New skills for endangered specimens: best practice in the conservation treatment and re-colouring of historic taxidermy

Danielle Measday

George Alexander Foundation Fellowship, 2025

International Specialised Skills Institute

THE George Alexander FOUNDATION

Figure 1. (Cover): Danielle Measday stands in front of Alaskan Brown Bear Diorama, Bernard Family Hall of North American Mammals, American Museum of Natural History, New York, New York. Photograph by Rebecca Smith 2024

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Table of contents

01 Acknowledgements

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Cultural warning: This report will contain images of dead and preserved animals. including Australian native species. These may belong to First Peoples animal totem systems, some may have other special cultural significance.

02
Executive Summary

This report details the experience of Danielle Measday, Conservator of Natural Sciences for Museums Victoria who was awarded a George Alexander Fellowship in 2024. Ms Measday is a graduate of the University of Melbourne Masters of Conservation of Cultural Materials and has a decade of experience working with biological and geological museum collections. She has linkages to the larger conservation sector internationally through the Society for the Preservation of Natural History Collections (SPNHC) Conservation group and locally as a member of Australian Institute for the Conservation of Cultural Materials Victorian Division Committee. The George Alexander Fellowship funded research travels to the United States in September and October 2024 to undertake a series of workplace immersions at prominent natural history museums including the Yale Peabody Museum of Natural History (YPM) in New Haven, Connecticut, the American Museum of Natural History (AMNH), in New York, New York; The Smithsonian National Museum of Natural History (NMNH), in Washington D.C; and the Natural History Museum of Los Angeles County (NHMLAC) in Los Angeles, California. The Fellow also undertook a training workshop with experts from the Harper's Ferry Center (Museum Conservation services for United States National Park Service) and the American Museum of Natural History (ANMH) in Charles Town, West Virginia. The fellowship was beneficial in expanding the Fellow's professional network and skills in the care, conservation and recolouring of historic taxidermy and is an expansion of the limited natural sciences conservation expertise available in Australia.

It is a desired outcome of the fellowship to improve the skills of Australian conservators in working with taxidermy collections, but a broader ambition is to improve the skill set in working with natural sciences collections as a whole. The Fellow has begun incorporating skills learned during the fellowship into the practice of Museums Victoria. Dissemination of materials and techniques amongst Australian colleagues has also commenced, ensuring the skills obtained from the fellowship have benefitted the Australian conservation profession more broadly. Future dissemination is planned through contributions to the *Natural Sciences 101 project*, generously funded by the Australian Institute for the Conservation of Cultural Materials (AICCM). This project collaborates with other Australian museums to distribute skills and knowledge about natural sciences conservation. This work will aim to connect conservators working on natural science collections and encourage best practice care respecting the unique value these collections hold.

The Fellow was moved by the generosity of international colleagues in sharing skills and information, and believes the information obtained from the research trip will be a valuable addition to the field of natural sciences conservation in Australia. The shared understanding of the struggle of being a specialist in a very limited field was a mirror to the Fellow's own experience. However, the dedication of international colleagues and their remarkable achievements provided inspiration for future directives in engaging the conservation field in natural science collections.

Increasing funding for ongoing natural sciences conservation positions, professional development and education opportunities, international collaboration and cross disciplinary partnerships are all recommended to bolster the natural sciences conservation profession in Australia. Investment in this area will have desirable outcomes for natural sciences collections, will serve a significant function within many fields of research and will also be an area of growth for the conservation profession.

03
Fellowship Background

Fellow Biography

Danielle Measday is a passionate natural sciences conservator with a decade of experience working in museum geological and biological collections at Museums Victoria. She has developed an international network through the Society for the Preservation of Natural History Collections (SPNHC) Conservation Group and serves locally as an ordinary member of Australian Institute for the Conservation of Cultural Materials Victorian Branch Committee. As part of her work, she also oversees a variety of interns and volunteers through the University of Melbourne's Masters of Cultural Material Conservation program. During her time at Museums Victoria, Ms. Measday has developed a holistic set of conservation skills, as well as skills in field collection, specimen preparation and a deep understanding of how the specimens are used in contemporary research.

Natural Sciences Conservation in Australia

As outlined by the Australian Institute for the Conservation of Cultural Material: "the conservation profession is responsible for the care of cultural material. Conservation activities may include preservation, restoration, examination, documentation, research, advice, treatment, preventive conservation, training and education." The conservation profession in Australia sprung from the recommendations of the Committee of Inquiry on Museums and National Collections in 1974-75. The report published by this committee, often referred to as "the Piggott report" painted a bleak picture of what was happening behind the scenes in collecting institutions around Australia, overcrowded storage, deteriorating collections, poor climate control, and fewer than 10 professionally trained conservators servicing the whole continent (Condé, 2011). While today there is a robust field of tertiary educated conservators working in Australia, with 472 people identifying their occupation as "conservator" in the 2011 Australian Census (Lelyveld, 2016), Natural Science as a specialty in the Australian conservation profession has not matched the growth seen in other areas. Williams and Cato (1995, pp 20-21) suggest on an international scale 'most natural history collections are 15 to 25 years behind trends of museum conservation ...This is a serious oversight, particularly when one remembers that the intention of natural history collections is the long-term preservation of objects for research and heritage purposes." This observation was made 30 years ago, but there has been little investment in natural sciences conservation since. Museums Victoria was the first large collecting institution in Australia to create an ongoing natural sciences conservator position in 2008, followed by a hybrid objects conservation/ natural sciences conservation at the Australian Museum in 2010, eventually growing into two ongoing natural science positions at the Australian Museum, one at a senior level by 2021. Natural Science is not included meaningfully on the curriculum in university courses and professional development opportunities often involve flying

visiting instructors from overseas. There is a gap in the skills, knowledge and education opportunities for conservators working with natural sciences collections in Australia. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) estimates "60 million natural history specimens [are] held at [Australian] museums, universities, botanic gardens, herbaria, seed banks and CSIRO," These collections are being critically neglected by the conservation profession. It is the Fellow's opinion that Australian conservation profession needs to acknowledge these massive collections and arm themselves with understanding, knowledge, and a willingness to work with experts in these areas to help safeguard these critically important collections.

What are Natural Sciences collections?

