Der Senat

20. März 2014

Stellungnahme zum Leibniz-Institut für Zoo- und Wildtierforschung (IZW) im Forschungsverbund Berlin e. V. Berlin

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Vorbemerkung

Die Einrichtungen der Forschung und der wissenschaftlichen Infrastruktur, die sich in der Leibniz-Gemeinschaft zusammengeschlossen haben, werden von Bund und Ländern wegen ihrer überregionalen Bedeutung und eines gesamtstaatlichen wissenschaftspolitischen Interesses gemeinsam gefördert. Turnusmäßig, spätestens alle sieben Jahre, überprüfen Bund und Länder, ob die Voraussetzungen für die gemeinsame Förderung einer Leibniz-Einrichtung noch erfüllt sind.[1]

Die wesentliche Grundlage für die Überprüfung in der Gemeinsamen Wissenschaftskonferenz ist regelmäßig eine unabhängige Evaluierung durch den Senat der Leibniz-Gemeinschaft. Die Stellungnahmen des Senats bereitet der Senatsausschuss Evaluierung vor. Für die Bewertung einer Einrichtung setzt der Ausschuss Bewertungsgruppen mit unabhängigen, fachlich einschlägigen Sachverständigen ein.

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 13. und 14. Juni 2013 das Leibniz-Institut für Zoo- und Wildtierforschung (IZW) im Forschungsverbund Berlin e. V. Ihr stand eine vom IZW erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das IZW nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 20. März 2014 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich den Beurteilungen und Empfehlungen der Bewertungsgruppe an.

Seinem **Auftrag** entsprechend untersucht das Leibniz-Institut für Zoo- und Wildtierforschung (IZW) im Forschungsverbund Berlin e. V. die Lebensbedingungen, evolutionsbiologischen Anpassungen und Erkrankungen von Wildtierarten sowie die Interaktion von Wildtieren mit der Umwelt und dem Menschen. Neben den erfolgreichen Forschungsarbeiten bietet das IZW qualitativ hochwertige wissenschaftliche Serviceleistungen an und ist aktiv in der Beratung von Politik und Öffentlichkeit sowie im Wissens- und Technologietransfer.

Unter der engagierten und kompetenten Leitung des Direktors hat sich das Institut seit der letzten Evaluierung sehr gut entwickelt. Es ist international sichtbar und anerkannt. Die Publikationsleistung wurde sowohl quantitativ als auch qualitativ stark verbessert und hat nun ein überzeugendes Niveau erreicht. Die **Leistungen** in den drei abteilungsübergreifenden Forschungsschwerpunkten werden jeweils als „sehr gut“ bewertet. Eine besondere Stärke des Instituts liegt in den reproduktionsbiologischen und -medizinischen Arbeiten, die weiterhin eine wichtige Rolle spielen sollten. Das IZW verfügt über hervorragende Möglichkeiten, Wildtierpopulationen über sehr lange Zeiträume umfassend und experimentell zu untersuchen. In der Vergangenheit haben diese Langzeitprojekte bereits zu viel beachteten Ergebnissen geführt. Künftig sollte dieses große Potenzi-

[1] Ausführungsvereinbarung zum GWK-Abkommen über die gemeinsame Förderung der Mitgliedseinrichtungen der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.

al noch stärker ausgeschöpft werden, insbesondere auch durch Einbeziehung europäischer Wildtierarten.

Das Gesamtkonzept und die übergreifenden Ziele des IZW sind überzeugend. Bei der Umsetzung seiner **strategischen Planungen** muss das Institut noch stärker darauf achten, die Projekte systematisch an den übergreifenden Fragestellungen auszurichten. Die hervorragenden wissenschaftlichen Sammlungen sollten noch besser mit digitalen Erschließungsmethoden für die Forschung auch außerhalb des IZW zugänglich gemacht werden. Um die Anpassungsreaktionen von Wildtierarten an veränderte Umweltbedingungen noch verlässlicher vorhersagen zu können, wird es für das IZW notwendig sein, seine Expertise in statistischer Auswertung, Modellierung und Programmierung deutlich zu verstärken. Auch die Kompetenzen im Bereich der Bioinformatik müssen ausgebaut werden. Weiterer personeller Bedarf wird im Bereich der IT-Betreuung und beim Facility-Management gesehen. Hierfür sollte das Institut Mittel einsetzen, die ihm durch den im Pakt für Forschung und Innovation vorgesehenen Aufwuchs zukommen. Außerdem sollte es die durch die Aufhebung der Verbindlichkeit des Stellenplans im Jahr 2013 gewonnene Flexibilität nutzen, um strategische Priorisierungen vorzunehmen.

Die **Geräteausstattung** ist derzeit sehr gut. Die Geldgeber sollten sich darum bemühen, dass sie auf einem modernen Stand gehalten wird, damit das IZW seine hohe wissenschaftliche Wettbewerbsfähigkeit bewahren kann. Bei der Einwerbung von Drittmitteln ist das IZW erfolgreich. Allerdings bestehen insbesondere bezüglich EU-Fördermitteln noch Steigerungsmöglichkeiten, die genutzt werden sollten. In Zukunft sollten Drittmittelprojekte noch stärker dazu beitragen, das Profil des Instituts zu schärfen.

Das IZW unterhält intensive und ertragreiche **Kooperationsbeziehungen** mit Universitäten, insbesondere in Berlin und Potsdam. Derzeit sind der Direktor und ein weiterer Abteilungsleiter gemeinsam mit der Freien Universität Berlin berufen. Es wird begrüßt, dass mittelfristig auch die übrigen Abteilungsleitungen in gemeinsamer Berufung besetzt werden sollen. Zwei Berufungsverfahren (an der Freien Universität Berlin und an der Universität Potsdam) wurden bereits eingeleitet. Innerhalb der Leibniz-Gemeinschaft ist das Institut sehr gut vernetzt. Es ist Mitbegründer des *Berlin-Brandenburg Institute of Advanced Biodiversity Research* (BBIB) und Gründungsmitglied des Leibniz-Verbunds Biodiversität. Das IZW pflegt intensive und ertragreiche Kontakte zu Zoologischen Gärten im In- und Ausland. Damit wird es seinem integrativen Ansatz mit Einbeziehung von Populationen sowohl im Freiland als auch in Gefangenschaft gerecht.

Die Maßnahmen des IZW zur Verbesserung der Vereinbarkeit von Familie und Beruf sind zielführend. Der **Frauenanteil** unter den wissenschaftlich Beschäftigten ist auf allen Hierarchieebenen hoch. Zum Zeitpunkt des Evaluierungsbesuchs waren zwei der fünf wissenschaftlichen Abteilungsleitungspositionen mit Frauen besetzt. Beim übrigen wissenschaftlichen Personal lag der Frauenanteil bei über 50 %. In Anbetracht anstehender Personalwechsel auf der Leitungsebene (Wegberufung einer Wissenschaftlerin) sollte das IZW in seinen Anstrengungen nicht nachlassen und auf der Grundlage des DFG-Kaskadenmodells auch für die Zukunft konkrete Ziele und Maßnahmen definieren.

Der **wissenschaftliche Nachwuchs** wird am IZW hervorragend ausgebildet. Die Beteiligung vieler Promovierender an Feldforschungsaufenthalten im Ausland ist sehr positiv. Auch für Postdocs ist das Institut sehr attraktiv. Kürzlich konnte eine BMBF-geförderte Forschungsgruppe eingerichtet werden. Damit ist das Potenzial zur Einrichtung von

Nachwuchsgruppen allerdings noch nicht ausgeschöpft. Es sollten weitere drittmittelgeförderte Nachwuchsgruppen etabliert werden. In der Berufsausbildung ist das Institut außerordentlich engagiert. Ende 2012 waren neun Auszubildende in fünf verschiedenen Ausbildungsberufen am Institut beschäftigt.

Mit seinen interdisziplinär ausgerichteten Forschungsarbeiten, den langfristig angelegten Projekten sowie seinen umfangreichen Service- und Beratungsaktivitäten übernimmt das Institut ein Spektrum von Aufgaben, das in dieser Form an einer Hochschule nicht bearbeitet werden kann. Die Eingliederung des IZW in eine Hochschule wird daher nicht empfohlen. Das IZW erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischem Interesse zu stellen sind.

2. Zur Stellungnahme des IZW

Der Senat begrüßt, dass das IZW beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das IZW als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

29 May 2013

Annex A: Status Report

Leibniz Institute for Zoo and Wildlife Research (IZW)
in the *Forschungsverbund Berlin e. V.*

Contents

1. Structure, tasks, and institutional environment

Development and funding

The Leibniz Institute for Zoo and Wildlife Research (IZW) in the *Forschungsverbund Berlin e. V.* (FVB) emerged from the *Forschungsstelle für Wildtierforschung* in the Academy of Sciences of the German Democratic Republic. After German reunification, it was positively evaluated by the German Council of Science and Humanities. Consequently, in 1992, it was re-founded and became a member of the *Wissenschaftsgemeinschaft Blaue Liste*, which developed into the Leibniz Association in 1997. Together with seven other Leibniz institutes in Berlin, IZW forms the FVB with a joint administration for all member institutes. 50 % of IZW's institutional funding is provided by the Federal Government, 50 % by the States (*Länder*). The national importance of IZW was confirmed in external evaluations by the German Council of Science and Humanities in 1998 and by the Senate of the Leibniz Association in 2007.

Responsible department at *Länder* level: Department for Economics, Technology and Research of the Berlin Senate (*SenWTF*)

Responsible department at federal level: Federal Ministry of Education and Research (*BMBF*)

Mission and tasks

According to its statutes, IZW studies the life histories, evolutionary adaptations and their limits, particularly the diseases, of wildlife species as well as their interaction with people and the environment. The institute's research aims at (1) contributing to the development of a comprehensive predictive framework that explains why some wildlife species are threatened by anthropogenic change whilst others persist or even thrive in degenerated or novel habitats ("understanding adaptability") and (2) designing appropriate concepts and methods for conservation intervention when natural mechanisms of adaptability are likely to fail ("improving adaptability").

Legal form, structure, and organisation

As a member of the *Forschungsverbund Berlin e. V. (FVB),* IZW belongs to a registered non-profit organisation under private law. Its supervisory committee is the Board of Trustees of FVB, which consists of up to ten members. The chair is appointed by the responsible department at *Länder* level; the deputy chair is appointed by the responsible federal department. The Board of Trustees is responsible for endorsing the programme budget, confirming the annual accounts, and appointing the IZW director, the managing director of FVB (head of administration), leading scientists, and the members of the Scientific Advisory Board. Decisions affecting IZW are prepared by the Institute Committee, which consists of representatives of the responsible departments at federal and *Länder* level as well as the chair of the Scientific Advisory Board; the scientific director of IZW and the managing director of FVB have guest status.

The institute is led by the director (scientific head) and the managing director of FVB (head of administration). The scientific director is in charge of staffing matters and re-

sponsible for designing and implementing the research programme. The head of administration is responsible for the institute's budget.

The Scientific Advisory Board (SAB), which consists of six to twelve internationally renowned scientists representing the range of disciplines of relevance to IZW, meets once per year. It advises the institute's management on scientific aspects of the research programme and on national and international networking strategies. It carries out regular reviews of the work of individual departments and conducts an audit between external evaluations according to the guidelines issued by the Leibniz Association.

IZW has one administrative unit and five research departments which focus on specific conceptual and methodological competencies: the Departments of Evolutionary Ecology, Evolutionary Genetics, Wildlife Diseases, Reproduction Biology, and Reproduction Management.

Since 1993, the institute has operated a field research station in Niederfinow, Brandenburg, which allows experimental research in semi-natural enclosures as well as cages.

The research programme is organised according to three research foci: "Adaptations", "Diseases", and "Conservation" (cf. Chapter 3). In each of these research foci, the expertise of the different disciplinary departments is combined, thus enabling a multidisciplinary approach to the respective research questions.

In addition to its scientific work, IZW communicates its results to stakeholders, policy makers, and the general public through a range of "Research-accompanying Activities", offers "Research-oriented Services" to the scientific community, and houses and develops scientific collections (cf. Chapter 3).

National and international scientific environment

IZW describes its leitmotif, "evolutionary wildlife research for conservation", as unique in Germany. According to the institute, behaviour, ecology, evolutionary genetics, and biodiversity of wildlife in temperate, tropical, and subtropical regions are addressed at only few German universities (e. g. in Bielefeld, Dresden-Tharandt, Freiburg, Göttingen, Ulm, and Würzburg). The three large natural history museums – Senckenburg Museum in Frankfurt/Main, Zoological Research Museum Alexander König in Bonn, and *Museum für Naturkunde* in Berlin – concentrate on taxonomic questions and monitoring issues. The German Primate Centre (DPZ) in Göttingen and the Max Planck Institute for Evolutionary Anthropology in Leipzig focus on primates, the Institute for Terrestrial and Aquatic Wildlife Research at the University of Veterinary Medicine in Hannover on population monitoring of game mammals and marine wildlife in Germany.

