Leibniz Gemeinschaft

Der Senat

18. März 2021

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. Ihr stand eine vom IZW erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst.

Wegen der Corona-Pandemie musste der für den 22. und 23. Juni 2020 vorgesehene Evaluierungsbesuch am IZW in Berlin abgesagt werden. Die Bewertung erfolgte im Rahmen eines schriftlichen Ersatzverfahrens, das der Senatsausschuss Evaluierung (SAE) am 17. April 2020 in Umsetzung eines Grundsatzbeschlusses des Senats der Leibniz-Gemeinschaft vom 31. März 2020 eingerichtet hatte. Der Senat hält im Grundsatzbeschluss fest, dass das Ersatzverfahren ein Notbehelf ist und ausschließlich auf Einrichtungen angewendet wird, die im Regelturnus von sieben Jahren evaluiert werden. Die Bewertungen, auf deren Grundlage der Senat Stellung nimmt, sind auf zentrale Kernfragen der Entwicklung und Perspektive einer Leibniz-Einrichtung fokussiert. Ausführliche Einschätzungen und Schlussvoten zu Teilbereichen und Planungen für „kleine strategische Sondertatbestände“ müssen regelmäßig entfallen.

Die Bewertungsgruppe erstellte den Bewertungsbericht (Anlage B). Das IZW nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 18. März 2021 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.

Das Leibniz-Institut für Zoo- und Wildtierforschung (IZW) im Forschungsverbund Berlin e. V. untersucht die Lebensbedingungen, evolutionsbiologischen Anpassungen und Erkrankungen von Wildtierarten sowie die Interaktion von Wildtieren mit der Umwelt und dem Menschen. Die Arbeiten zielen auf grundlagenwissenschaftliche Erkenntnisse und die Entwicklung von Maßnahmen zum Schutz und Erhalt von Populationen, die vor allem angesichts des Klimawandels unter einem zunehmenden Anpassungsdruck stehen.

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

Das IZW erzielte seit der vergangenen Evaluierung sehr gute **Leistungen**. Die Forschungsergebnisse wurden zahlreicher als zuvor und außerdem häufiger in international stark rezipierten Zeitschriften publiziert. Das Potential für solche Publikationen sollte noch weiter ausgeschöpft werden. Das IZW bietet ausgezeichnete Infrastruktur- und Dienstleistungen, die z. B. im Bereich der Reproduktionsbiologie von Zoos und Unternehmen genutzt werden. Das Institut hat sein großes Engagement im Wissenstransfer in den letzten Jahren ausgebaut und entwickelt derzeit Instrumente, um die Wirksamkeit seiner Arbeit im Naturschutz zu erfassen.

Im **wissenschaftlichen Konzept** des IZW sind die Langzeitprojekte besonders wichtig, denn sie ermöglichen besonders gute Einblicke in das Adaptionsgeschehen bei Wildtieren. Das Institut hat diese Projektform wie empfohlen weiterentwickelt und sehr häufig Transfermaßnahmen zum *capacity building* in Ländern des globalen Südens integriert. Es bleibt nun eine Aufgabe, zum einen die Kohärenz innerhalb der Langzeitprojekte weiter zu stärken und zum anderen eine gute Balance zwischen den auf Säugetiere konzentrierten langfristigen Projekten und kürzer angelegten Projekten mit neuen Forschungsfragen zu finden.

2018 wurde eine sechste Abteilung eingerichtet und damit wie empfohlen die Expertise in statistischer Auswertung, Modellierung und Programmierung deutlich ausgebaut. Es ist erfreulich, dass inzwischen die Leitungsstellen für alle **Abteilungen** gemeinsam mit Universitäten in Berlin und Potsdam besetzt werden. Einschließlich der Position des Direktors steigt damit die Zahl der Professuren nach dem Abschluss der beiden laufenden Verfahren von früher zwei auf künftig sieben. Die Arbeit der Abteilungen wird über drei **Programmbereiche** koordiniert. Dieser organisatorische Rahmen muss nun stärker mit Leben gefüllt werden, um die wissenschaftlichen Aktivitäten am Institut noch besser aufeinander abzustimmen.

Dies ist auch wichtig, weil sich im Rahmen der derzeitigen institutionellen Förderung nicht alle für die kommenden Jahre geplanten, methodisch ambitionierten Vorhaben umsetzen lassen. Um die Lücke zwischen der bestehenden institutionellen Förderung und den Mitteln, die zur Umsetzung der Planungen nötig sind, zu schließen, hat das IZW einen Antrag für eine große strategische Erweiterung ab 1. Januar 2024 ausgearbeitet. Ziel ist es, die Labor- und Datentechnologie mit Blick auf die gestiegenen wissenschaftlichen Anforderungen grundlegend zu modernisieren. Der Antrag wird derzeit in einem gesonderten Verfahren beurteilt.