Natural science collections hold the physical inventory of the natural heritage of the planet. They are the foundational resource for a broad range of scientific fields. "Without this resource, the understanding of species, species distributions, and basic information about natural history and ecology would be extremely limited. Such a limitation would have severe ramifications for other sciences and social services that depend directly or indirectly on information resulting from these collections," (Williams and Cato, 1995, pp. 16). Natural sciences collections also collect temporal and spatial data, where "each specimen is a record of biodiversity and documents, through a physical object, that a particular species was present at a particular place at a particular time," (Hilton et al. 2021, pg.379). With natural sciences collections all over the world collecting this same data, an immensely powerful dataset is produced. The utility of these collections is only increasing with time and technological and scientific advances, the physical preservation of specimens has allowed for the introduction of new techniques, such as the extraction of DNA, and the digitization of specimen data onto large data aggregators such as Global Biodiversity Information Facility (GBIF) and the Atlas of Living Australia (ALA) have also increased their utility and accessibility for many fields of research. "The biological and geological coverage of the *Global Natural History Collection* is enormous, and their diversity is as varied as the repositories that house them" (Caspars et al. 2024). Natural science collections are held privately and at national, state, educational and local organisations across the country. The collections contain many materials and preparation types including; skeletons, skins, fluid preserved specimens, DNA and frozen tissue samples, rocks, minerals, fossils, pinned insects, shells, eggs, nests and microscope slides. While these materials also occur in other collecting disciplines, such as social history and first people's collections, and many skills working with these materials may be transferrable, there are distinct differences in the way a natural science collection is used and the values that should be preserved (Chalmers et al. 1999, pp. 16) The value of natural sciences conservation positions in museums is a collaborative care of the collection with collection managers and curators with experience in how the collection is being used for research. Without this collaboration, conservation intervention, however well intentioned, may cause a loss in the scientific potential of specimens.

The value natural science collections provide society can be poorly understood by the public. Public perceptions of the collection can assume they are a relic of another time, as much of the research behind the scenes can be largely invisible. Despite, the "the negative connotation of "antiquity" (Rouhan et al. 2017, pp. 1) natural sciences displays continue to be beloved by contemporary and past museum audiences (Jenkins et al. 2013). Unfortunately, natural science collections can sometimes be insufficiently acknowledged by researchers using the collections. The trope of a scientist "discovering" a "forgotten" specimen in a collection is an appealing narrative, but one that excludes the "time- and cost-consuming processes [acquiring and maintaining collections, taxonomic identifications, curation, handling of specimens, and long-term preservation of vouchers]... even though they involve numerous skills and practices, specialised knowledge, and taxonomic expertise based on a broad and collective experience acquired through generations," (Rouhan et al. 2017, pp. 1). The conservation field has a role

to play in advocating for the careful management and care of these globally significant collections to ensuring their continued survival and utility.

What is taxidermy?

Taxidermy specimens are a complex composite of many materials; skin, fur/feathers, residual fats, hide pastes, tanning chemicals, pesticides, glass eyes, wax, modelling materials, wire, wood, plaster, ear liners, wood wool and paint. These materials all age differently in reaction to each other and their environment. The conservation treatment of historic taxidermy requires an understanding of the history of the taxidermy practice, and the materials used during different periods; see a summary in Hendry, 1999.

Kinney et al. 2023 outlines several categories of taxidermy in collections:

1. Scientific specimens (study skins) - collected and preserved to retain maximum originality of its material for research and study.
2. Diorama specimen - collected to be a faithful rendering of the overall appearance of a type of animal to educate the public.
3. Trophy specimen - hunted for sport and presented with a degree of lifelike quality dependent on the skills of the taxidermist and the wishes of the client as they are usually intended for personal display.
4. Iconic specimen - preserved to recognize the animal's place in history where the individual story of animal heroism is significant and understandable for the public.

The level of conservation intervention that is appropriate for each of these categories will be nuanced and require careful consultation with stakeholders. As Palumbo (2012, pp.51) notes, specimens in category 1 would include "type specimens and study skins [which] are key examples for the classification of families, genera, or species. These original samples should never be tampered with because they are of major scientific importance." Preventative conservation and protection of these specimens is paramount, but interventive conservation treatments are likely to be inappropriate. While the primary purpose of taxidermy in categories two, three and four are often education, display and storytelling, making conservation intervention appropriate, even necessary, to maintain their value and significance. The scientific cultural and historical significance of each specimen should still be carefully considered in each conservation treatment. Conservation treatments should be guided by codes of ethics and always be thoroughly documented, see Australian Institute for Conservation of Cultural Material Code of Ethics and Practice, (n.d.). The selection of materials and methods is an important component of conservation work. "The conservation professional is responsible for choosing materials and methods appropriate to the objectives of each specific treatment and consistent with currently accepted practice. The advantages of the materials and methods chosen must be balanced against their potentially adverse effects on future examination, scientific investigation, treatment, and function." (AIC, 2025). The techniques and materials investigated during this fellowship, and discussed in the fellowship learnings chapter are chosen for their ability to meet the ethical requirements of museum conservation practice. This includes using materials which are chemically inert, with known long term ageing properties. Treatments should also be reversible or re-treatable wherever possible, so they can be removed if new information or a different treatment is required in the future.

Feldman et al. 2024, writes an effective summary of considerations for performing conservation work on a taxidermy specimen. "From the perspective of the taxidermist (i.e., that of the artist), the mount was created to present an accurate and naturalistic representation of the animal in life and was meant for display. To keep it in pieces in a storage cabinet is akin to keeping a damaged painting unrepaired and in the dark. From the museum's perspective, the [specimen] is an irreplaceable rare resource for research. While some genetic information may be gleaned from it in its damaged form, its value is greater when fulfilling its original purpose as an educational tool for illustrating the planet's biodiversity... And

finally, yet perhaps most importantly, repairing and restoring the mount to its original appearance would return the individual's dignity in death," (Feldman et al. 2024, pp.136)

Why taxidermy?

In museums, requests to exhibit historic taxidermy must be constantly balanced with the responsibility to preserve them for future generations, as long periods of display can cause specimens' condition to deteriorate, including the loss of natural biopigments through light damage and oxidation. Contemporary museum lighting policies are often informed by micro fading, a "tool for assessing the risk of light damage in collections. It is an accelerated light exposure method for rapidly and nondestructively estimating the fading rates of colorants on real objects that relies on measuring the early response of a submillimetre spot of colorant exposed to megalux levels of light," (Ford and Druzik, 2013, pp.54). Very few published micro fading results exist for natural sciences collections materials, (See Daher et al, 2020; Pearlstein and Keene 2010; Tournié et al, 2021; Ford & Smith 2011). Lighting recommendations often lump natural sciences materials under one broad category, despite the remarkable number of biopigments and structural colours involved in colour of birds and mammals, more again for fish, reptiles insects and other invertebrates (beyond the scope of this report). Ideally, conservators should aim to prevent loss of biopigments through careful management of light exposure for taxidermy specimens. But light damage alone does not account for all the colour changes which may occur. For example, the fur of mammals is coloured by two melanin pigments, eumelanins and phaeomelanin. The combination of these two pigments creates every shade of brown. Eumelanin produces black and grey colouration. While melanin is generally considered an extremely stable molecule, it has been shown that the physical and structural properties of eumelanin may be strongly affected through the removal of bound water and may increase its susceptibility to auto-oxidation, (Riedler et al., 2014). Phaeomelanin produces earth tones like chestnut, gold, buff, red and yellowish colours. Phaeomelanin is unstable to UV radiation and produce peroxides as a product of the reaction. The colour of pheomelanin fur is more likely to fade and supporting structures will deteriorate more quickly when exposed to UV radiation. Since all melanin-based colour is formed by a combination of two melanin pigments, some studies have demonstrated that eumelanin may be more susceptible to degradation than pheomelanin pigments in museum lighting (without UV), as older specimens tend to colour shift to be redder, even study skins stored in the dark. (Davis et al. 2013). It is recommended that conservators should invest in improving the knowledge of the behaviour of biopigments and structural colours in taxidermy specimen, aided by micro fading technologies. The Fellow has provided a bibliography of literature relating to the lightfastness of bird and mammal colours as an appendix to this report.

