Library and Collections

2023 saw a return to normal, compared to the COVID period.

Visits to the collections for scientific research returned to pre-COVID levels, with 571 visits in 2023, compared to an average of 507 visits a year between 2012 and 2019. Nevertheless, there was a drop in the number of long duration visits. The COVID period saw the development of virtual access to the collections, a practice that has become habitual. This serves to reinforce the strategy of including collections in the ESFRI DiSSCo infrastructure (which is designed to digitally unify all the European collections in the field of natural sciences) but a specific indicator for the use of virtual collections should also be used.

The number of loans from the collections was again comparable to the pre-COVID period.

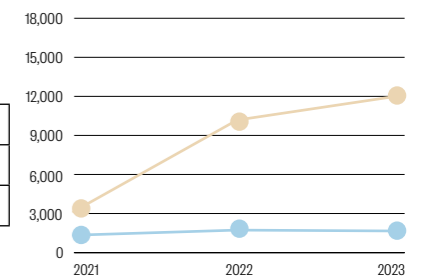
The number of additions to the collections was also comparable to the years before COVID (approximately 200,000 a year). Most of these new additions were the result of manual donations in entomology. In geology, we saw the notable donation of an exceptional mineral collection (Genot collection). The digitisation of the collections and of the library continued

steadily and in proportion to the resources committed. There was a decrease in the number of digitised type specimens following the end of the DiSSCo-FED project (the Belgian federal component of the project), but the global number of specimens encoded in DaRWIn increased. The DaRWIn tool (the collection management system) has more than 3,750,000 specimens belonging to some 143,000 species.

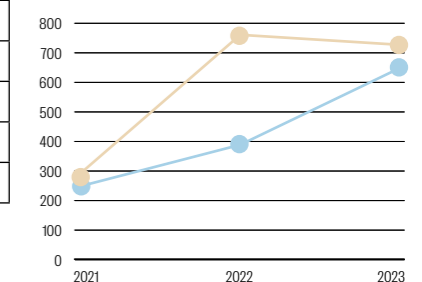
In 2023, the library received 894 internal visitors and 128 external visitors who borrowed 1,654 documents. The number of interlibrary requests increased, to 149. Consultations of electronic journals and databases are continuing to rise, hence the interest in direct access to PDFs through the government's Elsevier subscription (all journals/titles in addition to our other subscriptions). The back cataloguing remained stable with the addition of 17,000 articles. In the meantime, the development of the new map library is continuing with the encoding and relocation of some 3,500 maps. Cartography is an important resource for researchers, and we are pleased to make this collection even more accessible in future. Many maps are also digitised in the framework of the DIGIT-4 programme, with more than 18,500 maps digitised in the past 5 years.

Consultations

Library	2021	2022	2023
● Paper documents	1,332	1,726	1,654
● Electronic documents	3,139	10,180	12,100



Collections	2021	2022	2023
● Number of scientist visits	244	389	658
● Duration of scientific visits (days)	279	761	726
Number of loans from the collections	291	299	381
Number of loaned specimens	32,764	19,026	23,178



Size

Library	2021	2022	2023
Size of the library	446,743 items*	462,505 items*	479,697 items*
Growth of the library	Total growth of 3.6%	Total growth of 3.5%	Total growth of 3.7%

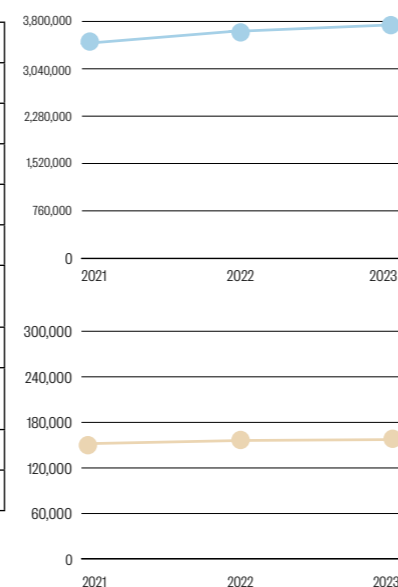
*item=physical unit

Collections	2021	2022	2023
Number of collections acquisitions	+98,063	+200,562	+183,254