Das IZW hatte 2013 auf eine aus seiner Sicht zu geringe **institutionelle Förderung** hingewiesen. Der Senat verwies damals darauf, dass zum einen das Institut selbst Prioritäten setzen muss, zum anderen aber auch Bund und Länder gefordert sind. Seitdem stieg der Kernhaushalt der institutionellen Förderung von 7,3 M€ (2012) auf 8,8 M€ (2019) und nach der Verstetigung zusätzlicher Mittel auf 9,6 M€ (2020). Dieses Wachstum verwendete das IZW zur Finanzierung allgemeiner Kostensteigerungen und für überzeugende strategische Maßnahmen wie die Einrichtung der neuen Abteilung (s.o.). Der Senat sieht es allerdings mit Blick auf die Selbststeuerung des Instituts äußerst kritisch an, dass das Institut seit 2015 die Finanzierung anderer wichtiger Aufgaben aussetzt: Positionen für

Auszubildende und den wissenschaftlichen Nachwuchs wurden reduziert; seit 2019 werden aus dem Kernhaushalt finanzierte Promotionsstellen nicht neu vergeben und Postdocs ausschließlich über Drittmittel gefördert. Anders als geplant soll auch die Finanzierung einer Junior-Professur 2024 enden. Diese Situation muss im Rahmen der zur Verfügung stehenden institutionellen Förderung ohne Verzug geändert werden.

Das IZW wirbt ein Drittel seiner Mittel für den laufenden Betrieb über **Drittmittel** ein und hat damit ein sehr gutes, gegenüber der Situation zur Zeit der vergangenen Evaluierung verbessertes Niveau erreicht. DFG-Mittel werden deutlich über die Abgabe hinaus eingeworben, es besteht aber noch weiteres Potential für kompetitive Anträge am Institut. Dies gilt auch mit Blick auf EU-Mittel.

Die **Kooperationen** mit den Universitäten in Berlin und Potsdam wurden in den letzten Jahren weiter intensiviert, vor allem durch die zusätzlichen gemeinsamen Berufungen. Über die Region hinaus arbeitet das Institut auf nationaler Ebene und innerhalb der Leibniz-Gemeinschaft eng mit Partnern zusammen. Die internationale Zusammenarbeit ist vielfältig, sollte aber strategisch stärker fokussiert werden.

Für den **wissenschaftlichen Nachwuchs** stellt das IZW sehr gute Betreuungs- und Arbeitsbedingungen zur Verfügung. So sind die Promovierenden in ein strukturiertes Programm eingebunden. Der Rückgang der Anzahl von haushaltsfinanzierten Stellen für Promovierende in den letzten Jahren ist jedoch kritisch (s.o.) und sollte so zügig wie möglich revidiert werden.

Die wissenschaftlichen Positionen am IZW sind zu gleichen Anteilen mit Männern und Frauen besetzt. Es ist sehr erfreulich, dass auf der Ebene der Gruppenleitungen eine hohe Anzahl von Wissenschaftlerinnen arbeitet. Von den sieben Leitungspositionen (Direktor, Abteilungen) sind derzeit zwei mit Frauen besetzt. Etwaige Neubesetzungen sollten auch auf dieser Ebene im Sinne der **Gleichstellung der Geschlechter** genutzt werden.

Mit seinen Arbeiten leistet das IZW bedeutende Beiträge zum weltweiten Natur- und Artenschutz, insbesondere auch im Zusammenhang mit dem sich stetig beschleunigenden Verlust der biologischen Vielfalt, der Zerstörung von Lebensräumen und dem Klimawandel. Das IZW verbindet dabei Grundlagenforschung, infrastrukturelle Aufgaben und Wissenstransfer in einer Art und Weise, die zu hoher Sichtbarkeit in der internationalen Wissenschaft als auch in der Öffentlichkeit führt. Die Erfüllung der Aufgaben des IZW ist in dieser Form an einer Hochschule nicht möglich. Eine 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.

9 June 2020

Annex A: Status report

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

Contents

1. Key data, structure and tasks

Key data

Year established:	1992
Admission to joint funding by Federal and *Länder* Governments:	1992
Admission to the Leibniz Association:	1997, founding member
Last statement by the Leibniz Senate:	2014
Legal form:	One of eight Leibniz institutes of the *Forschungsverbund Berlin e. V.* (a registered non-profit association under private law)
Responsible department at *Länder* level:	The Governing Mayor of Berlin, Senate Chancellery – Science and Research
Responsible department at Federal level:	Federal Ministry of Education and Research (BMBF)

Total budget (2019)

€ 9.48 m institutional funding

€ 4.67 m revenue from project grants

€ 0.18 m revenue from services

Number of staff (2019)