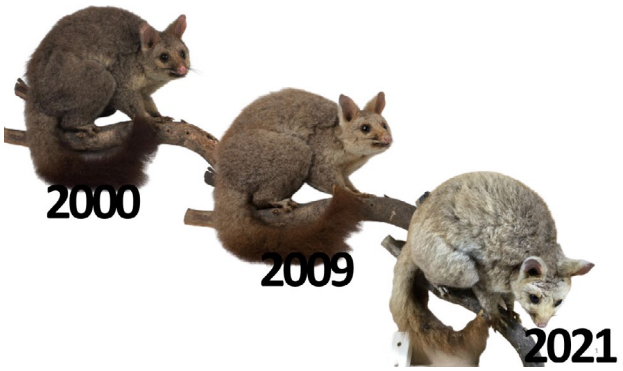

Figure 2. C 7010 Trichosurus vulpecula from the Collection of Museums Victoria, left: in 2000, centre in 2009, and right in 2021 A taxidermy mount of a brush tail possum Trichosurus vulpecula, shows colour loss occurring over a 21 year period of near constant exhibition. While the lighting conditions the specimen was exposed to during this period are unknown, these images are an example of a specimen deteriorating to the point it no longer is an accurate representation of its species, and limiting value for exhibition in the future without intervention. Source: Museums Victoria / Photographers Heath Warwick & Charlotte Walker 2024.

Taxidermy can be uniquely vulnerable in a museum collection. For a conservator they are difficult to protect, keep clean, repair, and keep free of pests. For a science curator or collection manager they are space inefficient to store and can end up adorning offices, tops of cabinets, hallways and swing spaces. They may or may not have a robust data set so their utility for research can be more limited than other collection materials like a skin, skeleton or fluid preserved specimen. Their scientific accuracy to

the species can be compromised by light damage and degradation, and the skill of the taxidermist who produced them. To the museum health and safety officer the handling of historic taxidermy (heavy metal pesticides) and the production of new taxidermy pieces (zoonotic diseases) alike present risks to the health and safety of staff that must be mitigated with care. Historical taxidermy collections have complex histories marked by changing attitudes, colonial legacies, and evolving ethical considerations. In some museums visited during the fellowship, taxidermy mounts were not commonly registered into the museum collection but considered "exhibition props," removing the imperative to care for them in perpetuity. There is precedent for taxidermy's vulnerability to shifting attitudes and tastes, Polliquin, 2008, provides some extreme examples of Museum's purging their collections of taxidermy to attempt to modernise and distance themselves from an uncomfortable colonial legacy. It is true that museums should no longer be "uncritically accepted as cathedrals of nature," (Poliquin 2008, pp. 123), and natural science, like all collecting disciplines have work to do in addressing their colonial legacies (Ashby and Machin, 2021). This can be true and still not negate the value that natural sciences collections hold for society. Likewise, taxidermy specimens can convey multiple narratives, and have multiple historical, cultural and scientific meanings.

During a fellowship visit to the Natural History Museum Los Angeles County the Fellow attended an exhibition entitled 'Reframing Dioramas: the Art of preserving Wilderness.' This exhibition was developed as part of the Getty's Pacific Standard Time (PST) Art & Science collide Initiative 2024. NHMLAC reopened a long-shuttered wildlife diorama hall with freshly commissioned art pieces and recontextualised historic dioramas. The museum director, Lori Bettison-Varga states 'this reopening serves a dual purpose: to critically re-examine the legacy of dioramas and reaffirm our commitment to this century old artform,' (Bettison- Varga 2024, pp. 14). This exhibition is a vulnerable self-examination of collecting and exhibition practices in museums. It acknowledges the human hand in the 'staged nuclear families' of species unlikely to form such groupings in the wild, and the total absence of human made changes depicted in the landscapes and ecosystems in the dioramas (Christensen & Heise, 2024, pp.30) The exhibition also acknowledges the 'stories, work and knowledge' of non-white hidden figures (Das and Lowe, 2018, pg. 8) who contributed to white naturalist's expeditions but received none of the accolades. These exhibitions are a reminder of the human history preserved in natural history, that historic taxidermy is not only an example of an animal in space and time, but an example of a human's impression of an animal in space and time. A recent resurgence in taxidermy's popularity as an artform is evident, and the new contexts of display and a desire to deconstruct colonial myths, shows there are many more stories historic taxidermy pieces can tell.

Before taxidermy, museum displays of natural science collections were targeted to an academic audience and often featured systematic displays of animal groupings. Taxidermy, often inside a wildlife diorama, opened a museum up to a more general audience. Davis, (2024, pp.23) notes "Imagine how exhilarating it would have been to face a leopard, mid snarl, in a time before computers, TV or even inexpensive colour books." Even to a contemporary audience, taxidermy is both object and an experience, because of their power to generate an emotive response. Taxidermy specimens are the charismatic public face of natural sciences collections and are often selected for exhibition and therefore more likely to be seen by the public, and more likely to be worked on by a conservator whose work is concerned with exhibitions. In attempting to raise the profile of natural sciences conservation, it was beneficial to choose a research topic which would be helpful for Australian conservators in the short term, whilst maintaining a long-term ambition to engage and upskill Australian conservators in natural sciences collections more broadly.