Digitisation

Library	2021	2022	2023
Back-cataloguing	18,237	17,268	17,192
New inventory entries	1,507	2,275	3,688
Number of digitised pages	8,325	43,257	25,512

Collections	2021	2022	2023
Type specimens	4,202	2,980	4,724
Non-type specimens	797	628	26,810
Boxes & drawers	2,889 + 1,660	9,931	1,782
The new registrations in the databases	54,697	79,764 + 26,856	111,192
The number of new types	5,313	3,744	1,271
The total of digitised specimens (metadata)	3,442,585	3,636,534	3,750,085
The total of digitised type specimens	151,246	155,625	156,896
The total of digitised species (all specimens)	131,400	139,556	142,912
Scientific archives	48,961	36,285	52,826
Pictures	57,397	6,908	0



Museum

Two thousand and seventy-seven visitors: that is how many more we would have needed in 2023 to reach the admittedly highly symbolic milestone of 400,000 visitors per year. Despite this slight disappointment, attendance this year was a record for the first quarter of the century. Group visitors (up 19.4%) as well as individual or family visitors (up 15.1%) visited our permanent and temporary exhibitions in large numbers (*Luminopolis*, an interactive exhibition from Cap Sciences Bordeaux; and *GIANTS*, an in-house production that will be travelling throughout Europe after being launched at our museum).

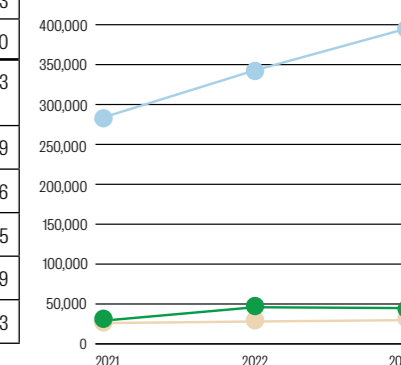
With these large visitor numbers, all the museum's services went into overdrive. The Education Service, MuseumShop and scientific, commercial and general public events all broke records, including in terms of financial revenue. Given the less than buoyant economic context, this is particularly noteworthy. The causes of success are often even more difficult to identify than the causes of failure. Our public popularity is certainly

the result of a series of efforts converging in the form of a coherent policy aimed at the overall quality of a museum visit. Effective information and promotion, a client-oriented welcome, reasonable prices, "tailor-made" services designed to cater for diverse audiences and of course scientific content that is both rigorous and entertaining – those are the keys that enabled us to establish this record.

This positive conclusion and high-quality rating in terms of public satisfaction and notoriety in the Belgian cultural and media landscape did not, however, mean that there was no scope for some major changes. This year the public discovered a new name and a new logo. Visitor Services are now part of Security rather than the Operational Directorate Public Services. Similarly, Communication now reports directly to General Direction.

Museum visitor activities

	2021	2022	2023
Total museum visitors	280,730	342,908	397,923
MuseumShop customers	25,918	28,057	29,823
Expenses per customer	€ 20.16	€ 18.06	€ 17.60
Participants in educational and cultural activities	28,208	45,936	44,783
Participant per activity (global)	24.7	18.7	19.9
Guided tours	4,392	12,150	12,276
Workshops	5,165	11,187	12,945
Other indoor activities	3,672	8,463	10,419
Outdoor activities	8,896	14,136	9,143

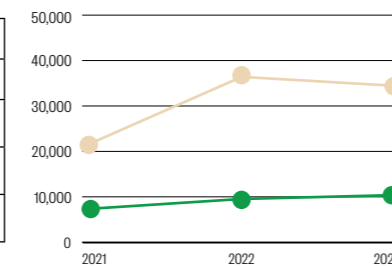
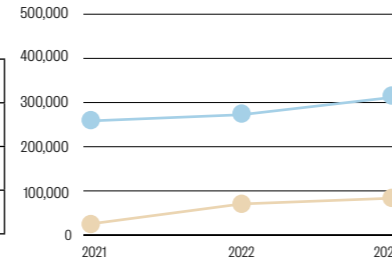


Profile of the museum user

By type	2021	2022	2023
● Visitors in groups	23,071	70,537	84,234
● Individuals and families	257,659	272,371	313,689
Total	280,730	342,908	397,923

