Inquiry into Australia's International Research Collaborations

Submission from the Western Australian Museum to the House of Representatives Standing Committee on Industry, Science and Innovation

WESTERN AUSTRALIAN museum

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Executive Summary

The Western Australian Museum gains both intellectual and financial benefits from international collaborations with a wide variety of stakeholders. Currently, the Museum is involved in 33 collaborative scientific research projects in a variety of disciplines with 49 international partner agencies, institutions and governments. These projects are funded wholly, or in part, by international agencies and governments.

Projects include those involving, planetary materials and Earth sciences, terrestrial zoology, aquatic zoology, materials conservation and maritime archaeology. The material benefits of these collaborations are many and varied including: access to scientific equipment (frequently at no cost to the institution) of limited availability in Australia; exchange of datasets to broaden scientific horizons; obtaining funding for 'blue skies' research not otherwise available; and the exchange of ideas with overseas colleagues to develop new research programs.

The key drivers for international collaboration include: increasing complexity of scientific problems and the need to build international consortia; and the inherently international nature of environmental changes, and their effect on the biota. The key principle for supporting research with international partners is one of mutual benefit to all. The spreading of research costs across partner agencies world-wide with similar aims and objectives is of direct financial benefit to Australia, allowing research to be carried out that otherwise could not be funded.

Strategies for supporting research collaborations include increased funding for international collaborative research programs, and greater linkages between State agencies and international agencies. Ultimately, the success of collaborative projects leads to increased investor confidence, and increased private and international government funding for important joint venture projects.

1. Scientific research at the Western Australian Museum

The Western Australian Museum first opened in 1891 and has since made a major contribution to the collection and conservation of, and scientific research into the State's natural history, maritime heritage, and heritage of indigenous communities in Western Australia.

The Western Australian Museum is established under the *Museum Act 1969* (as amended in 1973) and is a statutory authority within the State Government of Western Australia. It is a body corporate with perpetual succession and common seal, governed by a Board of eight Trustees. The Trustees are the Accountable Authority for the purposes of the *Financial Administration and Audit Act 1985.*

- The Museum holds research collections, as required under the Act, totaling more than 4.4 million objects valued at $629 million that are used extensively by government, industry, and the scientific research community world-wide.

- The Museum carries out original scientific research (on its own and with partners) in a wide variety of disciplines, including the biological (terrestrial and marine), Earth and planetary (palaeontology, mineralogy and meteoritics) sciences, the social sciences including archaeological, anthropological, and historical enquiry, and materials conservation sciences, and publishes the results of this research widely.

- The Western Australian Museum is one of the leaders in national taxonomic, biodiversity, geodiversity, planetary materials, materials conservation and maritime archaeological research.

- The collections provide the basis for the provision of high-level, authoritative and accurate taxonomic and other scientific information to government and industry regarding the identification of species (biological, palaeontological, and mineral) occurring within Western Australia. These data are also used to establish their past and present distributions and diversity.

- The Western Australian Museum makes an important contribution to building social capital and community capacity. Using its collections, it explores the stories and meanings of Australian society and environment allowing the broader community to better understand the past and plan confidently for the future. It is particularly important in providing a greater understanding of the diverse nature of national identity leading to greater understanding and tolerance between peoples.

- Scientific research is funded from multiple sources; including WA Government, Australian Federal Government, International Governments and funding agencies, WA Industry, and international industry. In 2008-09, the Museum secured research grants totaling $1.025 million.

- The Museum undertakes collaborative research with other State agencies, Federal agencies (e.g., CSIRO), Universities (Australian and overseas), Industry, and other Museums nationally and internationally.

- A key output of the Museum's biological research into natural ecosystems is the documentation of fauna. The discovery of new species is an ongoing process, and the rate of discovery of new species has increased markedly over the past few years following an increase in the level of environmental surveys by industry, and improved methods in the study of taxonomy, such as molecular analyses and scanning electron microscopy. With the view that bioprospectivity may become an important part of the States future economy, the Museum has recently established a WA Marine Bioresources Library.

- Materials conservation at the Museum uses innovative scientific techniques to provide conservation treatment to diverse scientific and cultural objects within the collections, including indigenous cultural materials, shipwrecks, and fossils. Museum conservation scientists and conservators also provide advice and assistance to a wide variety of national and international clients.

2. Nature and extent of existing international research collaborations undertaken by the Western Australian Museum

The Western Australian Museum's research activities are in line with some science priorities developed by the Western Australian Premier's Science and Innovation Council (2008). Notably;

- **Protecting biodiversity** – to develop a better understanding of WA's unique plants, animals and ecosystems.