04
Fellowship methodology

The fellowship took place from May 2024 to May 2025. The Fellow travelled to the United States on 23rd September 2024, returning October 19th 2024. Fellowship activities included workplace immersions at:

- Yale Peabody Museum of Natural History, New Haven, Connecticut.
- American Museum of Natural History, New York, New York
- Smithsonian National Museum of Natural History, Washington D.C.
- Natural History Museum of Los Angeles County, Los Angeles, California

These immersions allowed the Fellow to connect with fellow museum professionals, discuss their recent projects, and explore a variety of new materials and techniques. These included filling losses with replicated skin, fur and hair as well as the use of real hair and feathers. Options for recoloring faded hair and feathers were also thoroughly explored. This information was supplemented by discussions with taxidermy restorers working in private practice including staff at

- Gotham Taxidermy, New York, New York
- Regal Beasts, Vancouver, British Columbia.

The innovative use of LED lighting to temporarily re-colour bird specimens on display was also investigated by visiting the Getty Centre, Los Angeles to discuss a recent collaboration with NHMLAC.

The highlight of the Fellow's experience was a three- day workshop at the Harper's Ferry Center (Museum Conservation services for United States National Park Service), in Charles Town West Virginia, taught by Julia Sybalsky, Conservator of Science at the American Museum of Natural History (ANMH) and Fran Ritchie, Organics Conservator at the National Parks Service. Ritchie and Sybalsky are collaborators on the *In their true colours* research project supporting the preservation and conservation of taxidermy and related materials. This project has produced an incredible body of work and are leading the world in best practice treatment and recolouring for taxidermy collections and were the motivation for the Fellow to pursue travel in the United States.

05

Abbreviations / Acronyms / Definitions

AIC: American Institute for Conservation of Historic and Artistic Works

AICCM: Australian Institute for the Conservation of Cultural Materials

ALA: Atlas of Living Australia

AMNH: American Museum of Natural History

AMRI: Australian Museum Research Institute

BASF: Badische Anilin- und Sodafabrik

GBIF: Global Biodiversity Information Facility

IPCH: Yale Institute for the Preservation of Cultural Heritage

ILMS: Institute of Museum and Library Services

LEDS: Light Emitting Diodes

MVRI: Museums Victoria Research Institute

NHMLAC: Natural History Museum of Los Angeles County

NMNH: Smithsonian National Museum of Natural History

NPS: National Parks Service

SPNHC: Society for the Preservation of Natural History Collections

TMAG: Tasmanian Museum and Art Gallery

UCLA: University of California, Los Angeles

YPM: Yale Peabody Museum

Glossary of conservation terms:

Aquazol:

a family of water-soluble, synthetic poly-2-ethyl-2-oxazoline polymers used in conservation.

BEVA:

Family of synthetic Ethylene Vinyl Acetate heat-activated adhesives used in conservation. BEVA 371 can be purchased pre-cast in the form of a thin film.

Brush vacuuming:

A dry-cleaning method using a soft-bristled brush to dislodge surface dust and soiling. The brushing motion directs debris into the nozzle of a vacuum.

Consolidate:

Stabilising a deteriorating or fragile material by applying a low concentration of adhesive that penetrates the surface and binds loose or friable components.

Fill:

A material used to replace lost material on a specimen, for aesthetic reasons or to stabilize an

area with loss. An inert conservation-grade material of appropriate strength should be used. The fill should be reversible and may be colored or textured to blend into the original surface. Fills should be visually distinguishable from original material with close inspection.

Glass Microballoons:

Tiny hollow spheres of glass used as a bulking agent for changing the properties of conservation-grade adhesives.

Heated Spatula/Tacking Tool:

A tool with a heated tip to allow the application of precise heat and pressure in conservation treatments, such as activating thermoplastic adhesives.

Japanese Tissue:

Thin, strong, inert tissue paper used in paper tear mending and other conservation treatments, made from fibers of mulberry trees.

Lascaux Adhesives:

Conservation-grade adhesives, aqueous acrylic emulsions of butyl acrylate. These adhesives are thermoplastic. 303HV and 498HV varieties of Lascaux adhesive are often mixed to manipulate their working properties, most notably 303HV's tackiness and elasticity.

Orasol:

Family of metal complex solvent dyes

PanPastels:

Artist pastel in the form of a compressed powder made by Colourfin

Pitt Pens:

Artists brush pens made by Faber Castell

Paraloid:

A family of conservation-grade, reversible thermoplastic acrylic resins which can be dissolved in solvents. Can be used as an adhesive, coating, or consolidant.

QOR watercolours:

Water colour pigments in a Aquazol resin binder

Reemay:

A chemically inert spun-bound polyester fabric.

Reverse Tweezer:

A self-closing tweezer tool, where pressure is required to open the jaws of the tweezer.

Sofft tools:

an artist's tool designed for applying and blending pastels consisting of a closed cell foam sponge and a plastic handle

Talas:

Supplier specialising in conservation, archival, and bookbinding materials.

Treatment:

Interventive work performed by a conservator to stabilize, repair, or restore a specimen.

Vellux:

a blanket with a closed-cell polyurethane foam core and an outer surface of flocked nylon fibres, used in conservation cleaning applications.

Wet Cleaning:

Methods for reducing soiling which use a liquid solution; this may be aqueous, solvent, or another chemical solution.

06
Fellowship Learnings

Skills acquired during the fellowship:

The following section summarizes the skills acquired by the Fellow during their travel in the United States. It should be noted that when working with taxidermy specimens, especially historic taxidermy, care must be taken to reduce the risk of ingesting or inhaling heavy metal pesticides which may be present on the specimen. All work performed on taxidermy by the Fellow followed Museum Victoria's Arsenic safe handling procedures.

Repair and cleaning techniques for taxidermy

Cleaning taxidermy

Vellux blanket

Cleaning taxidermy, particularly feathers, can be difficult because the complex physical structure of the feather tends to trap soiling and particulates. Vellux® blanket 'consists of a double inner layer of closed-cell polyurethane foam secured around an inner network of 100% terylene polyester webbing, with outer surface layers of flocked 100% nylon fibre." (Tsang& Barnes, 2017) The structure of this fabric collects but does not redistribute particulates, trapping soiling in the PU foam interior. The fine flocked fibres on the exterior layer "effectively loosens dirt in feather barbule interstices, while the open structure of the foam membrane allows air to pass though easily.' (Sybalsky, 2023) By wrapping a layer of Vellux® over the end of a HEPA vacuum micro attachment, with or without a more rigid support material behind it, such as fly screen, an excellent tool for cleaning taxidermy is created. Figure three shows a taxidermy mount of Anhinga melanogaster from the collection of Museums Victoria, treated by Danielle Measday in 2025. The right wing has been cleaned using a Vellux blanket screen over a vacuum micro- attachment. The gentle suction of the vacuum had benefits in re-zipping and aligning tangled feather barbs during cleaning. For

Figure 3. 3324, Anhinga melanogaster melanogaster , taxidermy mount of Oriental darter from the collection of Musuems Victoria. Left wing has been brush vacuumed, right wing has been cleaned with Vellux Blanket over a vacuum micro-attachement. Source: Museums Victoria, Photograph by Danielle Measday 2025

comparison, the left wing was brush-vacuumed with a fan brush directed into a HEPA vacuum nozzle. There is a significant reduction in feather soiling noted using the Vellux technique. The Fellow has incorporated the Vellux blanket technique into all cleaning treatments they have undertaken since the fellowship travel.