79 individuals in research and scientific services

65 individuals in service sector

9 individuals in administration

Mission and tasks

Statutory mission: "*The institute pursues the vision to understand the adaptability of wildlife in the context of global change and to contribute to the enhancement of the survival of viable wildlife populations. For this purpose, it investigates the diversity of life histories, the mechanisms of evolutionary adaptations and their limits, including diseases, of wildlife and their interrelations with their environment and people. The IZW works on free-ranging and captive wildlife in Germany, Europe and worldwide. The institute fulfils its tasks through long-term, application-oriented, interdisciplinary basic research and cooperation with zoological gardens and other institutions*." (§2, Tasks)

IZW fulfils its mission through activities in **three Programme Areas**: i) Research on adaptability and conservation of wildlife populations in the context of global change, ii) Method development, infrastructures and services, and iii) Knowledge transfer and exchange. Work in these Programme Areas is carried out in **six research departments** delineated by conceptual and methodological competences, one independent junior professorship, a science management unit and an administrative unit.

2. Overall concept, activities and results

The **IZW vision** comprises two goals: (1) understanding adaptability of wildlife in the context of global change, and (2) designing appropriate conservation interventions to improve adaptability. This work, as IZW points out, is also important in the context of two UN Sustainable Development Goals: Goal 3 *Good Health and Well-being*, and Goal 15 *Life on Land* which comprises the aim to halt biodiversity loss.

Its **long-term strategy** focuses on the concept of adaptability of wildlife in the face of environmental change. IZW uses adaptability to describe the potential to cope with environmental change. This includes both the resistance, i.e. the extent to which wildlife is affected by some environmental change, and the resilience, i.e. the extent and speed at which individuals or a population recover after a challenge in the long term. To fulfil these tasks, IZW combines different fields of biology and veterinary medicine. Conducting long-term projects that bridge field studies, biobanking, laboratory work, data analysis, modelling and interaction with stakeholders provides opportunities to elucidate both the function and evolutionary consequences of traits.

IZW has summarised its work in **research**, **service** and **knowledge transfer** in **three Programme Areas**, which in turn are divided into **ten programme goals** (PG):

- Programme Area 1: Research on adaptability of wildlife populations in the context of global change
  - PG 1 Traits: Understanding traits and evolutionary adaptations
  - PG 2 Health: Understanding wildlife health and disturbed homeostasis
  - PG 3 Challenges: Understanding the environmental context
  - PG 4 Conservation: Improving population viability
- Programme Area 2: Method development, infrastructures and services to the scientific community
  - PG 5 Tools: Development of theory, methods and tools
  - PG 6 Service: Research-oriented services
  - PG 7 Collections: Scientific collections
  - PG 8 Scientific meetings: Organisation of scientific meetings
- Programme Area 3: Knowledge transfer and exchange
  - PG 9 Knowledge transfer: Knowledge and technology transfer to specific target groups
  - PG 10 Public relations: Science communication

Results

Research (Programme Area 1)

Since the last evaluation, IZW's work has yielded insights on wildlife traits and adaptations, host-pathogen interactions, the consequences of environmental changes and challenges, as well as concepts and methods for conservation. IZW has expanded the cellular

perspective as a complement to the genetic and organismic levels of its research and widened its previous focus on single species to species communities and whole ecosystems. Furthermore, the institute has set up new long-term projects, in terms of studying (1) Southeast Asian mammals, and (2) the causes and consequences of success or failure of wildlife in modified and novel habitats along the rural-urban gradient in the Berlin/Brandenburg region.

IZW publishes its research results as peer-reviewed articles, preferably in international journals of high reputation. Between 2017 and 2019 IZW researchers contributed to 451 publications, including 357 articles in peer-review journals (cf. appendix 2). The scientific results generated in the six departments are described in more detail in chapter 7.

Method development, infrastructures and services (Programme Area 2)

IZW is engaged in improving existing or developing new methodological tools, such as methods to improve cryopreservation of gametes and reproductive tissues, to secure the biosafety of cryobanks samples and to refine *in vitro* fertilisation techniques. It also refined methods for non-invasive hormone assessment. Furthermore it advanced molecular genetics, veterinary methods and statistical analysis tools (e.g. for automated analysis of camera trap photos).

IZW provides the following research-oriented services and infrastructures:

- Wildlife pathology (approx. 500 cases p.a.) and disease diagnostics (approx. 600 cases p.a.),
- Assessment of the reproductive status of wildlife (>200 cases p.a.),
- Computed tomography (CT, approx. 1,000 scans p.a.),
- Non-invasive hormone analysis (approx. 1,000 samples p.a.),
- Stable isotope analyses (approx. 8,000 runs p.a.),
- Nutritional analyses (approx. 300 samples p.a.), and
- Wildlife forensic services (genetic and morphological, 3–5 requests p.a.).

IZW houses i) a pathological-anatomical reference collection (PARS), ii) a morphological collection, iii) a genome resource bank (Arche), iv) a bio-cryobank, and v) a collection of video / ultrasound / CT images, mainly of reproductive organs and tissues.

