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Standing Committee on Environment and Communications References Committee
PO Box 6100
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Re: Inquiry into environmental biosecurity

Background:
Biosecurity is one of the four pillars of the Australian Museum's current Science Strategy. With a reference collection of over 18 million specimens, taxonomic research capacity and supporting infrastructure (including a wildlife genomics unit), the Museum is playing a key role in understanding biodiversity and related issues, a tradition that extends for nearly 200 years. According to Professor Merlin Crossley, Australian Museum Trustee, Dean of Science at the University of New South Wales and the chair of our Science Advisory Panel, "The (newly established) Australian Museum Research Institute is a leader in its field through its active scientific research, affording the Australian Museum a reputable, authoritative and important voice on issues of increasing significance to society." Our staff have provided pest identification training courses for Australian Quarantine Inspection Service offices and a broad range of our research projects are related to the critical issue of biosecurity.

We would be pleased to expand on our submission at a public hearing if required by the Committee.

The biosecurity capabilities of the Australian Museum (and other State natural history museums) are primarily in diagnostics and detection. These capabilities derive from our strengths in research taxonomy, led by expert systematics biologists working with extensive research collections, and supported by state-of-the-art laboratory infrastructure, including our *Australian Centre for Wildlife Genomics* (NATA accredited under ISO17025). Through active, collection-based research programs, we generate taxonomic knowledge. Unlike other organisations that may use taxonomic tools, museums produce the science behind the tools and the tools themselves. Our increasingly rare expertise enables us to provide specialist training to students and co-workers. Therefore, museums are uniquely positioned to make authoritative identifications, provide other species information based on the most current science, and share expert knowledge — critical for biosecurity decision making and capacity. Our comments focus on the contribution that the Australian Museum (and other state museums) can make to the national biosecurity system through our strengths in diagnostics and detection.

(a)The adequacy of arrangements to prevent the entry and establishment of invasive species likely to harm Australia's natural environment, including:

(i) The extent of detected incursions, including numbers, locations and species, and their potential future environmental, social and economic impacts.

Controls around domestic translocation of established invasives into unimpacted areas are not adequate. Two notable recent examples are from snails. (1) The introduced Liver Fluke Snail (*Pseudosuccinea columella*) is an intermediate host of the liver fluke, *Fasciola hepatica*, infecting livestock and humans (Molloy & Anderson, 2006). It was originally introduced to south-eastern Australia and reached the Northern Territory through interstate movement of ornamental aquatic plants (Marshall & Cribb, 2004). Fortunately, the NT population was noticed and successfully eradicated. (2) The Green Snail (*Cantareus apertus*), an important crop pest established in Western Australia since the 1980s, has recently become a pest in Victoria through translocation (http://www.vgavic.org.au/pdf/Green_Snail.pdf). These examples, with human health, veterinary and economic implications, highlight the need for tighter domestic controls on translocating established invasives.

(ii) The likely pathways of these recently detected incursions and any weaknesses in biosecurity that have facilitated their entry and establishment.

Ongoing active surveillance required. Understanding the complex interplay of variables leading to successful invasion is a key challenge for effective biosecurity planning. Modelling 'invasibility' can be informative to such planning. The incursion of the invasive European Fan Worm (*Sabella spallanzanii*) in Botany Bay, detected in 2013 by the Australian Museum (Murray & Keable, 2013) was predicted by a NSW DPI risk assessment (Glasby & Lobb, 2008). The Botany Bay incursion, however, was only accidentally discovered, highlighting the weaknesses in the system at the level of incursion detection. Regular ongoing surveillance may have detected the incursion at an early stage enabling the most effective response. Ongoing active surveillance programs are urgently needed.

Expert taxonomy required. The sweet potato flea beetle (*Chaetocnema confinis*), a pest from the Americas, was overlooked in Australia for at least 15 years. Although, quarantine monitoring was employed to prevent its entry, it had been collected during previous inspections, but was misidentified. This highlights the critical importance of in-depth taxonomic knowledge required for identification. Australian Museum scientists are frequently called on to determine whether detected animals are already present in Australia. Within Australia, insects are frequently found in food packaging, and it is important to know whether contamination occurred at harvest, postharvest storage, packaging or retail.

(iii) the extent of quarantine interceptions of exotic organisms with the potential to harm the natural environment, including numbers, locations, species and potential impacts.

The *Australian Centre for Wildlife Genomics* at the Australian Museum has handled more than 100 cases involving illegal wildlife over the past 5 years (Johnson et al., 2014). These cases span a broad diversity of species (including birds, reptiles, mammals, molluscs, and fish). With respect to quarantine, there is high risk that these illegal imports could carry diseases or additional pests/parasites (in the case of live animals). On this basis, illegal trafficking should be acknowledged as a potentially significant pathway for entry of exotic pests and diseases into Australia.

