Institution: Institute of Zoology

Unit of Assessment: B7

a. Context The Institute of Zoology (IOZ) makes a unique and distinctive contribution to the UK Higher Education sector through our holistic approach to animal conservation, using the results from our high-quality primary scientific research to develop evidenced-based conservation practice and policy advice at all scales, from local to international. IOZ produces impacts through our work on novel approaches to monitoring and assessing populations, quantifying status and trends in global biodiversity, advising governments and NGOs on key conservation issues and the best responses to them, working in the field with practitioners to solve conservation problems, and engaging the public in the need for conservation of animals and their habitats. The primary impacts of IOZ science therefore relate to the natural environment and driving public policy in this regard, but our work also has impacts on human health, practitioners, the economy and society. Non-academic user groups and beneficiaries of IOZ science include more than a dozen UK and devolved government departments and agencies, more than a dozen foreign governments, many multi-governmental organisations and bodies, a large number of UK and international NGOs, and several commercial enterprises. Impact is fundamental to the work of IOZ, is expected from all researchers and research groups, and is a key element of career progression in the organisation.

b. Approach to impact A key aim of IOZ is to transfer the high-quality science carried out here to achieve applied conservation objectives, and to inform and influence conservation policy. Our view is that effective applied conservation biology not only provides environmental support and regeneration, but also improves people's quality of life, and aids social improvement. This concurs with the views of leading biodiversity scientists and policy makers (including the Defra Chief Scientist, UK Government Chief Scientific Advisor, and Director of the UN Millennium Development Goals), as expressed at a workshop convened by IOZ (*Science* **325**:1502, 2009).

The bulk of IOZ's HEFCE grant is used to employ scientists and technical support staff to perform conservation-focused zoological research. The fundamental criterion for the employment of research staff is scientific excellence, but we expect all our research staff to provide added value to the HEFCE grant through "third stream" activities. Evidence of this is provided in the IOZ promotion criteria for research staff that include "*An effective and consistent contribution to activities other than research, including conservation projects*" as one of the requirements.

IOZ allows its scientists to develop impact by taking a longer-term and more wide-ranging view of scientific projects than is the case in most HEIs. Many conservation problems require long-term investigation, and IOZ supports several long-term field studies, including the Serengeti Cheetah Project (37 years), Cetacean Strandings Investigation Project (CSIP: 23 years), Disease Risk Analysis and Health Surveillance Project (DRAHS: 15 years), Tsaobis Baboon Project (14 years) and Indonesia Programme (10 years). Similarly, the complexity and scale of some conservation problems requires a concerted programme of research that involves multiple projects, often of an interdisciplinary nature, across diverse countries and regions. For example, over the last decade, the Bushmeat Research Programme has conducted 14 field projects in 9 African countries.

IOZ policy is that all work should be of the highest scientific quality, but projects of an applied nature are encouraged where they support work central to our mission and provide significant public value. Thus, IOZ provides support for projects that are not typical of more conventional HEIs. Examples of this include the EDGE programme, CSIP, Garden Bird Heath initiative (GBH*i*), Living Planet Index (LPI), and Sampled Red List Index (SRLI). These provide important information on the state of the UK and global environments and elevate the profile of UK government funded research, but do not have the obvious potential for high-impact scientific outputs. It is a tribute to the strength of these programmes that they nevertheless produce them (e.g. Wildlife Health: Science **287**:443-449, 2000; CSIP: *Nature* **425**:575, 2003; SRLI: *Science* **328**:1164-1168, 2010).

IOZ helps drive relationships with key users in 4 main ways: (**1**) by exploiting links through other ZSL staff in range states, feeding back information on key conservation needs to IOZ scientists, e.g. ZSL work in Africa identified the need for a better understanding of the efficacy of alternative livelihoods as a conservation measure, which has resulted in several PhD projects on the topic; (**2**) by exploiting links with graduates of MSc Courses in Conservation Science, Wild Animal Biology and Wild Animal Health co-run by IOZ, who now work on *in situ* and *ex situ* conservation of wildlife in academic, government and charitable sectors in more than 50 countries; (**3**) by exploiting the convening role of ZSL as a Learned Society: IOZ co-ordinates a series of symposia on conservation-related scientific topics e.g. "*Avian reintroduction biology: current issues for science*

and management" in 2008, which resulted in IOZ developing new links with conservation practitioners in Mauritius to help reintroduction programmes for threatened native bird species there; (**4**) by contributing to the work of government committees and conservation specialist groups, e.g. eight IOZ scientists sit on IUCN specialist groups, in New Zealand we provide the only non-Dept of Conservation recovery group chair (for the hihi *Notiomystis cincta*), and IOZ are the only HEI invited to be in the GB Wildlife Disease Surveillance Partnership, which collates information on native species disease, pertinent to human, domestic animal and wildlife health.

