

ZSL SCIENCE AND CONSERVATION EVENT

**Biobanking for conservation: Why cryopreservation  
is essential for addressing our biodiversity crisis**



© Left: Rebecca Spindler; Right: Mary Hagedorn

**Tuesday 13 July 2021**

**6:00pm – 7:30pm UK Time (GMT)**

Online event livestreamed to [zsl.org/IOZYouTube](https://www.youtube.com/watch?v=wyuDCPRkSx0)

[Direct link: <https://youtu.be/wyuDCPRkSx0>]

There is no charge for this event, and no need to register in advance

## **AGENDA**

**Paul Pearce-Kelly, Zoological Society of London**

*Why biodiversity conservation needs cryopreservation*

**Professor William Holt, University of Sheffield and  
Smithsonian Institution, Washington DC**

*Biobanking for breeding threatened species*

**Kirsty Lloyd, CryoArks, Natural History Museum**

*The UK animal biobanking landscape supporting research and conservation*

**Dr Mary Hagedorn, Smithsonian Conservation Biology Institute  
and Hawaii Institute of Marine Biology**

*Technological Advances to Help Save Coral Reefs*

# ABSTRACTS

## **Why biodiversity conservation needs cryopreservation**

*Paul Pearce-Kelly, Zoological Society of London*

It is widely recognised that humanity is facing an increasingly severe biodiversity extinction crisis, with the most recent global assessment report estimating a million species to be at risk of extinction ([IPBES Global Assessment Report](#)). When escalating climate change impact threats are sufficiently taken into account, it's very likely that the majority of our planet's current biodiversity is at risk of being lost at both species and ecosystem level, with coral reefs and the Amazon rainforest being two obvious examples.

The importance of cryopreservation as a species conservation aid is well demonstrated and there is a compelling argument for considering cryopreservation to be an integral supporting component of any species conservation action plan. Fortunately, there now exists significant technical expertise, facilities and biobanking initiatives around the world which are actively engaged in the global conservation effort. However, the number of species that can be considered to be sufficiently represented in cryopreservation banks is still extremely low relative to the scale of the biodiversity threat we have to contend with. There is pressing need therefore to rapidly scale up efforts to ensure that as much of our planet's biodiversity as possible is included in a greatly increased cryopreservation effort, while we still have time to do so.

**Paul Pearce-Kelly** is the Zoological Society of London's Senior Curator of invertebrates and fish and has over 30 years of experience developing and managing species conservation breeding and reintroduction programmes. He serves on a wide range of IUCN Specialist groups including those for conservation planning, reintroduction, coral and climate Change. Paul is the recipient of the Species Survival Commission Chair's Citation of Excellence and the Ulysses S. Seal Innovation in Conservation Award. His research focus is the evaluation of climate change impacts on species and ecosystems. A trustee of the [Frozen Ark](#) Cryopreservation Initiative, Paul is an advocate for the conservation potential of cryopreservation to help address the biodiversity crisis facing humanity.

---

## **Biobanking for breeding threatened species**

*Professor William Holt, University of Sheffield and Smithsonian Institution, Washington DC*

The term "biobanking" refers to the collection and storage of genetic resources using a range of technical approaches. While cryopreservation is the most common method, technologies for the reversible drying of live cells are also under development. The objectives of biobanks include the provision of genetic support for threatened, but extant, animal populations and the mitigation of harmful impacts of inbreeding on population health. In general, once the germplasm in question (i.e., live spermatozoa, oocytes, embryos, ovarian and testicular cells, as well as somatic cells) has been frozen, vitrified or dried, it can survive for many years without sustaining damage. However, the processes involved in thawing or rehydration can be very damaging unless they are carefully controlled.

The cryopreservation of semen from mammalian, avian, reptilian and amphibian species is widely practiced and, in principle, permits the continuing representation of genetically significant males within a breeding population long after their death. In the USA, the black-footed ferret recovery programme (<https://nationalzoo.si.edu/animals/black-footed-ferret>) benefitted hugely from the application of semen freezing and artificial insemination techniques. Similarly, the Giant Panda breeding programme in China incorporates the regular use of frozen and stored semen into its genetic management. The imminent global risk of disease-induced extinction faced by many amphibian species has spurred the rapid development of successful sperm cryopreservation and in vitro fertilisation methods, and has facilitated biobanking projects for captive and wild populations, especially in the USA, Australia, New Zealand and Panama. Recent advances in the generation of totipotent stem cells from somatic cells have added a new dimension to biobanking as they can be used for the production of cloned animals. Although this is not yet a suitably reliable approach for use in species conservation, it is likely that banked cells will provide valuable resources for the future restoration of some highly endangered populations.