Internationally, IZW mentions the following institutes with similar objectives: the Research Institute on Wildlife Ecology at the University of Veterinary Medicine in Vienna (A), the research institutes of the Zoological Society of London (Institute of Zoology with London Zoo and Whipsnade Zoo, UK), the San Diego Zoological Society (Center for Research on Endangered Species, San Diego, USA), and the conservation institutions of the Smithsonian Institution (Smithsonian Conservation Biology Institute, Front Royal, and National Zoological Park, Washington, D. C., USA).

National interest and justification for funding as a non-university institution

IZW states that its work is consistent with United Nations Millennium Development Goal (MDG) 7, "ensure environmental sustainability", especially MDG 7A ("integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources") and MDG 7B ("reduce biodiversity loss"), as well as with several Aichi Biodiversity Targets for 2020. IZW's two research goals contribute to key requirements of these MDGs and Aichi Targets, namely to understand the processes and mechanisms that generate and maintain biodiversity and to improve the ability of wildlife species and species communities to persist. In terms of transferring research results into conservation, IZW addresses problems at individual, population, and species levels, operates at the level of landscape use, incorporates stakeholder issues during the design and implementation of research projects, and contributes to societal discourse by providing scientifically supported answers. In the field of health research, IZW's work on infectious diseases transmitted among wildlife species, from wildlife to people (zoonoses), and between people, domestic animals, and wildlife in anthropogenically modified habitats is of considerable interest as well.

The institute states that several of its tasks and research topics are currently underrepresented or unfeasible at German universities. IZW additionally highlights its interdisciplinary approach, exemplified by the field of conservation medicine which combines veterinary and biological disciplines, and a large number of long-term research projects that are important in the study of long-lived wildlife species. According to IZW, the regular and prolonged absence of experienced researchers on field stays may cause conflicts with teaching obligations. IZW also owns and runs a field research station and hosts five scientific reference collections.

2. General concept and profile

Development of the institution since the last evaluation

Since the last evaluation, IZW has focused and refined its research programme. Based on its leitmotif, "evolutionary wildlife research for conservation", the institute has defined two major research goals: understanding adaptability and designing appropriate conservation interventions to improve adaptability.

To this end, IZW follows an interdisciplinary approach, combining both mechanistic and functional questions on the evolution of adaptations in wildlife and including the individual as well as the population and species levels. A better understanding of resistance and resilience and hence the adaptability of wildlife in the face of environmental change is then taken as a starting point to contribute to a predictive framework with the aim of designing appropriate intervention measures, if necessary.

Strategic work planning for the next few years

IZW aims to develop into a globally renowned centre of competence for wildlife research. Work on wildlife species in vital habitats will be continued. The following approaches are expected to gain importance in the coming years:

- use of spatially explicit approaches, e. g. for investigating the distribution of genetic variation, the epidemiology of pathogens and diseases, and movement ecology
- minimally invasive and non-invasive research techniques in genetics, genomics, reproduction biology, physiology, endocrinology, and immunology
- next generation sequencing techniques for host and pathogen genomes as well as for host microbiomes
- cell-based techniques for experimentally investigating evolutionary adaptations and interactions on a cellular level
- eco-immunological approaches in the study of life histories and the interaction between stressors, immunocompetence, reproduction, co-infection and other aspects of pathogen-host interactions
- epigenetics for identifying modifiers defining phenotypic characteristics beyond gene sequence information.

According to IZW, the research areas of host-pathogen co-evolution, spatially explicit approaches, and diversity of cell functions are particularly suitable for tightening the links between the three research foci.

Results

Research

IZW publishes its research results primarily in international, peer-reviewed journals, with a growing proportion of open access articles. As a complement to conventional scientific publications, it increasingly publishes in so-called stakeholder publications in media serving different stakeholders. During the reporting period (2010 to 2012), there were 260 articles in peer-reviewed journals (2003 to 2005: 127), 30 contributions by IZW staff in monographs (2003 to 2005: 28), 78 stakeholder publications (this category was only introduced in 2009), and 28 other articles (2003 to 2005: 65). The median impact factors for the reporting years were 2.5 in 2010 and 2.8 in 2011 and 2012. For detailed indicators of the publication record cf. Appendix 2.

Scientific services and infrastructure

IZW offers expertise and methodological competence to external partners; it houses and provides access to five scientific collections and runs a scientific library covering zoo and wildlife research. For more details cf. Chapter 3, the section on Research-oriented Services and Scientific Collections.

Consultancy, knowledge and technology transfer

IZW offers advice to stakeholders and policy makers, regularly holds workshops and laboratory courses, and collaborates with enterprises. These activities are subsumed under “Research-accompanying Activities”; a more detailed description of results is given in Chapter 3, the section on Research-accompanying Activities.

Academic events and public relations

Information on the organisation of and participation in academic events as well as public relations work are given in Chapter 3, section on Research-accompanying Activities.

Appropriateness of facilities, equipment, and staffing

In 2012, IZW's total revenue was € 10.7 million, including € 7.6 million (71 %) in institutional funding, € 2.0 million (19 %) in revenue from project funding grants, € 152,700 (1.4 %) from services (mainly commissioned work) and miscellaneous revenue, and € 944,000 (9 %) from revenue for construction projects (cf. Appendix 3). Between 2006 and 2013, the institute successfully participated in the Leibniz competitive procedure both as lead institution (five times) and as collaborative partner (three times).

IZW has a main building (built in 1984 and modernised in 1994) and two extensions (since 2006 and 2012, respectively). In addition, it operates a field research station in Niederfinow which houses experimental colonies of different mammal species. According to IZW, laboratory facilities at Niederfinow need to be extended to allow the processing of samples for physiological and energetic measurements, reproduction biology and reproduction medicine, and for immunological and genetic research on site. The cost for building these facilities is estimated at € 2 million.

The institute's facilities on the main campus include several laboratories for molecular biology, specific analytical laboratories, cell biology and microbiology laboratories, a transmission and scanning electron microscope unit, a veterinary clinical facility, an endoscopy room, a computed tomography facility (acquired in 2009 in the context of Economic Stimulus Package II), a facility for processing anatomical and morphological samples, and a necropsy facility. As a member of the Berlin Center for Genomics in Biodiversity Research, IZW has access to next generation sequencing equipment and hard- and software for bioinformatic processing.

IZW also maintains passenger vehicles, vans, and off-road vehicles, both in Germany and abroad (Namibia, Tanzania, and Borneo), which the institute describes as good and adequate.

With regard to scientific and technical staff, IZW states that its ability to implement future plans would benefit significantly if it could obtain funding for the following dedicated positions:

- five positions for postdoctoral researchers
- one epigeneticist
- one reproduction biologist
- one field veterinarian
- two CT veterinarians
- one bioinformatician
- one IT manager
- one GIS laboratory assistant
- one stable isotope laboratory assistant
- one technical assistant for research on cell diversity
- one technical assistant for research on host-pathogen co-evolution
- one conference organiser

- one citizen science/public relations officer
- one facility manager

IZW describes its scientific equipment as generally adequate, but mentions that current funding is insufficient in its view to replace outdated or defective equipment and to purchase new equipment to stay up to date with molecular technologies. The funding deficit is estimated at € 700,000 per year.

3. Subdivisions of IZW

Research Focus "Adaptations" (18.4 full-time equivalents [FTE] in research and scientific services, 7.7 FTE doctoral candidates, 15.5 FTE service staff)

Work programme development

In this research focus, traits relevant to life history, social behaviour, reproduction, nutrition, metabolism, morphology, and pathogen resistance are examined with the aim of establishing baseline information for the two goals in the institute's vision, namely to contribute (1) to a predictive framework on the adaptability of wildlife and (2) to the development of appropriate tools for conservation interventions. In comparison with the last evaluation, the spectrum has been refined and regrouped with the explicit intention to promote interdisciplinary projects. As areas defined in this way, IZW mentions (1) long-term experiments and observations on life-history parameters, resource allocation, intraspecific conflicts, and social structure conducted both at the field research station and in the field; (2) studies on sexual conflict, mate choice, and individual reproductive success; (3) investigations of factors regulating reproduction, reproductive strategies, and germ cell and embryonic development; (4) analyses of the traits determining the ecological and evolutionary success of species in niches under varying degrees of human influence, including movement ecology; (5) studies of the genetic basis of important adaptations.

Recent technological developments help generate new perspectives and approaches. For example, IZW now utilises next generation sequencing techniques, proteomics techniques, spatial modelling approaches, advanced imaging techniques, stable isotope analyses, and highly sensitive analytical methods.

Results

During the reporting period (2010 to 2012), there were 116 articles in peer-reviewed journals, six contributions to monographs (including editorships), 37 stakeholder publications, and seven other articles. Highlights amongst the results in this research focus are:

- on life history and social behaviour: first evidence for the influence of high maternal investment on the reproductive careers of sons and for an adaptive shift in X and Y chromosome-bearing spermatozoa in ejaculates of non-domestic species
- in the context of mate choice: effects of the individual constitution of immune gene alleles on ectoparasite susceptibility; in bats, the activation of the immune system was shown to unexpectedly lead to reduced plasma testosterone
- in reproduction: a comparison of endangered feline species with closely related, but not endangered, species showed that both groups exhibit unusual hormone cycles,

thus raising problems with conventional methods of monitoring and manipulating female reproduction; in elephants, the genesis and function of multiple *corpora lutea* were elucidated, and a unique gestation mode was discovered; superconception and its adaptive value were demonstrated in a mammal species, the European brown hare

- regarding niches: in bats, core body temperature and flight metabolism increase significantly during flight in daylight compared to nocturnal flights; the discovery of unique anatomical adaptations in locomotion and vocalisation, using the newly acquired computed tomography facility; low genetic variability over longer time scales than previously determined in koalas; unexpected results in studies on phylogeographic patterns in mammals, challenging the conventional assumption that the current distribution of mammalian species simply reflects dispersal routes in the evolutionary past
- with regard to adaptive genetic variability: the co-existence of specialist and generalist MHC alleles in terms of parasite recognition was found to determine the pattern of MHC polymorphism across habitats; a study on cheetahs showed greater MHC class I variability than expected, challenging conventional textbook knowledge; analysis of the genes responsible for fur colour in archaeological samples showed that the fur colours and patterns of wild horses depicted in prehistoric caves were accurate

Work planning

IZW will continue to apply a comprehensive approach, combining disciplines from biological and veterinary sciences, and use novel techniques to study different facets of adaptations. The ultimate goal is to contribute to a predictive framework on adaptability and thus to improve the ability to assess the need for intervention and to develop appropriate intervention measures.

In the next few years, IZW plans to develop in particular research on adaptive landscape genetic variability, niches in time and space, epigenetic effects, ageing and senescence, pre-implantation processes, and biodiversity of cell functions.

Research Focus "Diseases" (5.9 FTE in research and scientific services, 6.5 FTE doctoral candidates, 4.4 FTE service staff)

Work programme development

In this research focus, the health status of free-ranging and captive wildlife populations, the pathogenesis of important diseases, their immunological and genetic basis and their impact at individual, population, and species levels are examined. In comparison with the last evaluation, the spectrum has been broadened, and links to the other two research foci have been strengthened. Pathogens are recognized not as having a static impact, but as constantly adapting and co-evolving with their hosts. Thus, elucidating wildlife-pathogen interactions is seen as an important factor for understanding adaptability and designing conservation interventions.

Among the new and expanded research areas, IZW mentions (1) the health status of free-ranging and captive wildlife populations, including contacts between wildlife populations, domestic animal species, and humans; (2) the distribution, prevalence, and epidemiology of pathogens and diseases; (3) the impact of diseases on wildlife populations,

including studies on the functional differences between populations with strong or little resistance to pathogens.

IZW takes advantage of recent technological advances such as nucleic acid enrichment techniques to explore previously inaccessible aspects of pathogen diversity, ancient DNA techniques to measure evolutionary changes directly, advanced imaging technologies for non-destructive pathological and forensic examination, and species-neutral immunological methods.

Results

During the reporting period, there were 51 articles in peer-reviewed journals, five contributions to monographs (including editorships), eight stakeholder publications, and twelve other articles. Highlights amongst the results in this research focus include a methodological comparison of conventional with next generation sequencing techniques to estimate the presence of specific viruses, the detection of a key mechanism responsible for the evolution of either specialist or generalist pathogen strains, and studies on the dramatic consequences of the introduction of new pathogens. Furthermore, it could be demonstrated that bottom-up processes and top-down regulation (through predation and infection with pathogens) influence population dynamics in a complex synergistic manner. Cheetah females were shown to achieve high reproductive success and high offspring survival despite low genetic variability in immune genes. Also, a study on zoo animals demonstrated a recombinant zebra virus in polar bears, showing unexpected consequences of creating an epizootic environment not present in the wild. An ancient DNA study on the koala retrovirus showed that the virus has evolved slowly and thus intervention through vaccination may be successful. In mice, an association between climatic variables and parasite prevalence and abundance was found, linking global change with pathogen dynamics.