IOZ recognises the need to raise awareness of conservation issues, to ensure that our knowledge base is used widely and effectively, worldwide. To this end, IOZ scientists work with a dedicated member of the ZSL Press Office to promote the public understanding of science. They do this through extensive media work, and by providing technical assistance to production companies, expert commentary and stories for scientific documentaries, and substantial publicity for government-funded work in science and conservation through in the published and broadcast media. IOZ also works with ZSL Discovery and Learning to ensure that science and conservation messages are imparted to the 1.5 million visitors annually at London and Whipsnade zoos.

The approaches applied by IOZ have resulted in beneficial impacts on the natural environment, public policy, human health, practitioners, the economy and society. Examples include:

Impacts on the Natural Environment: IOZ has impact: (**1**) By monitoring status and trends in biodiversity, e.g. the LPI and SRLI. Other examples include: [i] developing a global acoustic bat monitoring programme (iBats), in collaboration with other national and regional NGOs (*J. Appl. Ecol.* **49**: 1064-74, 2012), providing data for government CBD targets; and [ii] establishing a carnivore monitoring and conservation centre in Tanzania (www.tanzaniacarnivores.org), employing 13 local people, and providing high-level professional training to several others; activities include surveys, species distribution mapping, outreach, education, and species action planning; (**2**) By developing conservation breeding programmes, e.g. IOZ co-developed an international conservation breeding programme for the three most threatened species of vulture in the Indian subcontinent, along with colleagues at other NGOs and with State and National governments (www.vulturerescue.org); (**3**) By preventing conservation problems, e.g. IOZ carried out disease assessments for 14 species reintroduction programmes in England and developed a novel method for assessing disease risks (*Conserv. Biol.* **26**: 442-52, 2012) which contributed to the development of IUCN Guidelines on Wildlife Disease Risk Analysis; (**4**) By developing applied conservation programmes, e.g. IOZ developed the EDGE programme, the only global conservation initiative to focus specifically on threatened species that represent a significant amount of unique evolutionary history, and has helped train 28 EDGE Fellows working in 18 countries.

Impacts on Public Policy: IOZ science particularly informs policy on environmental health, e.g. IOZ research on tissue concentrations of brominated flame retardants in small cetaceans helped to inform EU risk assessments of these compounds, which led to a highly effective EU ban on all commercial polybrominated diphenyl ether formulations (*Mar. Poll. Bull.* **64**: 1485-94, 2012). IOZ contributed to the development of the England Wildlife Health Strategy (2009) and GB Wildlife Disease Surveillance Partnership, which produces quarterly reports to inform government policy.

Impacts on Human Health: IOZ conducts research on a range of potentially zoonotic pathogens, e.g. bovine TB, brucellosis in marine mammals, and zoonotic viruses in a range of wildlife species. IOZ research on the spatial distribution of disease emergence (*Nature* **451**:990-993, 2008) was used to locate disease surveillance under the USAID PREDICT programme ($55million).

Impacts on Practitioners: IOZ work helps inform and build capacity in conservation-related fields around the world, e.g. IOZ scientists studying the welfare of captive wild animals, facilitated by ZSL's zoos, identified abnormal mortality schedules in zoo elephant populations (*Science* **322**:1649, 2008), prompting action on elephant diseases by the international zoo community; in the Commonwealth of Dominica, IOZ scientists established amphibian disease surveillance transects, built a molecular diagnostics laboratory and a captive breeding facility for the Critically Endangered frog *Leptodactylus fallax,* and trained local staff in molecular biology and husbandry techniques.

Impacts on the Economy: IOZ primarily helps the economy through disease mitigation research, e.g. IOZ scientists sat on Defra's bovine tuberculosis advisory group (bTBAG) throughout its existence (2006 – 2009), providing independent policy advice to the Chief Veterinary Officer and to the Secretary of State on the control of bTB, and continue to provide advice to government, politicians, NGOs and the public in respect of the cull of badgers in autumn 2013.