- **Enabling sciences and technologies** – to advance 'blue sky' research and fundamental sciences that will underpin WA's science future.

In turn, these priorities correlate with some National Research and Innovation priorities. Particularly;

- **An environmentally sustainable Australia.**

- **Australian researchers and businesses are involved in more international collaborations on research and development.**

Currently the Western Australian Museum is involved in 33 collaborative scientific research projects in a variety of disciplines with 49 international partner agencies and institutions. These projects are funded wholly, or in part by international agencies and governments. Specific examples in the following categories include:

Earth and Planetary Sciences

- The Museum, in collaboration with Imperial College London and the Andrejov Observatory in Prague, has developed and established an autonomous All-Sky fireball camera network (The Desert Fireball Network DFN) in the Nullarbor Region of WA. This $0.5 m project has recently been successful in recovering the first meteorite fall in the southern hemisphere from which an orbit has been calculated, and the first photographically recorded fall of a rare meteorite type. The continued success of the DFN project has great implications for the space sciences.

- In collaboration with The University of Arizona (Accelerator Mass Spectrometer Laboratory), Imperial College London (Earth Science and Engineering) and the Open University (Planetary Science Research) in the UK, the determination of the terrestrial age and quantitative degree of weathering has allowed the innovative use of ancient meteorite falls on the Nullarbor to interpret past climatic change in Southern Australia.

- In collaboration with the University of California, Los Angeles, USA, and at no cost, the Museum obtains Instrumental Neutron Activation Analyses (INAA) of planetary materials to aid its space research program.

- In collaboration with the Tyrell Museum, Canada, and the University of Alberta, Canada, palaeontologists in Earth and Planetary Sciences are studying the ontogeny and life history of *Cardabiodon ricki*, the largest known shark from the mid-Cretaceous period.

- In collaboration with Lund University, Sweden, Tyrell Museum, Canada and the University of Alberta, Canada, palaeontologists in Earth and Planetary Sciences are undertaking a revision of the lamniform shark *Cretalamna appendiculata*.

- In collaboration with the Natural History Museum in London, palaeontologists in Earth and Planetary Sciences are studying Lamniform sharks from the Vraconian of Mangyshlak, Kazakhstan.

Terrestrial Zoology

- In collaboration with the American Museum of Natural History (grant provider) staff from Terrestrial Zoology are researching spiders belonging to the group Oonopidae.

- Studies of the systematics of Pseudoscorpions are being carried out in collaboration with the University of Connecticut, through direct funding and a scholarship.

- Studies on aquatic oniscidean isopods of the Yilgarn mineral fields are being conducted in collaboration with the Istituto per lo Studio degli Ecosistemi, Consiglio Nazionale delle Ricerche, Italy.

- Studies on the highly diverse fauna of Bathynellacea (Crustacea) from the Yilgarn mineral fields are being conducted in collaboration with the National Institute of Biological Resources, South Korea.

- The first synthesis of anchialine ecosystems was undertaken in collaboration with The Karst Waters Institute (USA) and The Mediterranean Institute for Advanced Studies (Spain).

- The principle reference volume on Subterranean Ecosystems was prepared in collaboration with The American University, Washington, and the Zoologisches Institut und Zoologisches Museum, Hamburg, Germany.

- A study of micro-organism distribution in anchialine systems was undertaken in collaboration with the Massachusetts Institute of Technology, USA.

- The groundwater ecology of Marbling Brook was funded and conducted in collaboration with Arbeitsgruppe Grundwasserökologie Universität Koblenz-Landau, Germany.

Aquatic Zoology

- In collaboration with the Guelph University, Canada, staff from Aquatic Zoology are involved with the BOL (bar code of life) project, collecting Australian fish species for DNA coding.

- In collaboration with Bar-Ilan University, Israel, work is being undertaken by WA Museum Aquatic Zoologists on coral barnacles from Western Australia, and Australian sponge inhabiting barnacles.

- A study on the biogeography of calcareous sponges of Western Australia in collaboration with the Federal University of Rio de Janeiro, Brazil.

- In collaboration with Auckland University, New Zealand, a sponge symbiont biogeography study that includes Western Australian species.

- Studies on the recent lithistid sponge fauna of Western Australia are being undertaken with the Institute of Paleobiology, Polish Academy of Sciences, Poland.

- In collaboration with the Institute of Research (IRD) Tahiti, a study on the Phloeodictyidae (sponges) of New Caledonia, including chemistry, molecular and classical taxonomy.