Work planning

IZW's work in this research focus is embedded in the OneHealth concept, based on the assumption that human, animal, and ecosystem health are inextricably linked. Thus, results on wildlife diseases will be put in the wider context of human and environmental health, focusing on disease dynamics in the contact zone between human activities and wildlife.

In the next few years, IZW plans to expand in particular research on analyses of the immunological status of wildlife populations in the context of disease pressure, allostatic load, and anthropogenic disturbance (eco-immunology), on the molecular identification of known and novel pathogens of wildlife species, and on analyses of microbiomes and viromes of wildlife with the aim of understanding the interaction between pathogens and the host's resident microbiome and distinguishing between "healthy" and "sick" microbiomes.

The institute is currently in the process of establishing a new assistant professorship in "Ecology and evolution of molecular host-parasite interactions" for the molecular study of parasites, their effects on wildlife population dynamics, and their interactions with pathogens and host microbiomes.

Research Focus "Conservation" (9.4 FTE in research and scientific services, 4.6 FTE doctoral candidates, 5.5 FTE service staff)

Work programme development

Work in this research focus aims at developing scientific concepts and methods to improve adaptability by conducting research to design conservation intervention measures. To this aim, IZW works directly at the level of individuals and populations as well as indirectly at the landscape level and by changing attitudes and behaviours of stakeholders. Since the last evaluation, this research focus has been reorganised, and links to the other two research foci have been tightened. The following important areas have been identified:

(1) Risk analysis and assessment of wildlife populations: this specifically includes threats resulting from anthropogenic change. Risk factors are considered at individual and landscape levels as well as at the level of human-wildlife interaction such as land use conflicts.

(2) Stakeholder dialogue: in order to resolve human-wildlife conflicts successfully, IZW attempts to involve stakeholders, such as farmers, foresters, livestock owners, hunters, conservationists, lobby organisations, and local governments, during the conception and implementation phases of conservation-oriented research projects.

(3) Novel concepts and methods of conservation: with the aim of reducing the impact of research activities on animals and their habitats, non-invasive and minimally invasive methods are developed. Assisted reproduction technologies in combination with genome banking methods are improved to aid critically endangered species.

Technological developments are exploited, e. g. the improved portability of imaging equipment for use in field studies, the improved design and analysis of camera-trapping studies, the use of high-resolution satellite data in combination with GPS transmitters to track the movement of individuals, advances in statistical data analysis, spatially explicit models, and agent-based modelling, improved sensitivity in analytical methods, and advances in cryopreservation methods.

Results

During the reporting period, there were 74 articles in peer-reviewed journals, 14 contributions to monographs (including editorships), 22 stakeholder publications, and nine other articles. Highlights amongst the results include:

- regarding risk analysis and the assessment of wildlife populations: European bats suffer pathogen-induced illness and mortality caused both by agents pathogenic to many mammalian hosts and by agents specific to bats; the detrimental impact of wind power plants in Germany on bats extends to nearby as well as geographically distant populations; the importance of native vegetation cover for species persistence in fragmented landscapes and the relevance of genetic vulnerability to efforts to save critically endangered species; IZW initiated the establishment of a national wolf health monitoring programme
- considering stakeholder dialogue: its importance was highlighted by demonstrating that current procedures for analysing diet composition from faecal samples are likely to lead to an underestimation of the consumption of livestock by carnivores and thus

of conflicts over land use; in a project on wildlife poisoning by lead-based hunting ammunition, different stakeholder groups were successfully involved

- with regard to new concepts and methods in conservation: contribution to the development of camera trapping methods and application of advanced modelling techniques to infer historical and current distributions of less known, but threatened species; first successful insemination of a captive African elephant with semen collected from free-ranging males, thus demonstrating how captive and wild populations can be linked genetically without the risk of spreading diseases; development of an integrated conservation management plan for Sumatran rhinoceroses in collaboration with Malaysian colleagues; development of a pregnancy test to support the Iberian lynx captive breeding programme, with possible applicability of this procedure to other cat species

Work planning

Building on the realisation that most habitats are under some form of human influence, IZW departs from a clear-cut distinction between populations in captivity (*ex situ*) and in the wild (*in situ*) and rather considers entire meta-populations of species. Following this so-called OnePlan approach, it aims to find ways of connecting wildlife in captivity with free-ranging populations and to develop appropriate and innovative methods of wildlife conservation.

Accordingly, in the next few years, IZW plans to continue developing integrated species management strategies and to incorporate biotechnological methods such as cell culture and cryopreservation in conservation. According to the institute, it will be important to expand the concept of ecosystem services and pinpoint the economic benefits of conservation measures in order to convince different stakeholders to support such measures. IZW will also continue to provide information to stakeholders and the public and to involve them in the planning and execution of conservation-related research.

Research-accompanying Activities (5.0 FTE in research and scientific services, no doctoral candidates, 8.6 FTE service staff, 9.0 FTE vocational trainees)

Work programme development

IZW offers advice to and communicates with stakeholders, policy-makers, and the general public, regularly holds workshops and laboratory courses, and collaborates with small and medium-sized enterprises. In recent years, the institute has shifted its communication model from one-way transfer to mutual knowledge exchange. Where suitable, it attempts to involve stakeholders or members of the general public in the design and implementation of conservation-related research projects.

Research-accompanying Activities also include academic events and public relations work.

Results

IZW regularly offers advice to policy-makers. For example, IZW scientists have been actively involved in the discussion process on the amendment of the Federal Animal Welfare Act during the past few years and are members of various national and international expert groups and committees.

Different stakeholders, such as farmers, livestock owners, foresters, hunters, conservationists, lobby organisations, and local governments, are included in all phases of some conservation-related research projects. According to IZW, this interaction has proven fruitful and provided valuable input for designing appropriate research on intervention measures and suggesting solutions to human-wildlife conflicts.

IZW scientists regularly hold training workshops, laboratory courses, and summer schools on topics such as imaging techniques, reproduction biology, cryopreservation and vitrification of cells and tissues, statistical analyses, non-invasive hormone monitoring, wildlife diseases, genetic methods, and movement ecology.

The institute collaborates with small and medium-sized enterprises, promoting technology transfer in the areas of medical technologies, telemetry, and automated recording of behaviour. Employees at IZW are encouraged to patent new technological developments and found spin-off companies. The institute currently holds five patents.

Between 2010 and 2012, IZW organised ten international conferences and symposia (and co-organised a further four) and 50 national and international workshops.

The institute has published 48 press releases in German and 24 in English and was featured in 43 radio interviews, 70 television programmes, and more than 1,300 articles in print media. The famous polar bear *Knut* (died in Berlin Zoo in March 2011) was a special media highlight. IZW performed the necropsy and determined the cause of death. The institute's contribution was documented in 435 print articles. IZW has also produced four short films using the Sabah Rhino as a flagship to communicate conservation and sustainable development issues.

IZW participates in the Long Night of the Sciences and holds an Open Day each year. It accommodates visiting groups from schools and universities and receives delegations from national and international institutions and organisations.

During the reporting period, five peer-reviewed conference proceedings and nine stakeholder publications were published.

Work planning

In order for science-based concepts and methods for conservation to be successful, they need to be properly communicated to and taken into account by decision makers, conservation organisations, relevant interest groups, and the general public. IZW thus plans to expand its activities in the areas of communication and technology exchange. Among its initiatives are:

- a wind power stakeholder process with the aim of finding sustainable solutions to the conflict between two conservation objectives, the switch to renewable energy resources and the protection of endangered species (according to a study by IZW, large numbers of bats from distant populations fall victim to wind power plants)
- implementation of citizen science projects, whereby interested members of the public collect data for scientific projects; for example, a study of the ecology and population dynamics of wild boar in Berlin has been started in the CityScapeLabs (as part of the landscape laboratories developed by the Berlin-Brandenburg Institute of Advanced Biodiversity Research, BBIB)

- Biodiversity Policy Research Laboratories to assess the efficacy of policy and legal frameworks in maintaining biodiversity and ecosystem services
- collaboration with Technical University of Berlin to use computed tomography data for exhibitions using 3D visualisations of wildlife (working title: "Value of nature")

Appropriateness of facilities

IZW refers to an urgent need for an additional full-time staff position for the PR office and a full-time staff position for conference organisation (cf. Chapter 2, the section on Appropriateness of facilities, equipment, and staffing).

Research-oriented Services and Scientific Collections (3.9 FTE in research and scientific services, no doctoral candidates, 2.1 FTE service staff)

Work programme development

IZW offers expertise and methodological competence to external partners from science, government, industry, conservation agencies, and zoological gardens. It houses and provides access to five scientific collections and runs a scientific library covering a wide array of topics relevant to zoo and wildlife research. This library is open to external users.

Since the last evaluation, services in stable isotope analyses have been expanded. In 2009, a computed tomography facility was acquired. It is one of the highest resolution CT scanners in veterinary institutions worldwide and facilitates the non-invasive generation of 3D models of body parts and the performance of 4D analyses in real time.

Results

Among the services offered to external partners are wildlife pathology and disease diagnostics (more than 1,800 post-mortems and 1,800 diagnoses from 2010 to 2012), the evaluation of reproductive status in wildlife (45), non-invasive hormone monitoring (about 2,300 samples), forensic services (10 cases), electron microscopy (88 samples), stable isotope analyses (more than 24,000), and computed tomography (more than 2,000 scans).

The five scientific collections are (1) a pathological-anatomical reference collection (PARS; approximately 54,000 specimens), (2) a morphological collection (specimens of about 240 species), (3) a genome resource bank (Arche; approximately 3,500 blood or tissue samples from 500 wildlife species), (4) a gamete resource bank (at least 100 cryopreserved samples for cat species alone), (5) a digital case collection of ultrasound recordings, images, and video recordings. All of these collections grow continuously.

Research-oriented Services are integrated in the institute's research activities. During the reporting period, 19 articles in peer-reviewed journals and two stakeholder publications were published. According to IZW, a particularly successful research project was the development of an immunoassay measuring prostaglandinF2α metabolites in faeces, providing a non-invasive method to distinguish pseudopregnancies from pregnancies in felid species. This assay has been issued as a commercial licence.

Work planning

IZW aims to maintain the current ratio of Research-oriented Services to scientific research at roughly one to ten, while improving and refining its services and methods. The scientific collections will be expanded further. It is planned to transfer the pathological-anatomical reference collection database to an SQL-based system including a web-based search function to improve the accessibility of the data for external users.

Appropriateness of facilities

Due to the perpetual growth of the scientific collections, IZW refers to the need to expand storage capacity for the pathological archive and the liquid nitrogen facility (i. e. the Gamete Resource Bank). In addition, much larger, safe, redundant digital storage capacity is needed according to IZW to file the increasing amount of data from digitised collection data, next generation sequencing, and CT scans.

4. Collaboration and networking

Collaboration with universities

Both the director of IZW and the head of the Department of Wildlife Diseases hold joint professorships with Freie Universität Berlin (FU Berlin). Another joint appointment (for the head of the Department of Reproduction Management) is currently being established. The head of the Department of Reproduction Biology holds an extraordinary professorship at Humboldt-Universität zu Berlin (HU Berlin). The head of the Department of Evolutionary Genetics holds an extraordinary professorship at the University of Potsdam (UP); it is currently being converted to a full professorship. Four other IZW scientists hold positions as *Privatdozenten* at FU Berlin, HU Berlin, and the University of Stuttgart-Hohenheim. IZW plans to establish three assistant professorships as joint appointments with HU Berlin ("Ecology and evolution of molecular parasite-host interactions") and FU Berlin ("Disease ecology" and "Diversity of cellular functions and phenotypes").

Doctoral candidates writing their theses at IZW are officially enrolled at FU Berlin, HU Berlin, or UP. IZW scientists also co-supervise doctoral candidates at these universities and are involved in the Master's programme "Evolution across scales" at UP. Additionally, they teach at universities in Munich, Leipzig, Dresden, Vienna (Austria), London (UK), Santander (Spain), and Beer-Sheba (Israel).

IZW is also involved in coordinated programmes: the DFG-Research Training Group GRK 1121 "Genetic and immunologic determinants of pathogen-host-interactions" and the International Max Planck Research School for Infectious Diseases and Immunology, both of which are part of the ZIBI Graduate School at the Center of Infection Biology and Immunity at HU Berlin.