(iv) Any reviews or analyses of detected incursions or interceptions relevant to the environment and any changes in biosecurity processes resulting from those reviews or analyses.
Institutions like the state museums should be involved in reviews or analyses of biosecurity related procedures. Museum experts are involved in quarantine issues both at home and overseas, in the latter case of Australian species occurring as pests overseas. The Australian Museum is also sometimes involved in biocontrol and can perhaps provide a more international broadscale perspective of problems relating to the taxa in which we have expertise.

(b) Australia's state of preparedness for new environmental incursions, including:
(i) The extent to which high priority risks for the environment have been identified in terms of both organisms and pathways, and accorded priority in relation to other biosecurity priorities
Important high risk species are frequently overlooked. For example, the South American apple snails include at least two major agricultural pests, the Golden Apple snail (*Pomacea canaliculata*), and the Island Apple snail (*P. maculata*, also known as *P. insularum*) (Cowie, 2005; Hayes *et al.*, 2012; López *et al.*, 2010; Cooke *et al.*, 2012), accounting for US$55–248 billion agricultural damage annually (Joshi, 2005). Only the Golden Apple Snail is named as a priority risk to Australia (EFSA Panel on Plant Health, 2012) but both species pose major threats, especially to rice growers (Office of the Gene Technology Regulator, 2005). The aquarium trade is a significant vector for both of these species worldwide, and given the similarity between apple snail species, the invasive species could easily be accidentally imported together with the seemingly non-invasive Mystery Snail (*Pomacea bridgesii*) sold in Australian pet shops. This example highlights weaknesses in processes for recognising high priority risks given that focus is drawn to only one of two species with very similarly invasive profiles.
The high environmental risks of domestic translocations of a number of native species are currently underestimated. For example, the large eastern Australian gastropod, *Velacumantis australis*, when introduced to the Swan River, Western Australia, became orders of magnitude more abundant than any other native species in the river, probably impacting its fundamental ecology and biogeochemical cycling (Thomsen & Wernberg, 2009). The Yabby (*Cherax destructor*) from inland Australia, and Red-Claw Crayfish (*Cherax quadricarinatus*) from northern Australia have been translocated around the country for aquaculture and are now invasive in many parts of the eastern seaboard, outcompeting local species and in the case of the Yabby, even helping drive one native crayfish (*Euastacus dharawalus*) towards possible extinction (Coughran *et al.*, 2009; Fisheries Scientific Committee, 2011).

(ii) The process for determining priorities for import risk analyses and the process for prioritising the preparation of these analyses.
We believe fundamentally that such processes and analyses should engage museum-based experts in the taxa concerned.

(iii) The current approach to contingency planning for high priority environmental risks and the process by which they were developed.
An important deficiency is in the quality of the priority-species lists, suggesting inadequate processes in their development. For example, the 56 priority marine species that are likely to arrive in Australian and do harm, identified in the *Species Biofouling Risk Assessment* (Hewitt *et al.*, 2011a) anomalously includes the parasitic barnacle *Briarosaccus callosus* and horseshoe crab

Carcinoscorpius rotundicauda, neither of which are invasive anywhere in the world nor are likely to become so. *Briarosaccus callosus* occurs worldwide, including Australian waters, as a parasite of deep-sea king crabs (Lithodidae) and never occurs in biofouling. The only extralimital record of *Carcinoscorpius rotundicauda* is a single specimen from New Zealand in 1908 (Ahyong & Wilkens, 2011). Conversely, known high risk marine invasives, such as the amphipod *Caprella mutica* and crab *Hemigrapsus takanoi* (possibly more significant than the listed species, *Hemigraspus sanguineus*) are not included. Development of such lists should include input of taxonomic specialists at an early stage.

Control plans for some established high priority invasives have been developed (e.g., Aquenal Pty Ltd, 2008) as well as contingency planning for particular potential invasives. However, efficiency may favour developing some cases as generic plans, say for terrestrial slugs, terrestrial snails or freshwater snails rather than at the species-level. Species-specific action can be implemented once an incursion is suspected. We emphasise that the initial and critical step is to confirm the identity of the suspect species with specialists.

(iv) The adequacy of current protocols and surveillance and their implementation for high-priority environmental risks.

Marine surveillance is inadequate. Despite the national baseline marine port surveys conducted in the 1990s/2000s (Sliwa *et al.*, 2009), the absence of ongoing surveillance creates significant vulnerabilities. Detections of incursions are ad hoc, as in the recent incidental discovery of the invasive European Fan Worm (*Sabella spallanzanii*) in Botany Bay (Murray & Keable, 2013). The paucity of active surveillance programs nationally is conspicuous, with over reliance on passive surveillance. While extremely valuable, passive approaches should complement, not replace active surveillance. Although surveillance is generally a state responsibility, a nationally co-ordinated approach should be explored.

We believe fundamentally that such protocols and surveillance should have input from museum-based experts in the taxa concerned. In most of the diverse and taxonomically difficult taxa, determining which exotics are already present is an ongoing research challenge, so the adequacy of current protocols and surveillance is often difficult to assess, especially for some terrestrial taxa. Here, baseline studies of the culture-steppe in particular are needed – perhaps by routine long term trapping or sampling (appropriate to the taxa) at major ports and urban sites.