From 2013 to 2019 IZW organised 15 international conferences as part of its three conference series: The annual Zoo and Wildlife Health Conference, the bi-annual international conference on Wildlife Research and Conservation, and International Berlin Bat Meetings. In addition to these formats, the institute co-organised from 2013 to 2019 seven national and international conferences and organised 11 symposia, nine summer schools and 144 scientific workshops.

IZW has been recognised as a competence centre for zoological medicine in Europe in 2011 (one), 2014 (two) and 2017 (two) by the appointment of five diplomates in two specialties of the European College of Zoological Medicine, part of the European Board of Veterinary Specialists (EBVS).

Knowledge transfer (Programme Area 3)

IZW's transfer activities are bundled in a Knowledge and Technology Transfer-office (KTT) as well as in a Public Relations-office (PR). Implementing a third-party funded project starting in 2013 (–2020), a KTT strategy was developed, expanding the institute's KTT activities and establishing a KTT officer. The officer supports scientists in knowledge transfer and exchange with/advice to specific target groups and develops new transfer formats. In 2018, a new unit Science Management was established to encompass all activities in science management, PR, KTT, citizen science and conference organisation.

IZW reverts to the following instruments/formats for its knowledge transfer:

- Stakeholder dialogue such as the involvement of stakeholders in research projects,
- Policy advice by participating in expert groups or by providing experts reviews and reports to governments,
- Citizen Science by offering members of the public opportunities to become involved in research projects (e.g. to collect mosquitoes and flies, study hedgehogs and bats, and collect camera trap data in private gardens) as well as by contributing to the conceptual development of Citizen Science (e.g. as a member of a consortium to develop a Citizen Science strategy for Germany)
- Capacity building by training students, veterinarians, rangers and staff of conservation agencies as well as within the framework of the Leibniz IZW Academy, which was founded in 2017 as an institutional platform offering advanced training courses (so far, 16 workshops with over 300 participants in total were conducted),
- Advice to specific target groups by collaborating with zoological gardens and conservation NGOs, and advising the International Union for the Conservation of Nature on its Red List and 12 of its Species Survival Commission Specialist Groups,
- Stakeholder publications, including articles in non-scientific journals, aiming to communicate results to a specific readership (e.g. hunters), a user's guide for assessing wildlife with camera trapping and environmental DNA, two reports to the UN Environmental Programme (UNEP) as well as a children's book on how gemsbok in Namibia deal with drought and the development of an exhibition to explain the state-of-the-art of epigenetics research,
- Collaborations with the commercial sector (leading to the filing of nine patent applications since 1992, four of which have been filed between 2017–2019, see Appendix 2).

Media work is conducted by the PR office in cooperation with scientists and IZW's directorate. Since 2013, the office produced 331 press releases, resulting in a documented regional, national and international media response of more than 22,000 clippings. Between 2017 and 2019, IZW participated in 25 large public events (such as the 'Long night of the sciences' in Berlin), organised 20 events for children, pupil and student groups, and set up 39 external events and guided tours of the institute.

3. Changes and planning

Development since the previous evaluation

Since the last evaluation, IZW refined its research goals and added a **third Programme Area** 'Knowledge transfer and exchange' in 2016. Following the audit by the Scientific Advisory Board in 2017 IZW also restructured its research programme and established **ten new Programme Goals** replacing the former Research Foci (cf. chapter 2).

Following a recommendation of the institute's last evaluation IZW continued with existing **long-term studies** and established new ones, also including more European species. Also, it expanded the institute's expertise in theoretical modelling, programming and biostatistics. Following a respective recommendation, IZW successfully applied for additional funding for "Computational Biology" for the period 2017 to 2020 with this establishing a **sixth Department of Ecological Dynamics** in 2018 (cf. chapter 7).

In 2018, IZW applied for funds to construct a **new laboratory building** and for equipment (cellular techniques and biobanking). After granting, planning for the construction of the extension building is currently underway (cf. chapter 4).

Since the last evaluation, the institute hosted an independent **Junior Research Group** ('Species resilience to global change: Assessing the impact of sustainable forest management schemes on biodiversity', 2013–2018) and a **Junior Professor** ('Ecology and evolution of molecular host-parasite interactions', appointed in 2014 together with Humboldt-Universität zu Berlin). Also, a **new department head** was appointed in 2014 for the Department of Evolutionary Genetics after the former head had accepted a university position. In 2018, the former deputy head of the Department of Evolutionary Ecology took over as head of department.

Strategic work planning for the coming years

In the coming years, IZW plans to continue working in the three Programme Areas. It plans to focus its work on the overarching questions which are defined by the Programme Goals and for which IZW's long-term projects are about to play a pivotal role.