Besides cooperating with regional universities, IZW maintains research collaborations with more than 100 university institutes in Europe, Africa, Asia, Australia, North and South America.

Collaboration with other domestic and international institutions

IZW is a founder, lead or active partner in several research consortia and networks, such as the Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), the Berlin Consortium for Genomics in Biodiversity Research (BeGenDiv), the Berlin-Brandenburg Center for Stable Isotope Ecology (CeSIE), the Berlin Center for Biodiversity in Cell Functions (BiC), the Center of Infection Biology and Immunity (ZIBI), the Center for Genetic Variability and Adaptability, and the Competence Network Reproduction Biology (ReproTier). The partners comprise the regional universities, Charité – Universitätsmedizin Berlin, and other research institutions including six Leibniz institutes, several Max Planck institutes, and the Robert Koch Institute.

During the last three years, IZW has participated in four EU projects: as an official partner of the Mammal Research Institute in the Polish Academy of Sciences in Białowieża, funded as a Center of Excellence, as coordinator of the subgroup Cervids in a European network of excellence dedicated to research on prion diseases (NeuroPrion), and as a collaborative partner in the EU consortium WildTech and the EU project E-Track.

IZW also maintains contacts and collaborative projects with conservation organisations including the Species Survival Commission of the International Union for Conservation of Nature (IUCN), the German Federation of Zoo Directors, the European Association of Zoo and Wildlife Veterinarians (EAZWV), the European Association of Zoos and Aquaria (EAZA), and the World Association of Zoos and Aquariums (WAZA). Several staff members of IZW are members of IUCN/SSC Specialist Groups.

Other collaborations, networks, and visits

IZW participates in several national and international networks. It is a founding member of the Leibniz Biodiversity Network and the research network “European roe deer information system” and is a member of the German National Platform on Zoonoses Research, the Global Management and Propagation Board for Sumatran Rhinos, the Netzwerk Umwelt (a consortium of universities and research institutions in Berlin and Brandenburg), and the Frozen Ark Consortium. It also participates in the cooperative network for the early detection of behavioural disorders in farm animals and wildlife and in the network “European endangered species program for Przewalski horses”.

Between 2010 and 2012, IZW hosted 63 visiting scientists, most of them (52 ? 83 %) from abroad, including many non-European countries; 24 of them (38 %) stayed for more than three months. During the same period, IZW scientists went abroad on a total of 156 occasions; 45 visits (29 %) lasted more than three months.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

At the end of 2012, 118 people (97.5 full-time equivalents, FTE) were employed at IZW (excluding student assistants [14], vocational trainees [9], volunteers [7], doctoral candidates [14] or postdoctoral researchers [3] with external scholarships, and doctoral candidates earning their salary elsewhere [10]), 68 of them (53.9 FTE) working in re-

search and scientific services, 43 (37.1 FTE) in service positions, and 7 (6.5 FTE) in administration (cf. Appendix 4).

Of the 85 scientists (including scholarship recipients, but excluding doctoral candidates with external salaries), 75 % (64 persons) held fixed-term contracts. The proportion of women in this group was 58 % (49 women) (cf. Appendix 4).

No changes at academic leadership level (heads of department) have occurred since the last evaluation; two of the five positions are occupied by women. IZW has set itself the goal of upgrading all head of department positions to university professorships. This process is well underway (cf. Chapter 4, the section on Collaboration with universities).

IZW aims to recruit scientific staff and doctoral candidates from the international scientific community. Accordingly, all vacancies are advertised in both German and English print and online media. The number of foreign scientists increased from three in 2005 to ten in 2012, the number of foreign doctoral candidates from five in 2005 to 16 in 2012.

Promotion of gender equality

IZW endorses the German Research Foundation's (DFG) "Research-oriented standards on gender equality" which have been adopted by the Leibniz Association. A gender equality officer and deputy are elected by all female members of staff.

In 2012, the proportion of women was 57 % (21 out of 37) among doctoral candidates, 60 % (26 out of 43) among academic staff holding a doctoral degree but not in executive positions, and 40 % (two out of five) among the heads of the scientific departments. According to IZW, the proportion of male doctoral candidates has increased significantly in the past few years due to actively encouraging qualified male candidates to apply for open positions. In 2011, IZW was awarded the Total E-Quality certificate.

IZW now aims to increase support for employees with young children or family members in need of special care. Many employees work part-time, and the institute has introduced flexible working hours and home office days. Seminars are held in the early afternoon. Recently, a parent-child office for parents requiring *ad hoc* child care was established.

Promotion of junior researchers

All scientists are encouraged to participate in professional training courses and to engage in teaching activities. They are assisted when preparing their *Habilitation*. Veterinary scientists are supported in acquiring their qualification as specialist veterinarians.

Between 2010 and 2012, 27 academic degrees qualifying for doctoral work (diploma, Master's, *Staatsexamen*) were completed under the supervision of scientists working at IZW.

During the same period, 23 doctoral dissertations were completed at IZW. For doctoral candidates, Guidelines for Doctoral Dissertations have been revised and updated. Besides the scientific supervisor(s), there are two staff scientists who serve as general advisors to all doctoral candidates. New candidates are required to prepare a project proposal in English during their first months, present their project, and regularly discuss their progress in monthly seminars. Contracts are initially issued for two years, and a

work plan for a potential third year must be outlined and discussed before contracts are extended beyond these two years. The average duration of a doctoral dissertation at IZW is 3.7 years.

For positions funded from the institutional budget, IZW aims to employ doctoral candidates on 65 % research positions; no stipends are provided by the institute. Several doctoral candidates are enrolled in structured doctoral training programmes, such as the Dahlem Research School at FU Berlin or the ZIBI Graduate School at the Center of Infection Biology and Immunity at HU Berlin. IZW also offers financial support for attending conferences.

According to IZW, the institute does not have any positions for postdoctoral researchers financed from institutional funding. Senior scientists help promising doctoral candidates to write funding proposals, and positions for postdoctoral researchers are regularly included in IZW grant proposals. The institute has repeatedly applied for institutional funding for a Junior Research Group; however, this has not been approved so far. A proposal for an externally funded Junior Research Group has been submitted to BMBF.

Two IZW scientists completed their *Habilitation* in 2008 and 2010, respectively. One staff scientist was appointed full professor at the University of Stuttgart-Hohenheim in 2009; one postdoctoral researcher was appointed assistant professor at the University of Göttingen in 2011. One department head was appointed honorary professor at the University of Melbourne, Australia, in 2012.

Vocational training for non-academic staff

IZW offers apprenticeships for biology laboratory assistants, office administrators and specialists for office communication, zoo keepers, and IT specialists. The institute benefits from educating trainees in terms of the additional workforce and the up-to-date knowledge and skills of the technical staff involved in training activities. Trainees who complete their examinations successfully are employed by IZW for at least one year following their apprenticeship. Between 2010 and 2012, six trainees finished their vocational training. At the end of 2012, nine trainees were employed at IZW.

IZW regularly offers additional training for its technical staff. They are also encouraged to participate in subject-specific courses to develop and extend their professional skills, and they are supported in becoming apprentice instructors.

Volunteers and work placements

Between 2010 and 2012, 16 young people on a Voluntary Ecological Year and two additional volunteers from the Federal Volunteer Service joined IZW. During the same period, 123 secondary school pupils and undergraduate students did work placements in different departments or the public relations office.

6. Quality assurance

Internal quality management

At IZW, quality management procedures for research are in place at project and department level. At project level, quality is monitored via internal cost and performance accounting. Under this system, the total costs of a project are set in relation to its total output including the number of publications, presentations, talks, lectures, amount of third party funding, and patents as well as outreach and knowledge transfer activities. At department level, output is appraised at regular meetings by the department heads. The quality management regime for research-oriented services is published on the institute's website and thus available to its clients.

IZW has formally endorsed and is fully committed to the German Research Foundation's Rules of Good Scientific Practice. The institute has additionally enacted its own documents and has made good scientific practice an integral part of its Structured Doctoral Training Programme. Good Scientific Practice entails conducting research according to international standards and implementing a comprehensive quality management scheme. All methods and results have to be documented and stored in order to ensure transparency and reproducibility and to allow the critical examination of all findings.

The institute has created the position of an ombudsman who is elected every three years by the institute's scientific personnel. All new doctoral candidates, postdoctoral researchers, project and staff scientists starting at IZW are introduced to the ombudsman.

Individual performance is measured using a points system developed by IZW's staff and agreed upon by the directorate. The underlying criteria have been refined with regard to the allocation of performance-related funds to research departments and of performance-related bonuses (1 % of pre-tax salary) to individual employees. For scientists, the individual score is based on a points system incorporating publications, external funds, lectures, oral presentations, posters at conferences, supervision of students, cross-departmental scientific support, and services to the scientific community. Scientists primarily allocated to research-oriented services are rewarded by doubling the number of points for each peer-reviewed publication. In addition to evaluating their performance in their main tasks, technical staff receive extra points for supporting members of other departments and participating in PR activities.

Quality management by the Scientific Advisory Board and Supervisory Board

The Scientific Advisory Board (SAB) advises the institute's management on fundamental questions regarding the research programme, strategic development, and national and international networking. Every year, it reviews the work of one of the research departments. In 2003 and 2009/2010, the SAB conducted audits taking into account the performance of the entire institute.

Implementation of recommendations from the last external evaluation

The main recommendations from IZW's last evaluation conducted by the Senate of the Leibniz Association in 2006/2007 (in *italics*), were addressed by IZW as follows:

GENERAL CONCEPT AND PROFILE

1. *The diversity of research topics addressed by the institute is problematic. IZW has to focus its research activities to core topics and should develop a coherent research programme [...]. [...] IZW should develop a strategy to emphasise the aspects of basic research. The overarching Research Foci should be more precisely defined and should reflect a problem-solving approach.*

According to IZW, since the last evaluation, the institute has developed a research strategy with the goal of "understanding and improving the adaptability of wildlife". IZW states that it has explicitly refrained from reducing the number of disciplines and approaches represented at the institute, since it firmly believes the diversity of competences and perspectives to be a unique asset of IZW and a vital prerequisite for reaching the stated goal. Nevertheless, by creating a comprehensive conceptual framework and common goals, the institute has strengthened its interdisciplinary, problem-oriented (rather than discipline-oriented) approach. The institute's Research Foci have been conceptually refined in the context of the institute's strategy.

2. *Although the number of peer-reviewed publications has shown a positive development, it needs to be further increased. Emphasis should be put on journals with higher impact factors.*

According to IZW, both the number of peer-reviewed publications (a total of 260 between 2010 and 2012 compared with 127 between 2003 and 2005) and their median impact factor (1.56 in 2005, 2.8 in 2012) have increased substantially (cf. Appendix 2).

3. *Although the amount of external funds raised has shown a positive development, the proportion of third-party funds in the total budget is still considered to be too low. IZW should aim to increase this proportion to 30 %. In particular, EU funds are regarded to have potential for extension.*

In 2012, IZW's revenue from project grants amounted to € 2 million, i. e. 21 % of its total revenue including institutional funding, project grants, and revenue from services. This proportion was 28 % in 2010 and 33 % in 2011 (cf. Appendix 3). According to IZW, the changes in the proportion of revenue from project grants largely result from significant variation in total revenue due to the acquisition of resources for building construction. In comparison with a 20.5 % increase in institutional funding over the last seven years, the amount of third-party funds was raised by 79.6 %, and the external revenue calculated per full-time-equivalent (FTE) staff scientist allocated to research and research-oriented services grew by 49.3 %. Since the last evaluation, IZW has pursued EU funding possibilities, participated in several consortium applications, and continues to seek participation in FP7 projects. In total, IZW has been a partner in four projects in the past few years, most recently as a funded partner in the EU-FP7-project E-TRACK.

4. *The electron microscope, which is over 15 years old, urgently needs to be replaced.*

An extraordinary item of expenditure granted to IZW in 2008/2009 facilitated the replacement of the electron microscopes.

5. *Services rendered by IZW, in particular those of wildlife pathology and reproduction medicine, should be cost-effective.*

According to IZW, its Scientific Advisory Board recommended that research-oriented services should prioritise strategic considerations. Although this means that IZW's costs

are not always met, the institute considers this inconvenience to be compensated by non-financial benefits (e. g. additional publicity and prestige, access to rare wildlife sample material, and links to research institutes, zoological gardens, and conservation organisations).

SUBDIVISIONS

6. *Research Focus "Adaptations": to achieve a thorough understanding of the complex processes of adaptation, field studies to measure fitness (e. g. sex ratios in roe deer) should be combined with modern reproduction physiological approaches.*

In order to implement this recommendation, IZW has extended and intensified its collaborations in roe deer research with the Bavarian Forest National Park (Germany) and the Białowieża National Park (Poland). Furthermore, field studies operating mainly at population level are complemented by experimental studies at the institute's field research station.