**Professor Bill Holt** is currently a Visiting Professor at the University of Sheffield and an Honorary Research Associate of the Smithsonian Institution in Washington, DC. He obtained his PhD in 1979 through the Royal Veterinary College (London) and spent most of his professional life at the Zoological Society of London until retiring in 2011. Bill is currently the Secretary of the ZSL Ethics Committee for Animal Research. In his research he has combined studies of basic reproductive biology in various species, including many wild species, with some practical developments of reproductive technologies and their applications to wildlife conservation. In 2012 Bill was awarded the Setchell medal by the British Andrology Society, and in 2018 he was awarded the Marshall medal by the Society for Reproduction and Fertility.

---

## **The UK animal biobanking landscape supporting research and conservation**

*Kirsty Lloyd, CryoArks, Natural History Museum*

Biological resources provide a wealth of knowledge about an individual, population or species that can improve our understanding of the natural world. This information can inform how we protect and conserve the biodiversity on our planet in the face of anthropogenic threats. Biological samples must be cared for to preserve the information contained within them. In the UK, a network of institutions has been created to cryopreserve and manage collections and make samples accessible to the research community.

CryoArks is a coordinated UK zoological biobanking initiative supporting the aggregation and curation of existing and new collections to provide a sustainable resource for research worldwide. When the long-term cryopreservation of samples is considered and provided for, it dramatically increases their potential value, especially as so many samples remain undiscoverable in freezers across the country. Should biobanking of zoological material become mainstream the benefit could be far reaching.

An appropriately stored and curated collection preserves an invaluable snapshot in time of existing biodiversity, and the physical and informatic infrastructure is in place to capture and preserve these snapshots. Resources and support are available to facilitate the contribution of samples to biobanks

and increase their discoverability and accessibility. Biobanks are treasure troves of data that enable us to learn more about our planet, while empowering us to safeguard its biodiversity, both now and in the future.

**Kirsty Lloyd** is the CryoArks technician based at the Natural History Museum (NHM) in London. She curates the collections of zoological genetic material housed in the Molecular Collections Facility at the NHM, to facilitate increased access to samples by the research community. She also provides training and support to other institutions looking to improve collections care and management. She has a background in molecular ecology, science education, and is actively involved in the Natural Sciences Collections community in the UK.

---

## **Technological Advances to Help Save Coral Reefs**

*Dr Mary Hagedorn, Smithsonian Conservation Biology Institute and Hawaii Institute of Marine Biology*

Coral reefs are under siege in every ocean. However, modern reproductive technologies, using cryopreservation, may offer solutions to save coral diversity. Cryopreservation can store material safely for a few days– or hundreds of years, thus providing present and future restoration options. Coral spawn only a handful of days each year, nevertheless, a variety of assisted reproductive technologies are available for coral, creating the widest breadth of reproductive options for any wildlife species. For example, over 40 species of coral sperm have been cryopreserved and banked worldwide, which has been used for assisted gene flow experiments and diversifying shrinking populations. Additionally, coral larvae have been cryopreserved, using ultra-rapid laser-warming technologies, which can help prevent species extinctions when paired with proper restoration processes. With this in mind, high throughput technologies are under development to help cryopreserve 10,000's of larvae per hour, thus creating potential for a robust restoration process.

Coral must incorporate their algal symbionts to provide essential nutrients. However, most symbiont species cannot be cultured, therefore must be cryopreserved. Ultra-rapid warming has produced viable symbionts post-thaw and experiments are underway to determine whether coral larvae will take up these frozen-thawed cells. If successful, these technologies will help build symbiont banks for future restoration needs.