<u>Programme Area 1</u>

Subsequent to previous work to assess traits, their variation and limitation at the (epi-) genetic, cellular and organismic level, IZW plans to complement this work with theoretical approaches. This will also include expanding long-term projects in Europe, Africa and Southeast Asia complementing them with controlled experiments under captive condition (PG 1). Also, IZW wants to continue investigations of infectious and non-infectious diseases of wildlife in order to gauge the impact of diseases on individuals, populations and species. In this context, host-pathogen co-evolution and interactions, risk modelling, host immunology and cross-species microbe and parasite transmission will be of increasing interest (PG 2). Furthermore, IZW aims to investigate in more detail key drivers of biodiversity decline: land-use change, human-wildlife conflicts, illegal hunting, climate change, and pathogens (PG 3). Likewise, IZW intends to continue to focus its *in situ* conservation research at its long-term field sites also extending stakeholder involvement (PG 4).

Programme Area 2

With the new Department of Ecological Dynamics consolidated, IZW aims to develop, refine and apply dynamic models (population models, individual-based models) and statistical models (e.g. movement models) to elucidate factors driving individual movements, population dynamics or species distribution. Also, it will both continue to expand its toolbox for different –omics technologies as well as the development of non-invasive and minimally invasive techniques (PG 5). Research-oriented services are planned to be continually improved and updated (PG 6). Furthermore, IZW plans to expand its scientific collections aiming to digitise the metadata of all collections (PG 7). The three large conference formats organised by IZW are to be continued (PG 8).

Programme Area 3

In the coming years, IZW aims to pursue an evaluation of its KTT and PR instruments and the subsequent development of outreach strategies for individual projects (PG 9 and 10).

"High-tech for a new level of wildlife research in the Anthropocene"

As IZW points out, biodiversity research has undergone a fundamental change in the past decades, from a traditionally descriptive to equipment-intensive, technologically driven analytical research. In order to exploit the potentials associated with this, to fill knowledge gaps, to implement modern field and laboratory methods and to develop strategies for slowing down the advancing extinction crisis, IZW plans to realise a high-tech approach to take all its research fields to a new level of wildlife research in the Anthropocene.

To implement these plans starting in 2024, IZW envisages a proposal for a **large extraordinary item of expenditure of scientific-strategic nature** (*großer Sondertatbestand inhaltlich-strategischer Natur/Ausbaumaßnahme*) to invest more than € 5m per year additional institutional funding in the following areas: field work, biobanking, laboratory, modelling and data analysis, science-society interface, a platform for young scientists and administration. In accordance with current procedures, the Science Council (*Wissenschaftsrat*) would be responsible for the evaluation of such a proposal.

4. Controlling and quality management

Facilities, equipment and funding

In 2019, IZW's **revenues** totalled € 14.3m. They were made up of € 9.48m (66%) institutional funding by federal and *Länder* governments according to AV-WGL, € 4.67m (33%) revenues from project grants and € 0.18m (1%) revenues from services (cf. appendix 3). The most important **third-party funding providers** were the federal government (39%), national and international foundations (17%), the Leibniz Competitive Fund (10%) and the German Research Foundation (9%). IZW has a third-party funding strategy.

Due to rising costs for energy, personnel, consumables and equipment, as the institute points out, the gap between institutional budget and actual costs steadily increased since 2015 amounting to € 0.71m in 2020. In order to alleviate this shortfall, various measures have been implemented: IZW terminated the development of residency programmes for

veterinarians and vocational training positions have been reduced from ten to four. Also, PhD and postdoc positions financed through the institutional budget are not being filled any more. Furthermore, the junior professorship will not be filled after the contract ends in 2024 (cf. chapter 3). In recent years, no major new equipment was procured nor was outdated equipment replaced.

The institute has a main **building** with two extensions on its main premises at the Tierpark Berlin. Extension building I was opened in 2006, extension building II was completed in 2012. In 2018, IZW successfully applied for funds to construct a new laboratory building to increase the institute's capacity for employing cellular techniques. Planning for the construction of another extension building is currently underway (cf. chapter 3).

IZW operates a **field research station** in Niederfinow (65 km northeast of the institute in rural Brandenburg) since 1993. It houses experimental colonies of roe deer, European brown hare, bats and Alpine marmot.

IZW runs **laboratories** with specialised equipment for different research fields. Facilities include, amongst others, several laboratories for molecular biology, laboratories for cell biology, analytical laboratories, microscopy facilities, a veterinary clinical facility, a computed tomograph facility and a facility for processing anatomical/morphological samples.

The institute is part of the Corporate Network of the *Forschungsverbund Berlin*, a Berlin-wide computer-network of all eight institutes of the FVB. It was established in 2001 in order to achieve synergies in areas of common interests – cost savings, fast and redundant connection to the internet, backup facilities, and community services. In order to renovate IZW's **IT infrastructure** it has applied for a major construction project for 2022.