- Aquatic Zoology department are part of the international CReefs (Census of Coral Reefs) project examining coral reef species from Ningaloo. Funding is from the Sloan Foundation and BHP Billiton. Genetic barcodes are being produced in collaboration with the Ocean Genome Legacy Project.

- A study on barnacles found in Western Australian mangrove forests is being undertaken with researchers from Chiba University, Japan.

- Since 1997, Diana Jones has been a contributing chapter author in *A Field Guide to the Seashores of Eastern Africa and the Western Indian Ocean Islands*, edited by Dr Matt Richmond. Currently, the 3rd edition is being completely revised and updated. The field guide is published with funds from the Swedish International Development Co-operation (SIDA) and all proceeds from the sale of the guide go to a charitable trust, the Western Indian Ocean Marine Science Association (WIOMSA), which helps develop marine science in the area.

Conservation science

- The Museum is undertaking conservation work on archaeological bronzes (funded by the Jordanian Government) in collaboration with the CSIRO and the University of Melbourne.

- With colleagues at the University of Minnesota, conservation scientists are collaborating on research into the removal of iron corrosion products with selective agents.

- Studies of the treatment of archaeological ivory are being undertaken by Museum conservators in collaboration with colleagues at Texas A&M University.

- Analysis of acid affected timbers from historic shipwrecks to improve conservation strategies is being undertaken in collaboration with Stockholm University, Sweden, and other partners.

- A conservation project on reburial and analysis of archaeological remains is being undertaken in collaboration with the National Heritage Board, Sweden; Swedish University of Agricultural Science; The Norwegian University of Science and Technology; Studio Västsvensk Konservering, Sweden; The National Museum of Denmark; and Bohuslans Museum.

- Conservation of historic iron shipwrecks in the Pacific Ocean and development of methodologies for mitigation of the risks of oil pollution from sunk WWII vessels through *in-situ* conservation techniques is being developed in conjunction with the USA National Oceans and Atmospheric Administration.

- Conservation of historic Civil War shipwrecks the USS Monitor (1862) and the Confederate submarine H. L. Hunley is being assessed and developed in conjunction with The Mariners Museum in Newport News and the Warren Lasch Conservation laboratory in Charleston with Clemson University, respectively.

- Corrosion modelling for decay of submerged marine archaeological materials in conjunction with Old Dominion University, Norfolk, Virginia.

Maritime Archaeology

- Using timbers from the Dutch wreck *Vergulde Draek* staff in Maritime Archaeology are collaborating with The Dutch Centre for Dendrochronology (tree ring dating) to determine the source of the wood and date of construction of the ship.

- Through the auspices of the Government of Turkey, Maritime Archaeologists are locating two HMAS submarines lost in WWI. The

Museum is advising on the *in situ* preservation of one (AE2) found off the Turkish Coast, and continues to search for the other (AE1).

3. Benefits to Australia

International scientific research collaboration (for international partners see *Appendix 1*) brings many and varied benefits to the Western Australian Museum, and Australia as a whole. Specific benefits include:

- Access to scientific equipment either not currently available in Australia, or of limited availability, notably those in the nuclear industries.
- The opportunity to work with scientific colleagues from overseas, to exchange ideas and develop new research programs.
- Obtain funding for 'blue skies' research projects not otherwise provided by Australian agencies or industry.
- Acquiring expertise for Australia by interaction with overseas specialists.
- Exchange of materials and datasets with international partners to broaden scientific horizons, and obtain a better understanding of Australia's regional, global and temporal setting.
- Providing the opportunity for overseas students (and academics) to participate in research in Australia and, conversely, Australian students (and academics) to gain experience in overseas research groups.
- The success of collaborative projects leads to increased investor confidence, and increased private and international government funding for important joint venture projects.

4. Key drivers of international scientific research collaborations

The key drivers to international scientific collaborations undertaken by the Western Australian Museum are both intellectual and financial. Significant science can rarely be undertaken by small groups. Today, consortia of multi-disciplinary research groups are normal, rather than exceptional. Each group brings expertise and funding to a project, and the consortia are project driven.

Western Australia's unique features such as natural resources and biodiversity are likely to be key platforms on which to build future global collaborations, and subsequent innovation.

A recent Australian study (Department of Industry, Tourism and Resources, *Collaboration and other factors influencing innovation novelty in Australian businesses: an econometric analysis*, April, 2006) has demonstrated that organizations that collaborate are more likely to be innovative. International collaboration provides an additional driver to boost innovative research output.

Examples of key drivers of international research collaboration include;

- Improved access to, and sharing of, quality datasets. The availability of scientific data is one of the critical drivers of international participation in research.

- Increasing complexity of scientific problems and the need to build international research consortia.