7. *Research Focus "Diseases": IZW should incorporate toxicological investigations into its research portfolio.*

The field of toxicology is integrated in the Department of Wildlife Diseases.

8. *Research Focus "Conservation": projects in this Research Focus cover a very broad range of topics. Thus this focal point needs to be modified. The projects on "land use conflicts" and on "in situ conservation" lack scientific depth in places. [...] Work on projects related to these topics should therefore be reduced.*

In the Research Focus "Conservation", topics have been newly structured, streamlined, and better integrated. As of 2007, they are as follows: (I) risk analysis and risk assessment of free-ranging wildlife populations, (II) developing and improving mediated stakeholder discussions to assess potential conflicts between wildlife and people, (III) development and implementation of concepts and methods for conservation interventions in endangered species.

9. *Department of Wildlife Diseases: projects should be more focused to avoid the dilution of capacities. Presently the institute lacks methods such as confocal electron microscopy and other modern imaging methods. IZW should contact other institutions in Berlin to gain access to these important methods. IZW should also decide whether the pathology unit should mainly provide services or participate in competitive research.*

According to IZW, the work of the department has been developed and re-aligned to be consistent with the conceptual framework of resistance, resilience, and adaptability of wildlife populations.

In 2009, a life cell imaging system was installed at the Department of Reproduction Biology, and in 2011, it was supplemented by confocal laser scanning and fluorescence lifetime imaging.

Pathology research at IZW has become internationally competitive thanks to the development of the research topics addressed by the institute's two pathologists.

10. *Department of Reproduction Biology: work in reproduction biology should be underpinned with functional genome research. The staffing of the group should be complemented by an expert in molecular biology / proteomics.*

Functional genomics has now become a core topic for cross-departmental collaboration and has been implemented by establishing the Berlin Center for Genomics in Biodiversity Research. A project on paternal epigenetic effects, funded through the Leibniz competitive procedure from 2011 to 2014, is led by the Department of Reproduction Biology. Epigenetics is being established and developed in close cooperation between the Departments of Reproduction Biology and Evolutionary Genetics.

11. IZW has currently implemented only one Programme Area in the Programme Budgets [...]. It is strongly recommended to modify the Programme Area structure [...].

In 2008, IZW established a second Programme Area "Services", which encompasses the research-oriented scientific services and the collections.

COLLABORATION AND NETWORKING

12. IZW should promote its internationalisation. It needs to increase its efforts to intensify international exchange of scientists with other research institutions. It also needs to attract more renowned international scientists to work at IZW.

IZW has promoted internationalisation. In the last three years, stays abroad by members of the institute have increased by 24 % compared to 2005. The number of visiting scientists has increased by 97 % since 2007. In addition, the number of international scientists working at IZW has increased since the last evaluation in 2006, both in terms of researchers (from three in 2005 to ten in 2012) and doctoral candidates (from five in 2005 to 16 in 2012).

STAFF DEVELOPMENT AND PROMOTION OF YOUNG SCIENTISTS

13. In the Department of Evolutionary Ecology, a technical assistant is required to look after the isotope mass spectrometry equipment. For an in-depth expansion of projects in the fields of land use conflicts and in situ conservation, a GIS expert is absolutely essential. The Department of Reproduction Biology ought to be strengthened by expert knowledge in the area of molecular biology / proteomics. The access to technical assistants is not evenly distributed across departments; in particular the Department of Reproduction Management appears to be understaffed. To maintain its high-quality work, the Department of Reproduction Management needs additional personnel.

In 2009 and 2010, a molecular biologist was hired for the Department of Reproduction Biology and a GIS expert for the Department of Evolutionary Ecology. A technical assistant for the stable isotope laboratory and an additional technical assistant for the Department of Reproduction Management were recruited as well.

14. The establishment of a Junior Research Group at IZW is emphatically recommended.

As institutional funding to create a Junior Research Group has been applied for in the Programme Budget every year, but was not available so far, an application for external funding for a Junior Research Group was submitted to the Federal Ministry of Education and Research (BMBF) and was evaluated positively. The proposal for the second round has been submitted.

15. Projects for doctoral theses should be derived more frequently from the institute's core topics and should be better integrated.

The proportion of doctoral candidates funded by third-party revenue has increased substantially, and the institute has been successful in acquiring large externally funded research projects. The internal selection of projects to be proposed for these funding programmes is based on scientific excellence and relevance to the institute's strategic goals.

16. To improve their competitiveness, IZW is advised to support its employees when applying for graduation in advanced international education programmes.

IZW encourages and provides support for its staff members to participate in international education programmes and to qualify for international certificates in specialised disciplines.

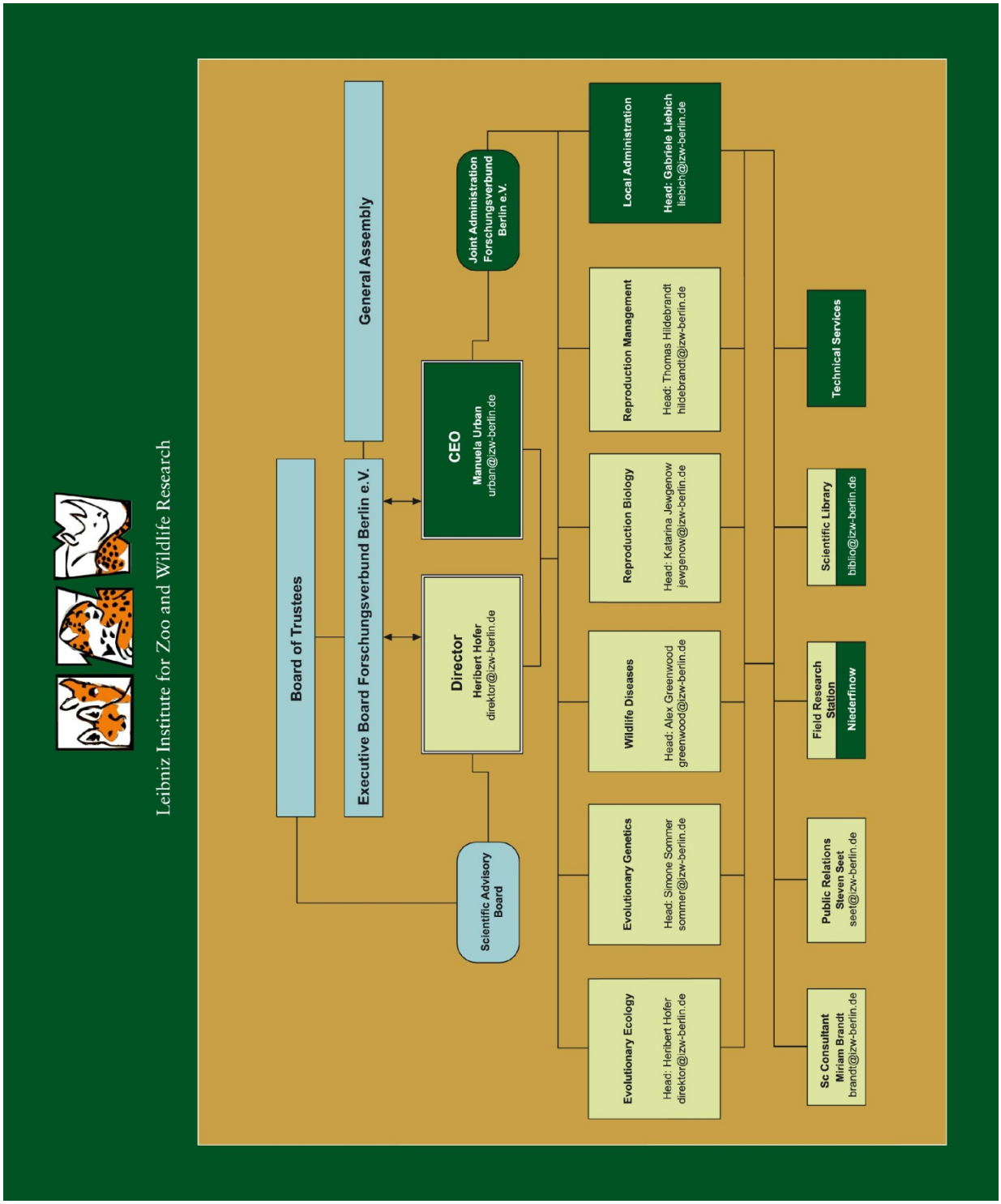
QUALITY ASSURANCE

17. The Scientific Advisory Board of IZW should have more international members. It is also desirable that more members reflect the evolutionary orientation of the institute.

At present, six out of the ten members come from abroad (Austria, Denmark, Finland, Netherlands, UK). Competence in evolutionary theory was enhanced by two new members.

Appendix 1

Organisational chart



Appendix 2

Publications and patents

	Period		
	2010	**2011**	**2012**
Total number of publications	**124**	**139**	**133**
Monographs, editorships of books, peer-reviewed book chapters	7	17	6 [5]
Articles in peer-reviewed journals [1)]	74	87	99 [37]
Articles in other journals or proceedings	17	7	4 [0]
Stakeholder publications [2)]	26	28	24 [2]
Publications co-authored with other subdivisions	26	26	36 [5]
Publications co-authored by different departments	20	22	29 [9]
Number of publications per full-time equivalent (FTE) in "research and scientific services" (not including doctoral candidates)	3.0	3.4	3.2

Industrial property rights (2010–2012)	Granted	Registered
Patents	1	0
Other industrial property rights	1	1
Utilization agreements / licences (number)	2	

[1] Contributions that have been accepted for publication but not yet appeared are added in [brackets].
[2] Stakeholder publications are articles written for specific stakeholder groups and published in periodicals read by them.

Appendix 3

Revenue and expenditure

Revenue		2010			2011			2012 [1]		
		k€	% [2]	% [3]	k€	% [2]	% [3]	k€	% [2]	% [3]
Total revenue (sum of I., II. and III.; excluding DFG fees)		**9,719.6**			**11,193.2**			**10,724.8**		
I.	**Revenue (sum of I.1., I.2. and I.3)**	**9,632.7**	**100,0**		**11,080.8**	**100,0**		**9,667.4**	**100,0**	
1.	Institutional funding (excluding construction projects and acquisition of property)	6,879.6	71.4		7,308.1	66.0		7,602.2	78.6	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* Governments according to AV-WGL	6,879.6			7,308.1			7,602.2		
1.1.1	*Institutional funding received through the Leibniz competitive procedure (SAW-Verfahren)* [4]	*408.3*			*385.3*			*163.3*		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	0.0			0.0			0.0		
2.	Revenue from project grants	2,702.8	28.1	100,0	3,698.6	33.4	100,0	2,025.9	21.0	100,0
2.1	DFG	461.2		17.1	430.0		11.6	306.5		15.1
2.2	Leibniz competitive procedure (*SAW-Verfahren*) [4]	0.0		0.0	247.9		6.7	604.0		29.8
2.3	Federal, *Länder* Governments	1,496.7		55.4	2,079.7		56.2	191.7		9.5
2.4	EU	0.0		0.0	0.0		0.0	27.6		1.4
2.5	German Academic Exchange Service (DAAD)	23.5		0.9	55.4		1.5	55.0		2.7
2.6	Other publically funded institutions	79.7		2.9	91.9		2.5	272.2		13.4
2.7	Zoological Gardens	143.7		5.3	33.2		0.9	39.2		1.9
2.8	Foundations	168.9		6.2	395.8		10.7	259.7		12.8
2.9	Industry / Business	171.8		6.4	125.8		3.4	98.5		4.9
2.10	Workshops, congresses	157.3		5.8	238.8		6.5	171.5		8.5
3.	Revenue from services	50.3	0.5		74.1	0.7		39.3	0.4	
3.1	Revenue from commissioned work	43.8			68.5			37.5		
3.2	Revenue from publications	6.5			5.5			1.8		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models etc.)	0.0			0.0			0.0		
3.4	Revenue from exploitation of intellectual property without industrial property rights	0.0			0.1			0.0		
II.	**Miscellaneous revenue** (e. g. membership fees, donations, rental income, funds drawn from reserves)	**86.9**			**112.4**			**113.4**		
II.1	Own income	78.2			108.9			112.3		
II.2	Financial income from previous year (reserves)	8.7			3.5			1.1		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* Governments, EU structural funds, etc.)	**0.0**			**0.0**			**944.0**		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		**8,948.9**	**11,749.4**	**10,754.3**
1.	Personnel	5,318.9	5,748.9	5,949.4
2.	Material resources	2,237.6	2,472.8	2,521.8
2.1	*Expenditures used for registering industrial property rights (patents, utility models etc.)*	*9.6*	*2.7*	*1.8*
3.	Equipment investments and acquisitions	957.9	1,156.4	1,093.7
4.	Construction projects, acquisition of property	91.8	2,148.1	892.8
5.	"Reserves" (e. g. cash assets, unused funds)	3.5	1.1	51.2
6.	Miscellaneous items	339.2	222.1	245.5

DFG fees (2.5 % of revenue from institutional funding)	176.4	174.7	185.8

[1] Preliminary data: yes/no

[2] Figures I.1, I.2 and I.3 add up to 100 %. The information requested here is thus the percentage of "Institutional funding (excluding construction projects and acquisition of property)" in relation to "Revenue from project grants" and "Revenue from services".