Organisational and operational structure

IZW is one of currently eight institutes of the ***Forschungsverbund Berlin*** (FVB), with administration being shared between the joint FVB administration and the local administrative unit.

IZW is headed by the **scientific director** and the **managing director** of the FVB. The institute's **governing board** consists of the director and the heads of the six scientific departments, advised by the head of local administration, the head of the Science Management unit and the PR officer. All decisions of institutional relevance are made in meetings of the governing board every two weeks, with the director having a right of veto. The main results of these meetings are communicated via email to all staff in German and English. The strategy and the concomitant work plan are reviewed once a year during a retreat of the governing board. The department heads conduct regular meetings with the members of their departments. **Standing committees** exist for (1) ethics and animal welfare, (2) health and safety, (3) building construction and laboratory renovation, and (4) library acquisitions.

Quality Management

IZW has enacted 'Guidelines of good scientific practice at the IZW' based on the rules of the FVB, and uses the 'Procedure in case of suspected scientific misconduct' (as amended

in 2004) in both cases referring to the guidelines and procedures adopted by the German Research Foundation (DFG) and/or Leibniz Association.

IZW has implemented various animal welfare measures, i.e. quality control for animal experiments (animal welfare body, animal welfare officer, advise on veterinary procedures, internal committee for ethics and animal welfare). IZW is also committed to complying with the 'Nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the Convention on Biological Diversity'.

IZW encourages the publication of important results in high-ranking multi-disciplinary journals and has recently revised its publication strategy to explicitly foster open access. Whereas IZW does not have an institutional open access fund, it regularly makes use of the support fund for open access of the Leibniz Association or, where possible, also includes open access fees in proposals for third-party funding.

IZW possesses an institutional strategy for knowledge and technology transfer which aims in particular to foster joint cooperative ventures in which it works with small and medium sized enterprises in developing products based on its scientific insights. For example, the lease on the computed tomograph is linked to a joint development and technology transfer contract with the manufacturer.

In order to ensure high quality, consistency and reliability of the results of the services rendered, all research-oriented services provided by the IZW are carried out according to Guidelines of Good Laboratory Practice and are subject to quality management. Personnel participate in training exercises, and labs and procedures are regularly evaluated by the health authority of Berlin. Where applicable, IZW uses international reference standards for data acquisition and analysis and has started to develop a data management plan.

IZW uses a performance-based bonus system. Quantitative indicators are collated in internal cost-performance calculations (*Kosten-Leistungsrechnung*, KLR) and include number and quality of publications, presentations, lectures, amount of external funding, patents, as well as outreach and knowledge transfer activities.

Quality management by advisory boards and supervisory board

The **Scientific Advisory Board** (SAB) of the IZW consists of at least six and at most twelve internationally renowned scientists representing the range of disciplines present at the institute. There is also one member each of the zoo and the conservation community, respectively. Representatives of the State government and the Federal Ministry of Education and Research (BMBF) take part as guests in the meetings.

The SAB meets at least once a year and advises the institute's management in fundamental questions regarding the research programme, its external scientific cooperation and the strategic development. The SAB regularly reviews the work of individual departments and conducts an audit three to four years after each evaluation. The last audit was held in 2017.

The supervisory board of the IZW is the **Board of Trustees** (*Kuratorium*) of the FVB, which is responsible for all essential scientific, programme-related and economic issues of all the institutes within the FVB, appoints directors and confirms joint professorial appointments for each institute. Decisions by the Board of Trustees that relate to IZW are

prepared by its **Institute Committee** consisting of the SAB's chairperson and both the representatives of the Berlin Senate Chancellery and the federal ministry (BMBF). The institute director and the managing director of the FVB have guest status. The SAB submits its recommendations to the Institute Committee, which then prepares the recommendations to be considered by the Board of Trustees.

5. Human Resources

On 31 December 2019, IZW employed 179 people (without student assistants). This corresponds to 144.4 full-time equivalents (FTE), 63.9 of which were assigned to research and scientific services, 55.0 to service positions and 7.5 to administration (cf. appendix 4 for details).

Leading scientific positions

Leading scientific positions at IZW (Director and heads of departments) are appointed as joint professorships with one of the three Berlin universities and the University of Potsdam. To this end, IZW draws on the relevant guidelines of Leibniz Association and the FVB:

Management of the Institute:

- Director (W3, 2000, Freie Universität Berlin, Professor of Interdisciplinary Wildlife Sciences)

Heads of departments:

- Department of Evolutionary Genetics (W3, 2014, University of Potsdam, Professor of Molecular Ecology and Evolution)
- Department of Reproduction Management (W3, 2015, Freie Universität Berlin, Professor of Wildlife Reproduction Medicine)
- Department of Wildlife Diseases (assoc Prof, W2, 2009, Freie Universität Berlin, Professor of Wildlife Diseases)
- Department of Ecological Dynamics (W2, 2018, Technical University Berlin, Professor of Animal Ecology in Ecologically-oriented Planning)
- Department of Reproduction Biology (apl Prof, 2009, Humboldt-Universität zu Berlin, Professor of Reproduction Biology)
- Department of Evolutionary Ecology

Two appointment procedures (W3) are currently underway with Technical University Berlin for the department head "Reproduction Biology" (due to retirement) and with University of Potsdam for an *ad personam* appointment for the department head "Evolutionary Ecology". Also, two appointment procedures are currently underway to lift the W2 professorships for two heads of departments to W3 level.