The feather cleaning guideline published by Julia Sybalsky, 2023 as an output of the *In their true colours* project rigorously tested a variety of wet and dry-cleaning techniques sourced from the conservation field through via survey. This guide is useful in recommending techniques to clean feathers, but also in calculating the risk tolerance of the treatment, how much damage may be caused, what this damage might look like, and providing a visual and language glossary for damage types. Among the most interesting results of Sybalsky's testing was the significant risk of damage to aged keratin structures from aqueous cleaning methods. Keratin becomes more polar, and much more sensitive to water as it oxidizes over time. As a result, an aqueous cleaning method which might be suitable for a newly prepared taxidermy specimen may cause irreversible damage to a historic specimen. Sybalsky and her teams also suggests a simple test for observing how a small droplet of water interacts with a feather, to predict damage caused by wet cleaning with an aqueous solution. (AMNH, 2022). Future work stemming from this fellowship will include performing testing on the wider suite of cleaning techniques described by Sybalsky to broaden the Fellows' options for cleaning taxidermy mounts at Museums Victoria.

Skin fills

BEVA 371 film, an archival heat activated adhesive, has long been an accepted material for leather repairs in conservation, see Nieuwenhuizen (1998) and Kronthal et al, (2003). As it is a thermoplastic resin, it can be manipulated with heat and does not shrink like other fill materials which cure via solvent evaporation. A novel preparation of BEVA 371 film is presented by Feldman et al. 2024, who melted BEVA 371 film, tinted with dry pigments, then rolled the mixture into "crayons." These crayons could then be reactivated with a heated spatula and applied to areas of loss in the face of severely damaged shoulder mount of *Ovis sp*. (Wild Sheep) from the collection of AMNH. The result is a flexible fill which is well bonded to the skin edges around it. As Nieuwenhuizen (1998, pp.136) notes "before considering treatment, an accurate assessment of the hydrothermal stability (shrinkage temperature) of the collagen fibres of the artifact should be conducted... a change in shrinkage temperature can occurring from exposure to heat from the use of thermoplastic qualities of an adhesive. (It is generally noted, however, that dry, undeteriorated fibrous collagen is considered stable up to temperatures of 200°C, whereas saturated, deteriorated collagen can exhibit shrinkage at room temperature." One outcome of the fellowship was an increased confidence in using heat in treatments on skin, largely due to an introduction to a new piece of equipment during the workshop, a Teflon coated "cool tip" heated spatula, available from Talas, with a maximum temperature of 132°C, and a fine curved tip allowing increased control heat application.

Bulked adhesives

Glass microballoons are microscopic hollow spheres of glass used as a lightweight bulking agent, which can be added to a variety of conservation grade adhesives to change their consistency. It is common practice in conservation treatments to use bulked adhesives, however a novel approach was observed when visiting the Hall of North American Mammals at AMNH. Specimens in the *Dicotyles tajacu* (Collared Peccary) Diorama, have had new noses installed to cover dehydrated and mishapen original noses. A silicone mould was taken from the original plaster death mask of the peccary, produced by an AMNH taxidermist during the specimen's original preparation. Death masks are still used as a reference tool for taxidermists today, where the specimens head, paws or other important features are dipped in a moulding alginate, and this mould is used to create 3d plaster cast to serve as a reference during the taxidermy process. To make the peccary nose, BEVA 371 solution bulked with glass microballoons was cast from the silicone mould of the death mask to make a flexible, reversible nose pad which can be slipped over the original deteriorated

nose and reactivated with heat or solvent to tack it in place. This has the added benefit of leaving the original taxidermists work intact, but hidden, which can be desirable to maintain the historical significance of the taxidermy mount, (Sybaslky et al. 2017 A) Other bulked adhesives used in taxidermy repairs include bulked Paraloid F10 which has the benefit of adhering to waxy surfaces (Sybaslky et al. 2017 A), bulked Paraloid B72 in acetone (Feldman et al, 2024) and Bulked Lascaux adhesive mixtures (Ritchie & Palumbo 2023).

Loss compensation for Fur and Feathers

Paper fur and feathers

An incredibly versatile material used in conservation, Japanese tissue is made from the long and strong fibres of certain varieties of mulberry trees. The tissue produced from these fibres is exceptionally strong and has been used for centuries in the repair of books and paper artefacts. Contemporary conservation practice has seen it used in many other applications, in natural science it has been used “giving support and filling gaps during the repair of fur, feather and skin and the repair of entomological collections,” (Larkin, 2016, 62). At the Yale Peabody Museum the Fellow observed several excellent examples of fills made from Japanese tissue manipulated to replicate feathers and fur, including skilfully executed paper fills on the snout of a bear in the Alaskan Tundra Diorama. The paper can also be “cast” to replicate areas of texture, such as scales and leather grain, (Ridley 2017) The feathered edges of water-torn Japanese tissue can mimic hair and can be used to fill areas of loss on taxidermy. The method is described in Ridely (2017) and Timmins (2022). Likewise Japanese tissue and spun bound polyester (Reemay) can be used to replicate lost feathers, see Ritchie & Syblasky (2016). The Fellow has used this technique in the past, an example is shown in figure four in the replicated tips of a Juvenile Indian Rhino mounts ears. The Fellow has found this technique to be effective to fill small losses but too time consuming and difficult to match colours and textures in larger areas of loss. An extension to the techniques available using Japanese paper explored in the fellowship is the use of “digital fills.”

Digital fills involve the printing of a photographed texture such as fur, feather or scales directly onto Japanese tissue, usually by tacking it to a regular sheet of cartridge paper to allow it to be fed through a printer. This method is described by Roberts, 2023, who used this technique to fill large areas of loss on a taxidermied snake. The Fellow observed some digital fills at AMNH on a moose shoulder mount hung above head height, where the distance to the observer made the digital fills unnoticeable.