Impacts on Society: IOZ has an extensive programme of public engagement in nature and science,

from school children through to expert scientists, e.g. a collaborative Citizen Science project for wildlife health surveillance, the GBH*i*, identified finch trichomonosis as an emerging infectious disease, based on 1000s of reports from members of the public. IOZ also co-ordinates a popular annual series of free evening scientific meetings, and IOZ scientists founded and run Soapbox Science (www.soapboxscience.org), a focus for scientists wanting to eliminate gender inequality in science by raising the profile, and challenging the public's view, of women in science.

The approaches to impact applied by IOZ have also resulted in a range of interactions between our scientists and non-academic beneficiaries. Examples include:

UK and devolved government departments and agencies, including Defra, the MoD, DfID, and Natural England, who receive policy advice, e.g. IOZ runs the national CSIP on behalf of the British government, and the DRAHS with Natural England, to ensure reintroductions meet IUCN Guidelines and comply with the Wildlife and Countryside Act 1981.

Foreign governments, who receive policy advice from IOZ, e.g. IOZ identified transport of mosquitoes in aeroplanes and boats as a key threat to Galápagos biodiversity, which led to national regulations prohibiting direct flights from other countries to Galápagos, and mandatory residual disinsection of aircraft flying there (*Nature Sci. Rep.* **3**, art. 1519, 2013).

Multi-governmental organisations and bodies, including several branches of the United Nations, who receive policy advice from IOZ, e.g. IOZ coordinated the development and delivery of two key biodiversity indicators designated for testing under the CBD 2010 Target: the LPI (with WWF) and the SRLI (with IUCN). Both indicators feature prominently in CBD outputs, and in the United Nations report 'Global Biodiversity Outlook - 3'.

UK and international NGOs, who receive independent and authoritative advice from IOZ, e.g. the RSPB on the disease risks of their reintroduction programmes (crane *Grus grus*, corncrake *Crex crex*), and New Zealand NGOs on translocations (e.g. Forest & Bird, Karori Wildlife Sanctuary).

Commercial enterprises, e.g. IOZ research on the bushmeat trade is helping the development of a new tropical timber-certification scheme with Timbmet, the UK's largest timber importer.

c. Strategy and plans IOZ occupies a unique position in the world as the research arm of a larger conservation NGO (ZSL) that maintains living collections at two zoos, that runs field conservation projects in more than 50 countries worldwide, and that engages with conservation policy makers around the world. The development of impact from IOZ research, in the UK and abroad, is therefore fundamentally predicated by the structure and type of organisation of which we are a part. It is stated explicitly in IOZ's Mission and Strategic Plan, and embedded in our strategic aims, which include *Attracting and engaging a diverse range of people and organisations in the science of zoology and conservation; Providing policy makers, conservationists and the general public with the information needed to make informed decisions on conservation issues; Working with other organisations and across disciplines to achieve our common conservation objectives; Working with government and industry in the UK and elsewhere in support of conservation; Developing our own and others' capabilities, expertise and resources in order to build capacity in zoology and conservation; Developing and applying objective criteria for setting priorities for conservation*.

Our drive for impact is facilitated by the kinds of on-going institutional investment described above, making available resources to carry out long-term and interdisciplinary studies, addressing applied conservation issues, raising public awareness, and employing staff with the skills to pursue both high quality pure and beneficial applied science. For example, we set aside £10K from the annual budget as a contingency fund to support key long-term studies through periods of funding uncertainty; and we are further promoting opportunities for impact through special-interest groups, on Amphibians, Climate Change, and Carnivores, that bring together scientists, conservation managers, policy experts and curators from across ZSL to work on conservation impact.

d. Relationship to case studies The CSIP shows how IOZs investment in staff with applied conservation interests who pursue long-term studies with conservation relevance, combined with appropriate technical support and public engagement, allows it to act quickly and flexibly to generate significant impact. Our work on biodiversity indicators demonstrates how IOZ drives relationships with key users to generate impact, exploiting links to other NGOs to identify basic conservation requirements, using the convening role of ZSL to bring together global experts for Red Listing workshops and meetings, and through the links generated by the eight IOZ research staff on IUCN committees and specialist groups. IOZ's chytrid research demonstrates our ability to raise awareness of conservation issues, for example through dedicated interpretation in London Zoo's Reptile House, and through public and governmental engagement in relevant countries.