Further professorships exist as follow:

- Junior-Professor of Ecology and Evolution of molecular host-parasite interactions (W1, 2014–2024, Humboldt-Universität zu Berlin)

- Professor of Wildlife Reproduction (adj assoc Prof, 2018, University of Sydney)
- Professor for Animal Genetics (adj Prof, 2018, Humboldt-Universität zu Berlin)

Postdoctoral staff

The promotion of postdocs at IZW follows the respective Career guidelines of Leibniz Association. According to IZW, the institute offers a stimulating scientific environment, in which postdocs can benefit in particular from long-term projects with established infrastructures and existing datasets. IZW fosters links to scientific networks, not only through research but also by involving postdocs in the organisation of seminars and conferences and in conducting research-based services. To elucidate career options outside of academia, IZW also includes postdocs in industry collaborations, stakeholder dialogues and public relations work. Following a survey among postdocs and postdoc supervisors IZW plans to develop guidelines for good mentoring.

In 2018 IZW established in-house financed positions for postdocs which are currently not offered due to cost-cutting measures (cf. chapter 4). Since the last evaluation five postdocs have moved to leading positions at other institutions.

Doctoral candidates

IZW provides "Guidelines for doctoral dissertations at the IZW" (2011, currently being updated) as well as "Guidelines for the good supervision of doctoral students at the IZW" (approved in 2019) to ensure standards and transparent procedures. The guidelines specify tasks/responsibilities of supervisors during different phases of a doctoral project, from the planning phase via the hiring and working phases to completion of the dissertation and publications of manuscripts, and puts down measures to be taken in the case of non-compliance.

IZW provides a **structured doctoral training programme**. Within this context, IZW offers several general and facultative courses annually. Also, some doctoral students are enrolled in structured programmes at universities, such as the Dahlem Research School of the FU Berlin, The Potsdam Graduate School or DFG Training Groups (cf. chapter 6). For students enrolled in university graduate schools, a thesis advisory committee is usually required.

There are monthly doctoral seminars and every two to three years doctoral students organise an international PhD student symposium. In addition to scientific supervisors, IZW appointed two staff scientists to be doctoral student coordinators and general advisors to doctoral students. IZW aims that dissertations should be completed within three years; the current median duration of completing a doctoral dissertation is 3 years and 9 months.

In 2019, IZW hosted 51 doctoral students (including 16 scholarship recipients). From 2017–2019, 78 degrees qualifying candidates to study for a doctorate, 34 PhD theses and one habilitation have been completed successfully.

Non-scientific staff

IZW provides vocational training in four professions. Members of staff are authorised instructors for biological laboratory technicians (since 1998), management assistants in office administration (since 1999), zoo animal keepers (since 2006) and IT specialists (since 2012). Between 2017–2019, ten trainees have completed their vocational qualification.

IZW trains its technical scientific staff within the departments and in the field of technical and administrative infrastructure in order to develop and expand their spectrum of professional skills. Since 2008, the IZW offers English courses for technical and administrative staff. All staff are also encouraged to take part in subject-specific external courses in order to stay up-to-date with technical, methodological, legal or other developments. Additionally, IZW supports technical staff to become certified apprentice instructors in their respective field. The institute systematically promotes the qualification of Laboratory Assistants to Biological-Technical Assistants (TA).

Equal opportunities and work-life balance

In accordance with the "Research-oriented standards on gender equality" of the German Research Foundation (DFG) IZW has set targets in its programme budget for increasing the proportion of women at specific qualification levels according to the **Cascade Model** (*Kaskadenmodell*) of the DFG.

On the reporting date 31 December 2019, 25 out of 51 doctoral students were women (49%), 16 out of 30 at the level of scientific staff in non-executive positions (53%, including externally financed post-doctoral researchers) and 14 out of 25 at the group leader level (56%). At the executive level, IZW had an equal gender distribution (4:4): two heads of the six scientific departments and the heads of the administrative unit and the Science Management unit are women (cf. appendix 4). Amongst the entire institute staff, 62% were women. Among the laboratory technical staff, 78% of the employees were female.

As of 31 December 2019, 38% of all people working in Research and scientific services came from abroad. At the level of doctoral students, almost two third of all people had a foreign background (33 of 51).