Natural Fills

Flocked hair fills

Flocked hair fills utilise hair from real hides transferred or “flocked” onto a backing tissue, or directly onto the skin of a taxidermy specimen. During the workshop at the national parks service the Fellow was able to successful utilise this technique to integrate an area of loss on the ear tip of a Odocoileus virginianus (White-tailed deer) shoulder mount, see figure five. This involved transferring hairs from a cow hide onto a sheet of Japanese tissue impregnated with 1:1 solution of Lascaux 498HV and 360HV conservation grade adhesives. A section of hair was picked up from the hide with a reverse tweezer and trimmed as close as possible to the base of the hair with a scalpel or fine scissor. The cut ends of the hair were dragged through 3:1 blend of Lascaux 498HV and 360HV then heat set to the tissue using a cool tip Teflon coated heated spatula. Layers of hair could then be built up methodically to create a natural looking hair pattern. Instructors Sybalsky and Ritchie have used this technique to recreate hair patterns such as cowlicks and partings, perhaps best exemplified by their treatment of Monarch the Grizzly Bear for the California Academy of Sciences, where the entirely bald muzzle was flocked from a calf hide radiating out from a central parting.

This technique was also used to fill very large areas of hair loss on the iconic Gilmore the Flying Lion, from the collection of the Smithsonian National Air and Space Museum. Kinney et al 2023, provide a detailed account of this very successful treatment.

Figure 4. C29897 Diceros bicornis Taxidermy mount of juvenile Black rhinoceros from the collection of Museums Victoria, Left: Before treatement, Source Museums Victoria, Photograph by Danielle Measday 2017; Right: After Treatment. Source Museums Victoria, Photograph by Rodney Start, 2017.

The benefit of using real hair is the ability to get a very good textural match to the specimen, difficult to achieve with any replicated fill materials or even artificial hair. This technique works very well in tandem with the Orasol dye technique described below, allowing the fills to be recoloured to match natural colouration of the specimen. Valid concerns about adding additional material from another species can be alleviated by discussions with stakeholders and thorough treatment documentation of fill locations.

Needle Felting

Hair fills can also be achieved using needle felting, where a fibre (natural or artificial hair) is punched through a substrate using a needle felting tool and a wool pad used as a work surface. The substrate used most in conservation applications is spun bound polyester (Reemay). The process of needle felting creates matting and tangling of the hair which does not create a good textural match for all applications, but has been applied successfully to replicate a large patch of fur loss near the tail of a Beaver specimen from the AMNH teaching collection (Sybaslky et al. 2017 A) and integrating a patch of lost fur on a taxidermy dog from the collection of the Horniman Museum, see (Ridley, 2015).

Feather fills

Areas of feather loss can be filled with trimmed down poultry feathers available at craft stores. The Fellow observed some successful treatments utilising real feather fills in a showcase of historic taxidermied parrots at the Richard Gilder Center for Science, Education, and Innovation (AMNH). The treatment of these parrots is documented by Paulson et al. (2022), who used a variety of techniques to shape, colour and attach feather fills to the parrots. An excellent example of both preventative and interventive conservation is seen in her treatment of *Calyptorhynchus banksii* (Red-tailed Black Cockatoo) taxidermy mount which had significantly faded red psittacofulvin pigment in its rectrices (tail feathers). Paulson skilfully recoloured some craft feathers with QoR watercolours to replicate the black and red banding of the cockatoo's tail and inserted them to cover the original faded rectrices, making the taxidermy mount a much more faithful representation of the living species while simultaneously preventing further light damage by creating a light shield for the original feathers.

Feather panel Fills

For filling larger areas of loss a feather panel fill can be used. This can be achieved using an embroidery hoop to tension a net fabric, like tulle, silk crepeline or a spun bound polyester to allow the shafts of cut down craft feathers to be woven or punched through the net in layers to create a naturalistic feather pattern . Once the feathers are arranged, they can be secured in place by lining the reverse with Japanese tissue, stitching the shafts in place, or securing each shaft with adhesive. These panels can also be padded to compensate for lost downy under feathers as demonstrated by the treatment of a bald eagle performed by Fran Ritchie and described in Ritchie and Sybalsky, 2016.

Recolouring Fur

In commercial taxidermy practice, aqueous and solvent-based acrylic airbrush paints e.g. Wildlife Colours are commonly used to colour taxidermy. Other reported methods include thinned oils paints, commercial hair dyes, shoe polish, wood stains and

fibre reactive dyes. These methods do not meet the ethical requirements of museum conservation practice, as they are not reversible, or may require rinsing after application to remove lingering acidic or basic dye products. Historical taxidermy with aged skin and keratin structures cannot withstand exposure to moisture and will be damaged by extremes in pH, (Nunan et al. 2012; Palumbo 2012). In 2013 AMNH, Yale University's Institute for the Preservation of Cultural Heritage (IPCH) and the Peabody Museum of Natural History were awarded an Institute for Museum and Library Services (IMLS) National Leadership Grant to fund a three-year project 'Recoloring Faded Taxidermy: Research into the Properties and Applicability of Dye Materials for Conservation Treatment,' which was built upon the successful recolouring and restoration of the Bernard family Hall of North American Mammals at AMNH in 2011-2012 and aimed to test the suitability, long term aging properties and lightfastness of a variety of recolouring methods.

Orasol metal complex dyes

Orasol dyes are metal complex solvent dyes which are soluble in a variety of organic solvents. They can be applied through an airbrush where the colour smoothly coats the outer surface but does not penetrate into the hair (Pollack et al. 2012). This technique was pioneered for use on taxidermy specimens by the conservation team at American Museum of Natural History, in collaboration with taxidermist George Dante. The dye doesn't change the texture or sheen of the hair and can be manipulated during application by brushing or massaging the fur to distribute the dye, making it comparable in application to commercial air-brush Wildlife Colour paints. Significantly, Orasol dyes are reversible/retreatable and can be removed from hair using the same solvent they were was applied with. This can aid in application, for example dye may be applied and then selectively removed from the tips of the hair to create a naturalistic silver flecked tip. There are 25 colours of Orasol dye, and they can be mixed with a variety of solvents. Solvent choice does influence the final colour, as well as changing the working time of the product. Because they are applied with no binding agent, there is a certain amount of pigment transfer that can occur which could be problematic for a specimen on open display at a museum which may need frequently cleaning. AMNH conservators have extensively tested the properties and aging characteristics of these dyes and found most colours to be resistant to fading over time, see Sybalsky et al, (2017 B).

During the workshop at the Harper's Ferry Centre, the Fellow had the opportunity to mix and test every colour of Orasol dye (1% in Ethanol) to create a sample colour chart to assist with colour matching and to practise the technique on a significantly faded *Odocoileus virginianus* (White-tailed deer) shoulder mount, see Figure 6: Hands-on experience practising this technique was invaluable. The workshop also introduced the Fellow to battery operated rechargable airbrushes, which run at a maximum PSI of ~30 and do not require an air compressor.