[3] Figures I.2.1 to I.2.10 add up to 100 %. The information requested here is thus the percentage of the various sources of "Revenue from project grants".

[4] Competitive procedure of the Leibniz Association: until 31 December 2010, funds allocated through this procedure were designated as institutional funding. Since 1 January 2011, the Leibniz Association has granted these funds as project grants.

Appendix 4

Staff

(as of 31 December 2012)

	Full time equivalents		Employees		Female employees	
	Total	on third-party funding	Total	on fixed-term contracts	Total	on fixed-term contracts
	Number	Percent	Number	Percent	Number	Percent
Research and scientific services	**53.9**	36	**78**	69	**44**	78
Professors / Directors (C4, W3, or equivalent)	1.0	0	1	0	0	0
Professors / Directors (C3, W2, A16, or equivalent)	1.0	0	1	0	0	0
Academic staff in executive positions (A15, A16, E15, or equivalent)	3.0	0	3	0	2	0
Junior research group leaders / junior professors / post-doctoral fellows (C1, W1, A14, E14, or equivalent)	0.0	0	0	0	0	0
Scientists in non-executive positions (A13, A14, E13, E14, or equivalent) on staff positions (*Planstellen*)	21.9	0	22	32	11	45
Scientists in non-executive positions (A13, A14, E13, E14, or equivalent) on project/postdoc positions	14.2	77	18	94	12	100
Doctoral candidates (A13, E13, E13/2, or equivalent)	12.8	65	23	100	12	100
Doctoral candidates supervised at IZW, but earning salaries elsewhere			10		7	
Service positions	**37.1**	13	**43**			
Laboratory (E9 to E12, upper-mid-level service)	3.8	0	4			
Laboratory (E5 to E8, mid-level service)	22.6	9	26			
Animal care (E5 to E8, mid-level service)	3.2	19	4			
Facility manager, car pool service, workshops (E5 to E8, mid-level service)	2.0	0	2			
Library (E9 to E12, upper-mid-level service)	1.4	0	2			
Information technology - IT (E9 to E12, upper-mid-level service)	1.0	0	1			
Director's secretary	1.0	0	1			
Workers council	0.1	0	1			
Conference organisation	2.0	100	2			
Administration	**6.5**	0	**7**			
Head of administration (E9 to E12, upper-mid-level service)	**1.0**	0	1			
Research coordinator, public relations (from E13, senior service)	2.0	0	2			
Internal administration (financial administration, personnel, etc.) (E5 to E8, mid-level service)	3.5	0	4			
Student assistants	**4.4**	79	**14**			
Vocational trainees	**9.0**	0	**9**			
FÖJ/BFD (voluntary ecological year / social year)			**7**			
Scholarship/stipend recipients at the institution	**9.0**	100	**17**		**12**	
Doctoral candidates	6.0	100	14		9	
Post-doctoral researchers	3.0	100	3		3	

16 October 2013

Annex B: Evaluation Report

Leibniz Institute for Zoo and Wildlife Research (IZW)
in the *Forschungsverbund Berlin e. V.*

Contents

1. Summary and main recommendations

IZW successfully studies evolutionary aspects of wild species and the interaction of wildlife with humans and the environment. One of its important objectives is to develop a better predictive framework on the adaptability and survivability of potentially threatened species and, if necessary, appropriate intervention measures. In addition to its research work, IZW provides high-quality scientific services and is very active in political and public consultancy as well as in knowledge and technology transfer.

Since the last evaluation, the institute has developed very well under the dedicated and competent leadership of the director. The overarching thematic objectives are now convincing, and the structure with its three Research Foci has proved useful. This has led to much better networking amongst the five discipline-based departments in the last few years. The ongoing projects are extremely diverse, thus a strong thematic focus in all research undertakings is encouraged. The conceptual framework with its objectives of understanding and improving the adaptability of wildlife and designing appropriate conservation intervention measures is a good basis for achieving greater coherence in research.

The institute's publication record has improved significantly since the last evaluation. IZW should continue this positive trend. All three Research Foci perform at a "very good" level. The institute's special strengths include the work conducted in reproductive biology and reproductive medicine, which contributes significantly to its reputation. In order to achieve its strategic goals of developing predictive frameworks on the adaptability and survivability of endangered species, IZW must continue to strengthen its expertise in theoretical modelling, programming, and biostatistics.

Currently, the institute is very well equipped, not least as a result of acquisitions made using special funding; this is an important basis for both research and scientific services. In order to ensure that the equipment can be maintained and that IZW can continue to compete on a high scientific level, provision must be made for adequate investment to be available in the coming years.

Particular attention should be paid to the following recommendations in the evaluation report (highlighted in **boldface** in the text):

GENERAL CONCEPT AND PROFILE

1. The large number of research projects covers a broad thematic spectrum. The institute must make efforts to align these projects more systematically to its overarching strategies and objectives in order to achieve greater coherence. This will require a strong thematic focus in all research areas.
2. In order to attain its goal of contributing to a predictive framework on the adaptability of wildlife species to environmental change, IZW must significantly enhance its existing expertise in theoretical modelling, programming, and biostatistics. This could be achieved by hiring additional modellers and theoreticians and by establishing systematic, comprehensive training and continuing education measures for all scientists in the relevant techniques.

3. IZW should investigate which other wildlife species would be suited for long-term studies and aim to include at least one Central European species to gain a better understanding of wildlife in temperate regions as well.
4. The *Land* Berlin government does not intend to increase investment funding in the coming years. In the mid-term, this could make it difficult to maintain equipment at an appropriate, state-of-the-art level.
5. In the area of third-party fund-raising, there is still room for improvement which should be exploited in the future, especially with regard to EU funding opportunities. When raising third-party funding, the institute should take care not to overstretch the thematic spectrum of its projects. Rather, the third-party projects should make a greater contribution to sharpening the institute's profile.
6. In comparison with the last evaluation, the publication record has been improved both in terms of quantity and quality. The number of publications has reached a very good level. IZW's efforts to increasingly publish in open access journals are recognized and should be further intensified in order to facilitate broader dissemination of the research results. IZW should also attempt to further increase the proportion of publications in high-ranking, internationally visible journals.

SUBDIVISIONS OF IZW, "RESEARCH-ORIENTED SERVICES AND SCIENTIFIC COLLECTIONS"

7. The institute's five collections are of great scientific value and are well maintained. However, the metadata management of the holdings must be improved in order to make them accessible – electronically and as widely as possible. It is recommended to devise an appropriate project and procure third-party funding for its implementation. If possible, this should involve collaboration with suitable partners in the Leibniz Association.

STAFF DEVELOPMENT AND PROMOTION OF JUNIOR RESEARCHERS

8. It is recommended that each department receive institutional funding for at least one postdoctoral and one doctoral position (instead of for two doctoral positions as is currently the case) in order to be able to fill these positions in accordance with the respective scientific focus on a fixed-term basis.
9. IZW should extend its expertise in bioinformatics using, if possible, the growth in funding allocated to the institute from the Joint Initiative for Research and Innovation. IZW should also prioritise the expansion of human resources in IT that, with just one employee, is currently understaffed. Furthermore, the institute should find a solution within the existing budget for expanding capacity in in-house facility management.

2. General concept and profile

Development of the institution since the last evaluation

IZW's mission is to study the life histories, evolutionary adaptations, and diseases of wildlife species as well as their interaction with humans and the environment. The aims are to understand adaptability (why are some wildlife species threatened by environ-

mental change whilst others persist?) and to design concepts and methods for conservation intervention.

These tasks are fulfilled very successfully. Under the dedicated and competent leadership of the director, the institute has developed very well since the last evaluation. The overarching objectives – the study of the resistance and resilience of individuals and populations, particularly in areas in which significant interaction occurs between wildlife and humans – are convincing. The approach of linking captive and free-ranging populations in conservation efforts is also appropriate today. To this end, IZW has established a very good collaborative network with zoological gardens world-wide that contributes to the institute's international reputation and should be further expanded, e. g. for captive breeding programmes of endangered species.

The broad disciplinary range of expertise at IZW is another one of the institute's particular assets, and it offers unique opportunities for collaborative approaches – both within the institute and with external partners – to different research questions. Following the establishment of three overarching Research Foci ("Adaptations", "Diseases", and "Conservation"), interaction between the five discipline-based departments (Evolutionary Ecology, Evolutionary Genetics, Wildlife Diseases, Reproduction Biology, and Reproduction Management) has improved significantly and should be further intensified. International exchange has also been enhanced considerably.

Strategic work planning for the next few years

IZW's overarching strategies and objectives – the study of the resistance and resilience of individuals and populations and the development of appropriate conservation measures based on the findings – should be perpetuated. **The large number of research projects covers a broad thematic spectrum. The institute must** now **make efforts to align these projects more systematically to its overarching strategies and objectives in order to achieve greater coherence. This will require a strong thematic focus in all research areas.** These efforts will also lead to even more intensive cooperation between the departments.

Thematically, IZW has identified a broad spectrum of research areas in which it wishes to intensify its work in the future. Such a broad spectrum, which also reflects the variety of disciplines and methods at the institute, is one of its strengths. However, IZW should always examine each individual case to determine whether it can have a far-reaching, sustainable impact on the respective area and, possibly, initiate cooperation with other relevant institutions.

IZW quite rightly plans to maintain its globally recognised expertise in reproductive biology and reproductive medicine as an important pillar, especially for developing conservation measures. Its work on wildlife diseases also has enormous potential to continue producing significant contributions to understanding the adaptability of individuals and species and to successful captive management of endangered species.

In order to attain its goal of contributing to a predictive framework on the adaptability of wildlife species to environmental change, IZW must significantly enhance its existing expertise in theoretical modelling, programming, and biostatistics. This could be achieved by hiring additional modellers and theoreticians and by establishing systematic, comprehensive training and continuing education

measures for all scientists (including doctoral candidates) **in the relevant techniques.** This will be necessary if the institute is to help shape developments in areas such as disease transmission and spatial epidemiology.

One way in which IZW can make an impact, compared to research conducted at universities, is by leading long-term studies, a purpose for which the institute is well-equipped. For example, the long-term project on hyaenas has produced an array of valuable insights. It is thus welcomed that the institute will continue its work on hyaenas. Furthermore, **IZW should investigate which other wildlife species would be suited for long-term studies and aim to include at least one Central European species to gain a better understanding of wildlife in temperate regions as well.** This would provide an opportunity to study adaptation under changing climatic conditions and / or in anthropogenically transformed landscapes. In this context, efforts should be made to determine Darwinian fitness, i. e. the relative genetic contribution of individuals and genotypes to subsequent generations, using precise genealogical data. Another approach would be to conduct experimental manipulation studies. Expertise in functional genomics is already available in the Berlin-Brandenburg area and should be accessed via collaborations.

Appropriateness of facilities, equipment, and staffing

IZW describes its core budget (2012: € 7.6 million) as extremely tight. It states that it needs a further 19 positions and investments in the order of approx. € 700,000 per year (see Status Report, p. A-6). Fortunately, it has now been possible to raise third-party funding to cover some of the additional positions required. Thanks to the abolition of the binding staffing plan in 2013, the institute now also has greater flexibility in setting strategic priorities. Whether this flexibility is sufficient to cover additional needs is something the institute will have to examine together with the relevant committees.

There is an urgent need for additional personnel in IT and facility management; existing capacity in bioinformatics should also be expanded (see Chapter 5). It should, moreover, be investigated whether permanent funding can be provided from the institutional budget to finance one postdoctoral and one doctoral position in each department; at present, funding is only made available for two doctoral positions (see Chapter 5).

Currently, the institute is very well equipped, not least as a result of acquisitions made using special funding (such as the Economic Stimulus Package II) which have opened up new scientific perspectives for the institute. However, **the *Land* Berlin government does not intend to increase investment funding in the coming years. In the mid-term, this could make it difficult to maintain equipment at an appropriate, state-of-the-art level** and thus guarantee the sustainability of the investments already made.

Via various collaborative centres in the Berlin-Brandenburg area, IZW is able to access mainframe computers and next-generation sequencing facilities. This bundling and joint use of resources is reasonable.