- Globalization and increasing interdependence, combined with linkages of scientific output, to social and economic needs.

- The inherently international nature of environmental changes, and their effect on the biota.

5. Impediments to international collaboration, and practical measures to address them

There are few real impediments to international collaboration at the basic scientific level. However, those that do exist can create problems that make collaboration more difficult than it otherwise should be. For example, some legislation, both State and Federal, could impinge adversely on future research projects. Some examples include:

- Lack of matched funding from Australian agencies.

- While they do not exist at the Federal level, some legislative barriers that currently inhibit venture capital to develop commercial applications out of basic scientific research exist at State level. For example, currently, Western Australia does not have regulatory protocols for bioprospecting.

- Some legislation (Federal and State) restricts the export or import of certain items e.g. *The Protection of Movable Cultural Heritage Act* (1986).

Legislation can sometimes impinge on the freedom to send and receive scientific materials.

To encourage international collaboration the following need to be addressed;

- Review of legislation with the potential to impede international collaboration.

- The recognition that quality science needs to be included in policy making, and that the requirements of science also need to be considered.

6. Strategies for supporting international research engagement

The key principle for supporting research with international partners is one of mutual benefit to all, whether through informal arrangements, or with formal written agreements and memorandums of understanding. The spreading of research costs across partner agencies world-wide with similar aims and objectives is of direct financial benefit to Australia, allowing research to be carried out that otherwise could not be funded, or achieved, by a single group.

International collaboration should be encouraged at every level. Some opportunities to engage internationally already exist through the Australian Academy of Science and other Australian agencies with formal exchange programs with other countries. Similarly, Governments and agencies of other countries (including International Scientific Unions) have funded research linkages with Australia. Individual scientific research agencies in Australia, notably State Government agencies, are less well positioned to take full benefit of international collaborative research opportunities. Strategies that increase the engagement of State agencies with international partners are highly desirable.

Strategies to facilitate international research collaboration include:

- Increased funding for international collaborative research programs, and greater linkages between Australian and international agencies.

- Transparency of the funding processes.

Appendix 1
Current international research collaborators/funding agencies with the Western Australian Museum

- American Museum of Natural History, New York, USA
- Andrejov Observatory, Prague, Czech Republic
- Arbeitsgruppe Grundwasserökologie, Universität Koblenz-Landau, Germany
- Auckland University, New Zealand
- Bar-Ilan University, Israel
- Bohuslans Museum
- Chiba University, Japan
- Clemson University, Charleston, South Carolina, USA
- Department of Biological Sciences, University of Alberta, Canada
- Federal University of Rio de Janeiro, Brazil
- Government of Turkey
- Government of Turkey, historians and researchers
- Guelph University, Canada
- Imperial College, University of London, UK
- Institute of Research, Tahiti
- Istituto per lo Studio degli Ecosistemi, Consiglio Nazionale delle Ricerche, Firenze, Italy
- Jordanian Government
- Korea Institute of Geoscience and Mineral Resources, 30 Gajeon-dong,Yuseong-gu, Daejeon 305-350, Korea.
- Lund University, Sweden
- Massachusetts Institute of Technology, USA
- National Heritage Board, Sweden
- National Institute of Biological Resources, Korea Environmental Research Complex Geoungseo-Dong, Seo-Gu, Incheon, South Korea
- National Oceans and Atmospheric Administration, USA
- NSF-Arizona AMS Laboratory, University of Arizona,Tucson, USA.
- Old Dominion University, Norfolk, Virginia, USA
- Planetary Sciences and Space Research, Open University, UK
- Polish Academy of Sciences, Poland
- RING, the Dutch Centre for Dendrochronology
- Sloan Foundation, New York, USA
- Smithsonian Institution, Washington, USA
- Stockholm University, Sweden
- Studio Västsvensk Konservering, Sweden
- Swedish International Development Co-operation (SIDA)
- Swedish University of Agricultural Science
- Texas A&M University, USA
- The American University, Washington, USA

- The Karst Waters Institute, USA
- The Mariners' Museum, Newport News, Virginia, USA
- The Mediterranean Institute for Advanced Studies, Spain
- The National Museum of Denmark
- The Natural History Museum, South Kensington, London, UK
- The Norwegian University of Science and Technology
- The Royal Tyrell Museum of Palaeontology, Alberta, Canada
- The Warren Lasch Conservation laboratory, Charleston, USA
- University of California Los Angeles, Los Angeles, USA
- University of Connecticut, USA
- University of Minnesota, USA
- Western Indian Ocean Marine Science Association (WIOMSA)
- Zoologisches Institut und Zoologisches Museum, Hamburg, Germany

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