XSL pigments

There is not a white Orasol pigment, but an alternative has been found by AMNH researchers in XSL dry pigments. XSL pigments have a "fine particle size and are treated with dispersing agents that allow them to form a homogeneous suspension in water [or a solvent mixture with at least 15% water]," (Nunan et al. 2012). The suspended pigment in solution then can be airbrushed and applied in the same method as Orasol. However, this technique does have some "potential for adverse effects on skin or other water-sensitive materials used in taxidermy preparation," (Nunan et al. 2012 pp. 32) An example of a successful treatment was observed during the fellowship travels in the *Oreamnos americanus* (Mountain Goat) diorama in the AMNH Hall of North American Mammals. The goats' coats had significantly yellowed over many years of exposure to exhibition lights, the application of XSL white pigment applied in a mixture of ethanol and water by airbrush achieved a significant reduction in yellowing and restored the naturalistic appearance of the specimens.

Figure 5. Danielle Measday repairs the ear tip Shoulder mount of Odocoileus virginianus, White-tailed deer , private collection, Charles town West Virginia. Source: National Parks Service: Photograph by Fran Ritchie, 2024. Inserts: (A) Damaged ear tip before treatment (B) Fill made from Japanese tissue impregnated with 1:1 solution of Lascaux 498HV and 360HV conservation grade adhesives and flocked with calf hairs dragged through 3:1 blend of Lascaux 498HV and 360HV then heat set to the tissue using a cool tip Teflon coated heated spatula. (C) Ear tip after treatment. Source: National Parks Service, Photographs by Danielle Measday.

Faber Castell Pitt Pens

Faber Castell Artist's Pitt Pens have also been used for particularly coarse hairs which do not take Orasol dye well. These artist brush pens have a good lightfastness rating. They have been used by The Museum Victoria preparation department to integrate areas of loss on echidna quills. At AMNH Pitt Pens were used to recolour the very coarse hairs on the Collard Peccaries in a diorama from the Hall of North American Mammals.

Recolouring Feathers

A second iteration of the *In their true colours* project began in 2018, The American Museum of Natural History (AMNH), in partnership with (IPCH) and UCLA/Getty Master's Program in the Conservation of Archaeological and Ethnographic Materials (UCLA/Getty), were awarded another three-year IMLS grant to fund conservation research on the conservation and recolouring of bird taxidermy. Orasol® dyes do

Figure 6. Shoulder mount of Odocoileus virginianus, White-tailed deer, (private collection) is airbrushed by Danielle Measday using a 1% solution of Orasol Brown 324 & Orasol Brown 326 in ethanol, Charles town West Virginia. Source: National Parks Service, Photograph by Laura Stapleton, 2024.

not bond well to feathers, so alternative materials are in the process of being tested by the project team. The Fellow had the opportunity to observe the results of some of the testing and treatments performed while visiting various museums and to discuss the properties of these materials with conservators with experience using them.

QoR watercolours

QoR watercolours by Golden Artists Colours are watercolour pigments in an Aquazol resin (Poly(2-ethyl-w-oxazoline) binder. Aquazol has been used as an inpainting medium in paintings conservation for many years. QoR paints were developed with and for conservation industry (Golden, 2014). “The paint dissolves easily in water, alcohols, and ketones (specifically acetone), and it is relatively insoluble in aliphatic and aromatic hydrocarbons. Golden also performs ongoing, rigorous testing for pigment lightfastness and paint performance,” (Rutka, 2024). Because QoR paints can be wetted out in a solvent like ethanol the barbule disturbance and deformation that can occur when introducing water to aged keratin in feathers is reduced. At YPM, the Fellow observed a treatment performed by conservation student Anna-Collette Haynes on a light damaged *Apteryx sp*. (Kiwi) Haynes meticulously in-painted each feather of this kiwi to restore its correct coloration using QOR water colours in ethanol.

Pan Pastels

PanPastel Professional Quality Pastels from Colourfin have high pigment load with a low binder and come in the form of a pressed powder. When applied to feathers, using a brush or Sofft tools the pigment becomes physically enmeshed by structure of feather barbules. This is very effective for plumacoeus feathers which are difficult to recolour while maintaining their texture. As with Orasol®, this technique involves the application of a colourant with little to no binding agent, creating the potential for pigment transfer onto other surfaces. It can be difficult to get sharp definition in patterns when recolouring with pastels, (Paulson et al. 2022). Pan pastels are also a favourite among private taxidermists for recolouring beaks and other hard parts and to achieve soft colour gradients.

Both pan pastels and QoR watercolours are not completely reversible but are able to be significantly reduced by vacuuming (Panpastel) or solvent (QoR), (Paulson et al. 2022).

Recolouring with Tuneable LEDS

The Getty Centre and UCLA in collaboration with NHMLAC have performed some experiments using tuneable LEDS to recolour taxidermy birds with light. The inspiration for this work came from the recolouring of the Mark Rothko's Harvard Murals which were lit using carefully mapped coloured projections to restore the original colour without disrupting the unique paint surface, see Khandekar, 2014. The Getty experiments focused on a male taxidermied *Cardinalis cardinalis* (Northern Cardinal) which had significant fading to the red carotenoid pigment in its feathers. The colour was restored using Ketra S38 and A20 lamps which have red, green, blue and white LEDS which can be tuned to a huge range of colours. Further to this, the vibrancy of the light can be customised, essentially making white light using different recipes of colours which can impact on the colours seen by the viewer. Extra lamps were required to counteract the spillage of light behind the bird and to reduce or mask out redness on areas like the branch and beak. (Beltran et al. 2024) As lighting technology advances this will be an interesting space to watch as it will open new avenues for interpreting specimens in exhibitions and may be less a interventive option for displaying specimens that can or should not be treated for reasons of rarity, significance, to preserve scientific potential.

07

Personal, professional, and sectoral Impact

Williams and Cato (1995) stated “Until the conservation profession becomes more involved in the natural history community, individuals in existing collections positions are the primary resource for promoting long term care of collections. For this reason, there is a desperate need for opportunities and resources to provide training of existing professionals as well as entry level professionals”, (1995, pp. 24.) For the small but dedicated team of conservators working in natural sciences collections in Australia and the USA the responsibility of being a primary resource can be a heavy burden to bear. This weight is lessened significantly by the clear and undeniable purpose of natural science collections and the privilege of contributing to the world’s knowledge of natural heritage. In nurturing both a local and international network of colleagues the personal responsibility carried by the Fellow feels shared. The culture of this international network is collaborative, supportive, and generous to share information and skills. Spending time with international colleagues provided the Fellow professional and personal confidence in her practice. The opportunity to have practical experience with new materials and techniques guided by experienced practitioners is invaluable and would not have been an option without travelling overseas.