In the last few years, IZW has been successful in its efforts to procure **third-party funding** for research projects (2012: € 2 million). Overall, however, **there is still room for improvement which should be exploited in the future, especially with regard to EU funding opportunities. When raising third-party funding, the institute should take**

care not to overstretch the thematic spectrum of its projects. Rather, the third-party projects should make a greater contribution to sharpening the institute's profile.

Results

Research

Research projects are conducted within the cross-departmental Research Foci, usually involving discipline-based expertise from several departments. The performance of all three Research Foci is rated as "very good". Certain projects, such as the work on bats, or in reproductive biology and reproductive medicine, have produced excellent results.

In comparison with the last evaluation, the publication record has been improved both in terms of quantity and quality. The number of publications has reached a very good level. IZW's efforts to increasingly publish in open access journals are recognized and should be further intensified in order to facilitate broader dissemination of the research results. IZW should also attempt to further increase the proportion of publications in high-ranking, internationally visible journals.

Since decisions on participating in projects as well as the distribution of resources rest with the individual departments, a short summary of the performance of the departments follows (see Chapter 3 for a detailed presentation and evaluation of the performance in the Research Foci).

The Department of Evolutionary Ecology produces very good work. Its research on bats, in particular, is outstanding: the results it has achieved on the energetic costs of flight during daytime, the white-nose syndrome (in cooperation with the Department of Wildlife Diseases and research groups in the USA) as well as on fatalities at wind energy facilities have attracted worldwide attention and contribute significantly to IZW's reputation. The long-term studies on hyaenas are also very successful and integrate issues from all the Research Foci. It is welcomed that this work, which has contributed to a more comprehensive understanding of hyaenas, will be continued.

Very good results have also been achieved in the Department of Evolutionary Genetics. The work on cheetahs, in particular, integrates themes from the various Research Foci and should continue to be conducted in the long-term. The unexpected results on phylogeographic patterns in mammals have also attracted much attention and the results on methylation in epigenetics are very promising, too. However, in this thematic area, IZW should examine whether it can compete successfully with other, better-equipped institutes in the long run. It could, for example, make a significant contribution if it managed to conduct large-scale epigenetic studies on natural populations with full parentage data of all individuals. This would mean working together with other research institutions or intensifying existing collaborations. The knowledge of bioinformatics amongst scientific staff should be further enhanced.

The Department of Wildlife Diseases is closely connected with the Research Focus "Diseases". Its many, very good projects are an asset to IZW. The work on the white-nose syndrome, in particular, is excellent and generates good networking with external research groups. Interaction with the other departments at IZW could be intensified. The scientific potential inherent in the systematic application of evolutionary-ecological modelling is not yet being utilised comprehensively (see Chapter 3, section on Research Focus "Diseases").

The two Departments of Reproduction Biology and Reproduction Management host globally recognised expertise in reproductive biology and reproductive medicine. This expertise should categorically be fostered and, if possible, extended. It is greatly welcomed that IZW is striving to retain the head of the Department of Reproduction Management at the institute. Staff members in both departments are actively involved in knowledge transfer; they have, for example, successfully run method training courses for scientists in Sabah (Malaysia). Similar collaborations should be undertaken in other regions in order to empower local scientists to apply modern methods independently and pass on their knowledge to others. The performance of these two departments in developing endocrinological tests for pregnancy in felines and methods of cryopreservation and embryo transfer is excellent. Much attention has also been sparked by results they have achieved in fundamental research, such as that on superconception and its adaptive value in the European brown hare, and on an adaptive shift of "female" and "male" sperm.

Scientific services and infrastructure

IZW provides high-quality services for external users and maintains five scientific collections (see Chapter 3, section on "Research-oriented Services and Scientific Collections").

Scientific consultancy, knowledge and technology transfer

IZW is extremely active in providing information and advice for relevant interest groups, political decision-makers, and the public at large. It plays an especially important role in designing conservation and environmental protection measures relating to wildlife (see Chapter 3, section on "Research-accompanying Activities").

The institute's outstanding equipment and laboratory infrastructure are used for a variety of continuing education measures on biotechnological methods and modern analytical procedures.

In addition to this, the institute conducts valuable technology transfer by cooperating, for instance, with small and medium-sized enterprises in the medical technology sector. Furthermore, interesting insights into telemetry and recording have been gained from wildlife observations, which are also exploited.

Academic events and public relations

IZW regularly organises conferences, symposia, and workshops with a focus on wildlife which are highly regarded internationally. The institute's performance in public relations is impressive, and it successfully manages to involve stakeholders and members of the public in scientific projects (see Chapter 3, section on "Research-accompanying Activities").

3. Subdivisions of IZW

Research Focus "Adaptations" (18.4 full-time equivalents [FTE] in research and scientific services, 7.7 FTE doctoral candidates, 15.5 FTE service staff)

Projects on life history and social behaviour, mate choice, reproduction, niches, and adaptive genetic variability have been conducted successfully by this Research Focus. The work on bats, in particular, is excellent. For example, a new method for blood sam-

pling with the help of bugs has been established. Insights into the energetic costs of flight during daytime have significantly extended our understanding of the ecological niche occupancy in bats. Ultrasound research on the lynx and investigations into maternal effects and sibling conflict in hyaenas have been very successful and provide an outstanding basis for initiating further high-yield, long-term projects.

The overarching objective of resistance and resilience of wildlife is a good starting point and should be integrated more systematically into the individual projects so that, in the future, the large number of projects can be strategically more intensively interrelated. Using a theory-driven approach, clear hypotheses should be drawn up and tested. A central component of this approach should be to quantify the adaptive value of traits by employing experimental manipulation. IZW is aware of this and has, for example, in the context of its work on hyaenas, conducted successful investigations amongst populations with individually identifiable animals. Comparable measurements of Darwinian fitness going beyond just the recording of population size should be undertaken for other species, too. Long-term studies would be the necessary instrument. IZW is well-placed to conduct such long-term projects and is encouraged to do so, also focussing on Central European species.

The overall research performance of this Research Focus has improved considerably since the last evaluation. It is rated as "very good". The publication record is convincing; several very good articles have been published in high-ranking journals and acknowledged internationally. IZW should drive this positive trend and continue increasing the number of publications in high-ranking journals.

Research Focus "Diseases" (5.9 FTE in research and scientific services, 6.5 FTE doctoral candidates, 4.4 FTE service staff)

The health status of free-ranging and captive wildlife populations, the distribution, prevalence, and epidemiology of pathogens and diseases, and the impact of diseases on wildlife populations have been successfully investigated by this Research Focus. The results have been very well published. The OneHealth approach that has been adopted provides a convincing strategic framework for the various projects.

The results on the white-nose syndrome amongst bats have deservedly received the highest recognition worldwide. Work in eco-immunology has also been very successful. Studies of the major histocompatibility complex (MHC) on cheetahs in Namibia revealed the important finding that, contrary to previous assumptions, low genetic variability does not lead to reduced immune competence. At the same time, this project also profitably connected research issues from all three Research Foci.

Overall, the experimental studies undertaken by this Research Focus are convincing and stimulating. Consequently, work on wildlife diseases should continue to play an important role in the institute's research portfolio. More attention should, however, be devoted both to the theoretical foundations and, in particular, to mathematical modelling in order to further the work on disease transmission and spatial epidemiology. Already rated as "very good", this would open up potential for enhancing the performance of the Research Focus yet further.

Research Focus "Conservation" (9.4 FTE in research and scientific services, 4.6 FTE doctoral candidates, 5.5 FTE service staff)

Risk analyses and assessment of wildlife populations have been successfully conducted by this Research Focus. The OnePlan approach that has been adopted is appropriate. It means that conservation measures are no longer considered separately for populations *in situ* or *ex situ*. The strategy of involving various stakeholders in planning projects and developing conservation measures has proved its worth. The results achieved in the many projects conducted in this Research Focus have been published in appropriate journals.

The institute has an outstanding international reputation for its expertise and achievements in assisted reproduction, including *in-vitro* fertilisation, embryo transfer, and the development and successful application of pregnancy tests, e. g. for felines. IZW staff also regularly train scientists from other institutions, for example in South Africa and Sabah (Malaysia), and thus assume an important role in spreading their knowledge. They are encouraged to maintain and, if possible, increase these efforts with the goal of enabling other scientists to apply the respective techniques independently.

Outstanding results have been achieved in developing and applying cell-based techniques, i. e. cell cultures and cell banking as new conservation tools. In the future, these methods could gain in significance. IZW should systematically continue to develop this highly relevant field and draw up a clear, long-term, sustainable strategy indicating where, how, and to what extent relevant cell cultures should be acquired and used for conservation measures.

The projects in this Research Focus cover a broad spectrum of topics. It is recommended to focus on research areas in which IZW's specific expertise can be exploited to the greatest advantage and to pursue them as intensive, long-term projects in cooperation with other research groups. In this context, researchers should not lose sight of the overarching objective of resistance and resilience, which should be systematically integrated into the projects undertaken. Furthermore, it must be elucidated what population status should be considered as the norm and how the target state of conservation measures should be defined accordingly. On this basis, a critical recording of the relevant parameters to determine resistance and resilience in the populations under scrutiny should be carried out.

Overall, the performance of this Research Focus is rated as "very good". Research in the field of reproductive biology and reproductive medicine stands out as especially successful and renowned and should continue to play an important role as one of the institute's particular strengths.

Research-accompanying Activities (5.0 FTE in research and scientific services, no doctoral candidates, 8.6 FTE service staff, 9.0 FTE vocational trainees)

IZW adopts an important role in the transfer of scientific insights to policy-makers and the general public. The number of print media clippings is impressive, and the institute is also featured regularly on radio and television. In addition, four short films have been produced on the Sabah rhinoceros which have recently become available for download from the BMBF website. These activities make valuable contributions to the important

aim of enhancing public awareness of central themes like biodiversity, conservation, species preservation, and sustainability.

The strategy of involving various stakeholders and interested members of the public in scientific projects has proved its worth and has, for example, been very successful in reducing the volume of lead shot used in hunting. The interdisciplinary research project "Loss of the Night", in which IZW is a partner, seeks to investigate and raise public awareness of the socioeconomic impact and the implications for health of increasing light pollution in settlement areas.

IZW regularly organises conferences, symposia, and workshops with a focus on wildlife. These events are very highly regarded in the international scientific community and play an important role in knowledge sharing and networking.

Research-oriented Services and Scientific Collections (3.9 FTE in research and scientific services, no doctoral candidates, 2.1 FTE service staff)

IZW offers high-quality services to external partners such as research institutions, authorities, companies, zoos, and environmental protection agencies. The excellent equipment and laboratory infrastructure are the foundation on which this work is based. Special mention should be made of the CX-Computed Tomography Scanner which was purchased using funding from the Federal Government's Economic Stimulus Package II in 2009. It facilitates the examination of bodies weighing up to 300 kg. The services provided include wildlife pathology and disease diagnostics, non-invasive hormone monitoring, stable isotope analyses, computed tomography (CT), toxicological analyses, and forensic services.

It is welcomed that IZW has acted on a recommendation made at the last evaluation and now regularly checks whether the fees charged for its services are appropriate. The institute refrains from trying to generate significant income from the services, which contribute to invigorating, extending, and cementing its network of institutional academic relations. Yet, in the context of these strategic considerations, further options to increase the cost-effectiveness of services rendered by IZW should be examined.

In the field of stable isotope analyses, IZW has managed to combine services with its own research issues and to publish the results. It should try to generate and publish research results deriving from other services as well in order for its own research to profit appropriately from the services it provides. The accessibility of digital data, such as the impressive morphology data from CT scans, must be significantly improved.

The institute's five collections (see Status Report, p. A-13) **are of great scientific value and are well maintained. However, the metadata management of the holdings must be improved in order to make them accessible – electronically and as widely as possible. It is recommended to devise an appropriate project and procure third-party funding for its implementation. If possible, this should involve collaboration with suitable partners in the Leibniz Association.**

IZW should regularly monitor its collection activity to determine whether and how the objectives associated with it are being achieved. The institute should also discuss with the committees whether an enlargement strategy is appropriate or whether the holdings should be reduced and/or partially outsourced.

4. Collaboration and networking

Collaboration with universities

IZW fosters intensive, fertile collaborative relations, particularly with the universities in Berlin and Potsdam, but also with the University of Stuttgart and the University of Melbourne (Australia). At the time of the evaluation visit, two of the five heads of department held professorships at Freie Universität Berlin on the basis of joint appointments. Two other heads of department held extraordinary professorships at Humboldt-Universität zu Berlin and the University of Potsdam. The fifth head of department was a professorial fellow (honorary appointment) at the University of Melbourne (Australia).