As climate change progresses, coral bleaching events are becoming more common, threatening reproduction. Therefore, development of new cryopreservation technologies for non-reproductive tissues is essential. Towards that end, two advanced technologies are underway to cryopreserve small coral fragments. These methods cryopreserve the entire coral community, including the coral cells, their symbionts and surface microbiome. These new technologies will allow us to preserve material throughout much of the year potentially, paving the way for new adaptations help coral survive warming oceans.

**Dr Mary Hagedorn** received her Ph.D. in Marine Biology from Scripps Institution of Oceanography and is a Senior Research Scientist at the Smithsonian Conservation Biology Institute. She has worked in aquatic ecosystems around the world from the Amazon to Africa, has taught many university-level classes, lectures frequently to lay audiences, maintains an active laboratory with graduate students

and post docs, and is a successful researcher and active grant writer. Dr Hagedorn has created the field of coral cryopreservation and founded biorepositories around the world for coral species. Today, she is the Director of the Reef Recovery Initiative, a global coral conservation program.

---

## Format of Live Events

- This interactive online event will be livestreamed to our YouTube channel here: [zsl.org/IOZYouTube](https://zsl.org/IOZYouTube). A direct link to the livestream will also be shared on the event web page before the event.
  - Before attending this event, please read our Code of Conduct found [here](#).
  - This event will run from 6:00pm – 7:30pm, and will be recorded and available to watch afterwards on our YouTube channel.
  - Each event will comprise of 3 – 4 presentations from experts in the topic, similar to our previous events.
  - There will be opportunities for the audience to submit questions during the event (this process will be explained on the night), to be answered live after each presentation. If you wish to submit a question to a speaker prior to the event, please send it to [scientific.events@zsl.org](mailto:scientific.events@zsl.org). Please be aware we may not be able to answer all questions.
  - There is no charge for this event, and no need to register in advance.
- 

## ZSL Wild Science Podcast

Listen to our award winning **ZSL Wild Science podcast** episodes produced by Dr Monni Böhm and Eleanor Darbey here: [www.zsl.org/zsl-wild-science-podcast](http://www.zsl.org/zsl-wild-science-podcast).

---

## Thank you for joining our online 2020 – 2021 events!

We hope you have enjoyed this past year's series of our Science and Conservation Events in their new online format. Since October 2020, we've accumulated over 1,720 subscribers to our [YouTube channel](#), and our events have been viewed more than 20,000 times both live and on demand, in 44 countries worldwide! Online events provide a unique opportunity to collaborate with speakers and connect with audiences from around the world – thank you so much for watching, taking part and supporting ZSL's science and conservation work.

If you have an idea for a future Science and Conservation event, you can find out more information here: <https://www.zsl.org/science/whats-on/proposing-a-science-and-conservation-event> or email [eleanor.darbey@zsl.org](mailto:eleanor.darbey@zsl.org).

---

## Further Information

- Please contact the Science Communications and Events Manager, Eleanor Darbey ([eleanor.darbey@zsl.org](mailto:eleanor.darbey@zsl.org)), if you have any queries about our Science events or podcasts.
- For press enquiries, please contact the ZSL Press Office: [press.office@zsl.org](mailto:press.office@zsl.org).

- For more information about how to join the ZSL Fellowship programme and engage with a network of thousands who are shaping the future of conservation, please visit: [www.zsl.org/membership/zsl-fellowship](http://www.zsl.org/membership/zsl-fellowship).
- To receive email updates about forthcoming ZSL Science and Conservation Events, please visit: [www.zsl.org/science/whats-on/science-and-conservation-events-email-updates](http://www.zsl.org/science/whats-on/science-and-conservation-events-email-updates)
- Read the latest blog posts from our scientists and conservationists here: [www.zsl.org/blogs/science](http://www.zsl.org/blogs/science).
- Follow us on Twitter [@ZSLScience](https://twitter.com/ZSLScience) to hear about new publications from our researchers, upcoming events and podcast episode releases.
- Join us on our Facebook page [@ZSLScienceAndConservation](https://www.facebook.com/ZSLScienceAndConservation) for announcements of each event.

To feed and care for our 30,000 animals, many of which are endangered, costs £1million a month and the national lockdown has left us struggling. But with your help we can carry on caring for our amazing animals and continue our global conservation work. Support us today – **Join**, **visit** or **donate**.