The Fellow has begun to share the knowledge and skills acquired during the fellowship with colleagues in Australia. Within MVRI, the preparation team have been very receptive to the new materials and techniques the Fellow has demonstrated since returning to Australia. As an unexpected bonus, the preparation team have found that as well as bonding to hair, Orasol® dyes are also able to bond well to flexible polyurethane, wax, and freeze-dried plant material which are commonly used in museum model making. This shows the techniques communicated by the Fellow will have a wider range of applications than initially expected.

By sharing techniques more broadly with conservators around Australia (see dissemination and stakeholder engagement section) the Fellow will contribute to the formalisation of Natural Sciences Conservation as a specialist field, and advocate for the preservation and care of historic taxidermy collections and natural sciences collections more broadly.

08

Recommendations and Considerations

The following section summarises the recommendations for the development of natural sciences conservation field in Australia, with a specific focus on the care of historic taxidermy.

1. Build Cross disciplinary partnerships:

Taxidermy is an artform, requiring immense skill to produce life-like and scientifically accurate mounts that last the test of time. These skills are increasingly being privatised. The Fellow is concerned for the loss of these skills in a museum context. The restoration of the Hall of North American Mammals at AMNH, often used as an example in this report, is a wonderful case study of a partnership between the materials knowledge and testing of a conservation department, the mastery of artisanal skills of a taxidermist, and the scientific knowledge of the animal and its environment held by collections staff. The successful conservation of taxidermy must include advocating for the maintenance of taxidermy preparation skills and building partnerships with taxidermists/preparators and sciences collections staff, private practice restorers, wherever possible.

2. Acknowledge natural science collections and include them in conservation education

Natural science collections are an opportunity for growth for the conservation sector, where there are limited employment opportunities. At present, the language of professional conservation associations consistently references the protection of 'cultural heritage' and 'cultural materials,' which reflects the status quo of Australian conservation's disconnect with natural science. Natural science conservation is not included meaningfully in tertiary conservation education. This also reflects the very limited expertise available to provide this education. However, this does not preclude general education about natural sciences collections and their functions within society, and the challenges this sector is facing. The Fellow can foresee benefits to the conservation profession from bringing allied professionals working in natural sciences into the fold. As conservation education is often at the post-graduate level, inclusion of natural science may attract more diverse field of students from the biological and geological science backgrounds, such as Dr. Mariana Di Giocomo of the Yale Peabody Museum, who retrained as a conservator from a palaeontology background. She notes that museum conservation was not mentioned in her previous science training, so the disconnect is present in both directions. Facilitating two-way learning between allied professionals in natural science and or skilled practitioners in private practice may help bridge this divide.

Finally, the concept of caring for collections in perpetuity can be increasingly difficult to reconcile in the face of the global climate change crisis. The Fellow has found tremendous meaning and purpose

in their work in natural science collections as it supports the efforts of species conservation.

3. Strengthen community

Renee Riedler states museums quite often “invest a lot of energy and resources to maintain the status quo of their rightfully or not acquired objects and sometimes forget that heritage is also a bundle of relationships,”(Riedler 2024) The culture we build as natural sciences conservators supporting each other and relationships we build with allied professionals like taxidermists, curators, collection managers, the perspectives and understanding of traditional owners can be our “bundle of relationships” that help close the skills gap in natural sciences conservation, and preserve collections for research and storytelling into the future. For this reason, allowing staff to participate in conferences, visit other museums, collaborate on projects, participate in field work and spend time with the communities they are serving is extremely valuable. These activities should be considered a part of conservation work.

4. Fund collections positions and skills development

Positions within museums have been the primary method of growth for the natural sciences conservation field in Australia. The opportunity to be embedded within an active natural science collection, with all its research, fieldwork, acquisitions, loans, students, publications, outreach and community engagement activities allows for a holistic education into how the collection is used and the unique value it holds. This Fellow would argue that the funding of more natural science conservation positions in museums will be of immense value to the field and allow the Australian conservation field to build expertise in this area. This may come in the form of philanthropic fellowship positions as seen successfully implemented in some galleries and museums.

With the absence of local expertise to provide education and professional development opportunities, funding international opportunities for skills expansion and growth will sustain and encourage the development of this specialisation in Australian conservation field.

09

Dissemination and Stakeholder Engagement

The Fellow has presented her findings to the Museums Victoria Board, as well as at a town hall meeting for all Museums Victoria Staff, and at Strategic Collection Management meeting for her division. In the future, the Fellow plans to lead a hands-on workshop for collections, preparation and conservation staff at MVRI to give them the opportunity to try new products and techniques in taxidermy conservation.

To disseminate her findings to the wider conservation sector, the Fellow has presented at AICCM Victorian division's "Off the Record" event. She has also presented to the conservation and preparation teams at the Australian Museum Research Institute (AMRI) in Sydney, including a practical demonstration of the Orasol dye technique. The Fellow also gave AMRI conservators samples of the full suite of Orasol colours and has guided them on the purchase of Pan Pastels and Pitt Pens so they can perform their own experiments with taxidermy re-colouring. A future workshop is planned at TMAG in 2025. Future dissemination activities will also be facilitated by the *Natural Sciences 101* project. The Fellow has partnered with conservators from AMRI and TMAG to share natural science conservation skills with Australian conservators. This project is grant funded through AICCM's 50k for 50 years appeal, and will be presented online, making it accessible for every Australian conservator with an interest in taxidermy conservation. Since taxidermy collections are held privately and at many national, state, educational and local organisations across the country, the impact of the dissemination of skills acquired on the fellowship have the ability to impact a large number of Australian collections. One outcome of *The Natural Science 101* project will be the launching of a new natural sciences special interest group within the AICCM to provide a structure for future events, workshops and meetings to continue professional development for conservators working on natural sciences material. This group will serve as a community of practice for conservators and allied professionals working with taxidermy specimens and other natural sciences collection materials.

10 Conclusion

The current species extinction rate is estimated to be 1,000 to 10,000 times higher than the natural background extinction rate (WWF, 2024, pp.21). Pettitt, 1997 suggests “for some groups and parts of the world, museum collections will soon represent the only record of biodiversity (pp. 94) The continued preservation of taxidermy collections for education and research is necessary. Just as these specimens may represent endangered or extinct species, the skills required to prepare, and conserve historic taxidermy specimens are likewise endangered. Skills development in Australia in the conservation of historic taxidermy, and more broadly in the conservation of natural sciences collections will have benefits to society though engaging exhibitions and storytelling and the preservation of collections which are the foundation of so many avenues of research. The development of this expertise would not be possible without opportunities like the George Alexander Fellowship through the International Specialised Skills Institute.

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12

Appendix one: Bibliography on Lightfastness of Bird and Mammal specimens

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