By age	2021	2022	2023
Small children (0-4 years)	14.76%	6.46%	6.31%
Young people (5-17 years)	28.29%	40.86%	40.16%
Adults (18-64 years)	49.25%	46.30%	46.97%
Senior citizens (65+)	16%	2.38%	2.50%
Not known	6.11%	3.99%	4.06%

Participants in educational and cultural activities	2021	2022	2023
Total of participants	28,208	45,396	44,783
● Visitors in groups	20,946	36,405	34,364
● Individuals and families	7,262	9,531	10,419
Average participants per activity	24.7	18.7	19.9



Press and Internet

This year we were cited in 2,206 reports or articles: 800 more than in previous years. One in seven of those were on our museum's activities and six in seven covered our research activities. On average, we appeared in the media six times a day in 2023. The audiovisual media, both regional and national, reported on our work.

Nationally, two scientific themes and two items of museum news received particular attention: the marine world (the beached orca and whale; pollution in the North Sea), the Belgica expedition to Greenland, the opening of the new Climate Centre and the new *GIANTS* exhibition.

Internationally, the discoveries of a meteorite in Antarctica and a whale fossil skeleton in Peru—the latter probably the heaviest animal known to have lived on earth—attracted a lot of media attention in neighbouring countries. Anthrozoology studies on mummified crocodiles and baboons also drew attention to our work across the globe. This marked interest in science highlights the importance of communicating about our Institute's research activities, as well as about our museum activities.

Members of staff were quoted in more than half of the radio and television reports and in a third of articles in the written press. Our 55 websites received 665,164 visitors in 2023, 502,624 of them visiting our general* website, which is 21,632 more than in 2022 for this site alone. The new website has recorded 152,292 visits since it was launched on 18 October 2023. This represents an increase of 9,352 compared to the same period in 2022.

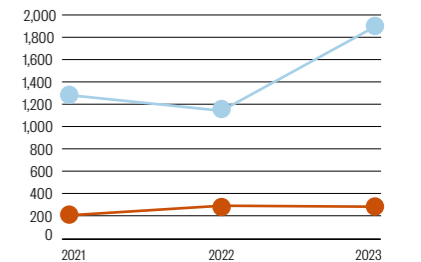
A digital communication strategy was put into place after a digital communication manager came on board in June. The number and frequency of posts and stories have increased significantly, as has the production of videos and reels.

On Facebook, the number of followers increased by 2,000 to reach 22,010. X is continuing to progress slightly with an additional 156 followers, making a total of 14,100. Instagram again recorded a strong increase of 1,156 followers, making a total of 7,152. On LinkedIn the number of followers increased by 300 to reach 5,254.

*The new website (launched on 18 October) is measured using a new system and parameters. This is why we took into account the number of visitors between October and December 2022 to complete the 2022 estimation, so as to permit comparison with the figures for previous years.

In the media

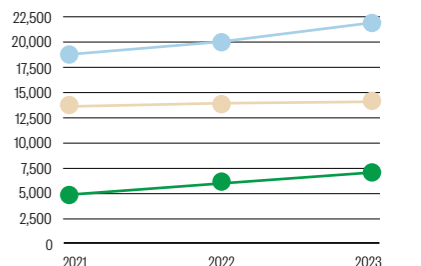
	2021	2022	2023
● Printed press	1,288	1,141	1,925
Of which research	1,046	945	1,670
Of which museum	259	196	255
● Radio and TV	200	290	281
Of which research	127	205	209
Of which museum	73	85	72
Total	1,488	1,431	2,206



Online and social media

Websites	2020	2022	2023
Website visitors	865,883	710,399	665,164
Website visits	1,493,720	1,359,301	1,116,777
Visited pages	3,898,989	3,063,695	2,814,773

Social media	2021	2022	2023
● Facebook followers	18,724	20,009	22,010
● X followers	13,616	13,944	14,100
● Instagram followers	4,856	5,996	7,152



Note: These are the website figures without the streaming of Falcons for Everyone, because the streaming numbers appeared to be difficult to compare over the last few years. Just to give an idea: the streaming normally accounts for a million to several millions of visited pages.