(v) Current systems for responses to newly detected incursions, the timeliness and adequacy, and role of ecological expertise.

Responses to recent incursions, such as the 2007 Green mussel (*Perna viridis*) incursion in Cairns (http://www.marinepests.gov.au/pest_outbreaks/Pages/Asian-green-mussel-outbreak-in-Cairns.aspx) and to the isolated occurrence of New Zealand mussel (*Perna canaliculus*) in South Australia in 2008 (Wiltshire *et al.*, 2010) appear to have been prompt, decisive and effective. Effectiveness of an incursion response is in large part predicated on the rapidity with which the incursion is detected. As indicated in (b)(iv), an ongoing system of surveillance is required for timely incursion detection.

(vi) The extent to which compliance monitoring and enforcement activities are focused on high priority environmental risks.

Despite the biosecurity threats posed by vessel biofouling (Yeo *et al.*, 2010), Australia is yet to develop empirically based fouling standards, contrasting strongly with New Zealand, for which mature Import Health Standards have existed for many years. Moreover, guidelines for

Australian domestic shipping exist only as voluntary recommendations. Enforceable biofouling standards are required, and these should be evidence based, indicating further research is required, especially given shifting patterns of international shipping (hence changing the suites of potential invasives). Current biofouling risk assessments based on vessel movements and modelling based on biological and physical parameters are invaluable (e.g., Hewitt *et al.*, 2011a,b) but need to be calibrated against actual species arriving as biofouling and against estimates of propagule pressure derived from levels of fouling. This requires direct field sampling.

(vii) The adequacy of reporting on incursions, transparency in decision-making and engagement of the community

Public awareness/education programs highlighting priority invasives and official points of contact can improve community engagement and more importantly, increase the efficacy of passive surveillance. Web-based species pages/profiles are excellent public resources, but need regular updating, especially if they are to function as passive surveillance tools. NIMPIS distribution maps of marine species presently have limited value because of poor or coarse baseline data. The maps need regular updating with the changing state of knowledge, especially in Australian records of pest species. Linking the NIMPIS databases to the Atlas of Living Australia (http://www.ala.org.au/) would allow more comprehensive recording of pest species and may foster community engagement.

(viii) Institutional arrangements for environmental biosecurity and potential improvements.

Given the structure of the national biosecurity system, with components dispersed among the Commonwealth and States, the roles of individual components must be clearly recognised. A critical component of any biosecurity system is accurate diagnostic capability that provides reliable taxonomic identifications of incoming samples, whether from surveillance, border intercepts, or other sources. For most animal species, this taxonomic capability resides almost exclusively within state natural history museums through taxonomic expertise and associated diagnostic facilities. These institutions, with active taxonomic and phylogenetic research programs are best placed to provide the most reliable identifications, critical for detection of exotic species, produce identification tools and provide training. Moreover, museums are ideal repositories for biosecurity reference collections. Currently, however, the role of museums within the biosecurity framework is ill-defined. The *National Biosecurity Research and Development Capability Audit* 2012 identifies museum expertise as part of a national capability, but does not clearly identify its role. Therefore, we recommend the following:

1. **Museums should be formally recognised within the national biosecurity framework as key national biosecurity infrastructure**. As the prime sources of taxonomic expertise, critical for authoritative identifications, museums should be formally identified through contract or MoU (but must involve resourcing) as first line providers of taxonomic identifications with explicit identification of their role/position within the national biosecurity framework. Current ad hoc arrangements for species identifications should be abandoned. Minimally, informal biosecurity-related associations between museum experts and other government agencies should be formalised at the institutional level to ensure relevant communication between partners. Formalising the role of museums will also assist them in prioritising research within a national context.

2. **Establish a streamlined pathway for identifications through a centralised identification framework.** We recommend a nationally co-ordinated system for taxonomic identifications, similar in principle to the *Marine Invasives Taxonomic Service* (MITS) operating in New Zealand (Gould & Ahyong, 2008). MITS, contracted by the New Zealand government, provide a centralised end-to end system for identifications of all samples collected under national marine biosecurity programs. Although the Australian biosecurity framework spans two tiers of government, a similar end-to-end identification service could be implemented through the *Intergovernmental Agreement on Biosecurity* 2012 (IGAB; COAG, 2012), centrally managed but coordinated through museums nationally. Properly implemented, this would speed sample turnaround and therefore speed detection, create a streamlined pathway for identifications, and make efficient use of national expertise by avoiding duplication of efforts among states.

   A system as described above was identified as a *Priority Reform Area* under Schedule 4 of the IGAB for collaborative effort over the near term: "Establish and adopt a framework for funding and managing nationally collaborative surveillance and diagnostic activities including the development and consolidation of infrastructure and capacity." Natural history museums can contribute significantly to this priority reform and are, indeed, essential to its efficient operation.

Yours sincerely

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