It is welcomed that, in the mid-term, all heads of department are supposed to hold joint appointments. Negotiations are already underway with Freie Universität Berlin to appoint a W3 professor in Wildlife Reproduction Medicine (in conjunction with the leadership of the Department of Reproduction Management) as well as with the University of Potsdam for a W3 professorship in Molecular Ecology and Evolution (in conjunction with the leadership of the Department of Evolutionary Genetics). As happened in both these cases, all future joint professorships should be announced internationally.

It is also seen as very positive that three additional assistant professorships are scheduled to be established on the basis of joint appointments at Humboldt-Universität and Freie Universität in Berlin in 2013 and 2014.

Apart from staffing linkages, close connections exist with the universities due to IZW's participation in numerous research consortia and regional networks. For example, IZW is a founder member of the Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), which not only includes the three Berlin universities, but also the University of Potsdam and four additional Leibniz institutions. Other collaborations involving universities are designed to exploit resources efficiently by the joint use of ultra-modern laboratories and technology platforms. Via the Berlin Center for Genomics in Biodiversity Research (BeGenDiv), for example, IZW has access to next-generation sequencing facilities. In association with the Center of Infection Biology and Immunity (ZIBI) at Humboldt-Universität zu Berlin, IZW is also involved in a graduate school funded by the German Research Foundation (DFG).

Collaboration with other institutions in Germany and abroad

IZW cultivates equally intensive, productive collaborative relations with numerous non-university scientific institutions in Germany and beyond. Within the Leibniz Association itself it is excellently connected; in the last few years, it has been very successful in raising funding in the Leibniz Competition, both as the lead applicant and as a co-applicant. Furthermore, it is a founding member of the Leibniz Biodiversity Network, which embraces 21 Leibniz institutions.

At European level, the institute has also been quite active in the last few years, participating in four EU projects. IZW's international engagement is illustrated not least by the large number of foreign visiting researchers, some of whom spend several months at the institute, as well as the numerous visits undertaken by IZW staff to scientific establishments abroad. Further expanding collaborations externally offers opportunities for applying the recognised strengths of IZW in combination with scientific excellence of other organizations, when the combined skills exceed those of strictly in-house efforts. In in-

ternational collaborations supporting professional advancement of local scientific staff, full recognition and integration of local expertise is crucial for attaining long-lasting results to the benefit of the local wildlife.

Other collaborations and networks

In addition to its collaborative relations with universities and non-university research institutions, IZW maintains intensive contact with zoos and takes an active part in the work of conservation organisations at home and abroad. Moreover, as a result of its diverse information and advisory activities, fruitful connections have developed with various interest groups, authorities, political decision-makers, and companies. This is welcomed, as is the institute's engagement in a citizen science project for which it coordinates large-scale citizen surveys in order to acquire empirical data on wildlife populations in urban areas.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

In comparison with the last evaluation, IZW's staff has increased by a total of 32 % (from 84 full-time equivalents [FTE] in 2005 to 111 in 2012). The scientific staff (including doctoral candidates) went up by 46 % (from 37 FTE to 54). Two of the five head of department positions were successfully filled in 2006 (Department of Evolutionary Genetics) and 2009 (Department of Wildlife Diseases). Thanks to a consistent international appointment strategy, since the last evaluation, IZW has developed into an international research institution employing many foreign staff. It is pleasing that the number of foreign doctoral candidates has also risen significantly (from five to 16) since the last evaluation. IZW is encouraged to continue increasing this percentage and to recruit more doctoral candidates and postdocs from other European countries.

It is greatly welcomed that the *Land* Berlin abolished the binding staffing plan in 2013. IZW now has greater flexibility in the utilisation of personnel funding, which should be used for strategic development based on scientific criteria. **It is recommended that each department receive institutional funding for at least one postdoctoral and one doctoral position (instead of for two doctoral positions as is currently the case) in order to be able to fill these positions in accordance with the respective scientific focus on a fixed-term basis.**

In order to be able to meet current scientific requirements more appropriately, **IZW should extend its expertise in bioinformatics using, if possible, the growth in funding allocated to the institute from the Joint Initiative for Research and Innovation. IZW should also prioritise the expansion of human resources in IT that, with just one employee, is currently understaffed. Furthermore, the institute should find a solution within the existing budget for expanding capacity in in-house facility management.**

Promotion of gender equality

IZW has already made very great progress in its efforts to achieve gender equality, not least in scientific leadership positions. Two of the five scientific head of department positions are held by women. The proportion of women amongst the rest of the scientific

staff is 50 %. It is welcomed that the institute was awarded the TOTAL E-QUALITY certificate in 2011. IZW has also made great efforts to create family-friendly working conditions. The institute should not diminish its efforts to achieve gender equality, particularly at leadership level, and should define concrete goals and measures also for the future, in correspondence with the Joint Science Conference's decision on the implementation of DFG's cascade model.

Promotion of junior researchers

Junior researchers receive excellent training at IZW. Various structured programmes and graduate schools, which are run in cooperation with the universities, exist for this purpose. Parts of the curricula, which include very good soft-skills modules, have been designed by IZW scientists.

Against the backdrop of the research requirements and opportunities at IZW, it is welcomed that both the doctoral candidates in natural science and those in veterinary medicine are prepared for the same doctoral degree (Dr. rer. nat.). With doctorates taking an average of 3.7 years to complete, the institute has achieved a good ratio.

It is very positive that so many doctoral candidates are involved in field work abroad. The institute's many collaborative relations should be used to an even greater extent to open up opportunities for junior researchers to work at research institutions abroad when they have finished their doctorates. It is pleasing that in case of unforeseen difficulties, doctoral candidates receive continued financial support to complete their theses.

The promotion of postdocs at IZW is also very good. The plans to establish three additional assistant professorships as joint appointments with Humboldt-Universität zu Berlin ("Ecology and evolution of molecular parasite-host interactions", 2013) and Freie Universität Berlin ("Disease ecology" and "Diversity of cellular functions and phenotypes", both 2014) are convincing.

The modules offered by researchers at IZW to improve the statistical and modelling skills of the scientific staff are very important because, in many research projects, these skills are an indispensable precondition for achieving outstanding results. These offerings should be extended.

In 2013, IZW was granted funding by BMBF for establishing a junior research group with the aim of developing a standardised biodiversity monitoring system. IZW should continue its efforts to procure third-party funding for additional junior research groups at European level (Marie Curie Fellowships, for example). It would make sense to use funding of this kind to strengthen theoretical work at IZW as well.

Vocational training for non-academic staff

Between 2010 and 2012, six trainees completed their vocational training at IZW. At the end of 2012, nine trainees were employed. At 8 %, IZW thus achieved a remarkably high proportion of trainees.

6. Quality Assurance

Internal quality management

The performance of individual members of staff is assessed according to a bonus system that sets effective incentives. IZW also implements a targeted quality assurance system that allows the costs of the various activities, both at project and department level, to be set against the scientific outcomes and thus to assess efficiency in the use of resources. It is welcomed that this internal evaluation is not only applied to research results, but also to scientific services. It should be examined whether this control system should also be itemised in the programme budget. Currently, only two programme areas are itemised, one for research and the other for service activities.

IZW should apply stricter criteria to its internal peer review of manuscripts to be submitted to scientific publications in order to be able to publish the most noteworthy research results in higher-impact journals.

Quality management by the Scientific Advisory Board and Supervisory Board

IZW's Scientific Advisory Board (SAB), which is composed of distinguished international scientists, fulfils its tasks diligently and fairly. With regard to its expectations vis-à-vis IZW's scientific performance indicators, it could afford to be somewhat more demanding.

According to the institute's statutes, the members are supposed to be appointed for four years, whereby the appointment date for half the members should be staggered. In 2015, seven of the ten current members will complete their term and leave the board. IZW should investigate how an appropriate level of continuity can be guaranteed in SAB's supervision of the institute's work.

Together with seven other Leibniz institutions, IZW is a member of the *Forschungsverbund Berlin e. V.* (FVB). FVB's Board of Trustees carries out its tasks as IZW's supervisory body on the basis of its statutes. According to the AV-WGL[1], decisions made by the institutions' supervisory bodies on important research and science-policy matters, having significant financial implications, or referring to the institutions' managerial staff require the agreement of the representatives of the Federal Government and the *Land*. The wording of the FVB statutes should now be brought into line with the relevant formulations in the AV-WGL.

In order to prepare the Board of Trustees' decisions, committees have been established at the institutes composed not only of representatives of the Federal Government and the *Land*, but also of the chairs of the member institutes' advisory boards. This provision should be changed so that the chairs of the advisory boards only participate in institutes' committee meetings as non-voting guests, as do the directors of the institutes and the managing director of FVB.

Implementation of recommendations from the last external evaluation

IZW has largely been able to implement the 17 recommendations made by the Leibniz Association Senate after the last evaluation (see Status Report, p. A-18 ff.). Both the publication record and the volume of third-party funding have increased significantly, al-

[1] Administrative Agreement between the Federal and *Länder* Governments with regard to the joint funding of member institutions of the Leibniz Association.

though there is still room for improvement, particularly with regard to publications in high-ranking journals (see Chapter 2, section on “Results”) and the procurement of EU funding (see Chapter 2, section on the “Appropriateness of facilities, equipment, and staffing”). The recommendations on certain additions to be made to human resources and equipment have been implemented. International networking has been improved, as has the training of junior researchers. It is extremely pleasing that IZW recently managed to procure third-party funding in order to establish a junior research group (see Chapter 5).

Action still needs to be taken with regard to sharpening the focus of research work (see Status Report, recommendations 1, 8, and 9): whilst IZW has strategically developed its research programme and the three Research Foci in the last few years, and thereby strengthened fundamental research, there is still a pronounced diversity amongst the numerous projects which require greater thematic focus in certain areas (see Chapter 1).

Appendix

1. Review Board

Chair (Member of the Leibniz Senate Evaluation Committee)

Susanne **Foitzik**	Johannes Gutenberg University Mainz, Germany

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Elisabeth **Niggemann**	German National Library, Frankfurt am Main, Germany

Experts

Heinrich **Bollwein**	University of Zurich, Switzerland
Serge **Daan**	University of Groningen, The Netherlands
Kate **Jones**	University College London and Zoological Society of London, United Kingdom
Christian **Laforsch**	University of Bayreuth, Germany
Jorge Ramón **López Olvera**	Universitat Autònoma de Barcelona, Spain
Sheila **Pankhurst**	Anglia Ruskin University Cambridge, United Kingdom
Oliver **Ryder**	UCSD Center for Reproduction of Endangered Species, San Diego Zoo, USA
Wolfgang **Stephan**	LMU Munich, Germany
Carol **Vleck**	Iowa State University, USA
Christine **Wrenzycki**	Justus Liebig University Gießen, Germany

Federal Representative

Dieta **Lohmann**	Federal Ministry of Education and Research, Bonn, Germany

Representative of the Länder (Member of the Leibniz Senate Evaluation Committee)

Georg **Brun**	Bavarian State Ministry of Sciences, Research and the Arts, Munich, Germany

2. Guests

Representative of the responsible Federal Government Department

Fabian **Kohler**	Federal Ministry of Education and Research, Bonn, Germany

Representative of the responsible Länder Department

Björn **Maul**	Berlin Senate Department for Economics, Technology and Research, Germany

Representative of the Leibniz Association

Klement **Tockner**	Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany

Chairman of the Scientific Advisory Board

Volker **Loeschcke**	Integrative Ecology and Evolution, Aarhus University, Denmark

3. Representatives of collaborative partners (one-hour interview)

Peter A. **Frensch**	Vice President for Research of Humboldt-Universität zu Berlin, Germany
Jörg **Junhold**	President of the World Association of Zoos and Aquariums (WAZA) and Director of Zoo Leipzig, Germany
Monika **Schäfer-Korting**	Executive Vice President of Freie Universität Berlin, Germany
Robert **Seckler**	Vice President for Research and Young Academics, University of Potsdam, Germany

14 November 2013

Annex C: Statement of the Institution on the Evaluation Report

Leibniz Institute for Zoo and Wildlife Research (IZW)
in the *Forschungsverbund Berlin e. V.*

The IZW is grateful to the evaluation commission for its detailed assessment and recommendations and would like to thank the commission for its work. We consider ourselves to be assessed and treated in a fair and just manner. It is particularly important to us that the evaluation commission considers the conceptual framework that we have developed for our work to be a convincing and useful basis to further refine and develop our research programme. We are also pleased to see that the commission considers our three research foci as a useful and helpful thematic guide to structure our research. To the institute it is important that the commission recognises our broad interdisciplinary range of expertise as an asset and that we are encouraged to continue our long-term studies as a source of particularly useful insights. We are also grateful that our research-oriented scientific services, collections and outreach work are thought to be valuable and that we are encouraged to maintain and develop these further. We are looking forward to implementing the prescribed recommendations, in partnership with our regional scientific collaborators and our government funders where appropriate.