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

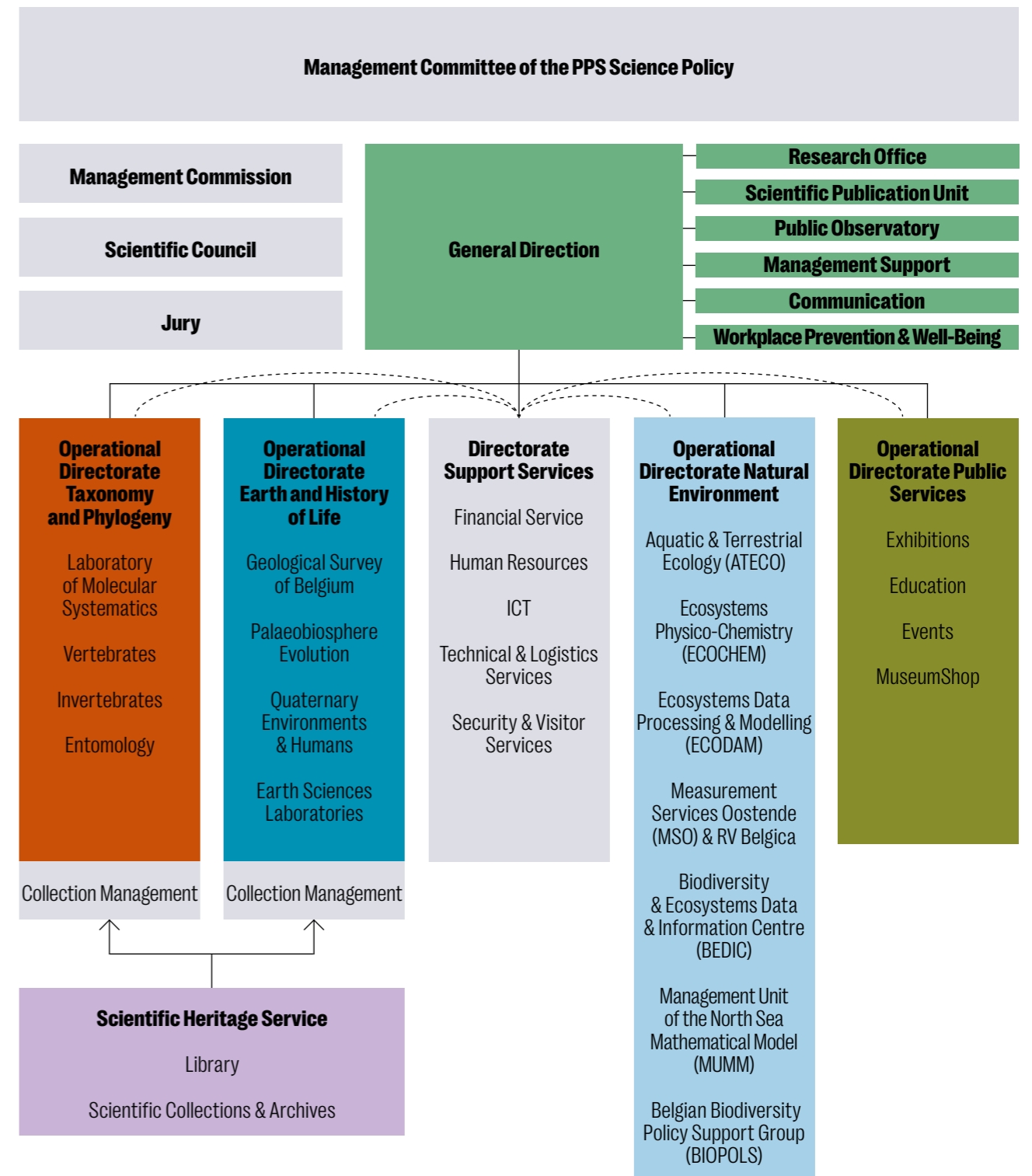
With their 38 million specimens conserved as Belgian heritage of universal significance, the RBINS's collections come just after London and Paris in the European classification, and belong to the top 10 largest collection in the world. They serve above all as reference and research tools and as such 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 m² of permanent galleries, temporary exhibition rooms and educational workshops, public spaces of all kind, enabling it to welcome more or less 340,000 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/he is assisted by the Management Board.

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

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

Credits

Cover: Still from Diplodokus' documentary series "Er was eens"

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Websites and publications

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