IZW received the **Total E-Quality certificate** in 2011, and has renewed it twice since, in 2014 and 2018. Since 2005, the female IZW staff elects a gender equality officer and her deputy. The institute follows a working plan on gender equality which is discussed quarterly between the director and the gender equality officer.

IZW promotes **life-work-balance** and health of its employees. Corporate health management has been recently developed and supports staff to reintegrate into work after long periods of sick leave, and implements measures such as company sports. Following a survey in 2015 and structured workshops various measures have been implemented to alleviate stressors at work. Also, a company agreement on "Partnership-based fair conduct of work" was developed.

IZW is committed to providing support for all employees with young children or family members in need of care, as well as for currently nine disabled employees. It offers, e.g.,

flexible hours, home office days as well as the reduction of full-time positions. A parent-child office is available for parents requiring *ad hoc* child care.

6. Cooperation and environment

IZW collaborates with the three Berlin **universities** (Humboldt-Universität, Freie Universität and Technical University Berlin) and the University of Potsdam with respect to the appointment of joint professorships, academic teaching, regional consortia as well as scientific projects. Besides this, IZW maintains research collaborations with 26 national and 108 international universities worldwide.

IZW is a founder, lead or active partner in several **research consortia** and **regional networks**:

- Berlin-Brandenburg Institute for Advanced Biodiversity Research (BBIB)
- Berlin Center for Genomics in Biodiversity Research (BeGenDiv)
- Center for Infection Biology and Immunity (ZIBI)
- Berlin-Brandenburg Center for Stable Isotope Ecology (CeSIE)
- DFG Research Training Group "Parasite infections: from experimental models to natural systems" (RTG 2046; 2015–2024) together with Freie Universität Berlin, Charité – Universitätsmedizin Berlin, Robert Koch Institute Berlin, MPI for Infection Biology Berlin and MPI of Colloids and Interfaces Potsdam/Golm
- DFG Research Training Group "Integrating biodiversity research with movement ecology in dynamic agricultural landscapes – BioMove" (RTG 2118; 2015–2024) together with University of Potsdam, Freie Universität Berlin and the Leibniz Centre for Agricultural Landscape Research (ZALF)

IZW collaborates with various institutes of **Leibniz Association**, e.g. Senckenberg – Leibniz Institution for Biodiversity and Earth System Research (SGN), Leibniz Institute for Science and Mathematics Education (IPN) and the Leibniz Institute on Knowledge Media (IWM). It is partner in three Leibniz Research Alliances: "Infections '21", "Healthy Aging" and "Biodiversity". Also, IZW is one of four partners in the Leibniz graduate school for parasitology and contributes to the conceptual and strategic development of the Association, e.g. with the director leading a Working group on gender equality from 2014–2017.

At present, IZW maintains cooperation with 90 **non-university research institutes** worldwide. There are collaborations and joint projects with 39 conservation organisations and 72 zoological gardens in research, conservation and wildlife husbandry. It collaborates with **national or international organisations**, including specialist groups of the *IUCN Species Survival Commission*, the *German Federation of Zoological Gardens*, the *European Association for Zoos and Aquaria* (EAZA), the *World Association of Zoos and Aquariums* (WAZA) and the *European Association of Zoo and Wildlife Veterinarians* (EAZWV). Other networks include the *Frozen Ark Consortium*, the *Global Management and Propagation Board for Sumatran Rhinos* (GMBP), the long-term network "*European endan-*

gered species breeding program for Przewalski horses", and the research networks EURODEER and EUROLYNX. At IZW's long-term **field sites** in Africa and Asia, the institute collaborates with conservation organisations, governmental institutions and other local stakeholders to transfer scientific findings into sustainable management strategies.

IZW is partner in a Marie Sklodowska Curie Innovative Training Network as well as in the **EU** LIFE project "LIFE FOR DANUBE STURGEONS - Sustainable protection of lower Danube sturgeons by preventing and counteracting poaching and illegal wildlife trade". Furthermore, IZW scientists participate in four COST Actions.

Institution's status in the specialist environment

According to the institute, there are no institutions that are similar to IZW in both mission and structure in the national and international research landscape. Some wildlife research topics are being investigated at German universities and at the three large German natural history museums as well as some other non-university research institutions, e.g. the German Primate Centre (DPZ) or the MPI for Evolutionary Anthropology. However, all of these institutions investigate only selected aspects of wildlife biology (e.g. behaviour, ecology, evolutionary genetics or the biodiversity of mammalian wildlife).

Internationally, in the view of the institute, IZW can be compared to some extent with the Research Institute on Wildlife Ecology at the University of Veterinary Medicine in Vienna, the research institutes of the Zoological Society of London (Institute of Zoology with London Zoo and Whipsnade Zoo, UK), the San Diego Zoological Society (Centre for Research on Endangered Species, San Diego, USA) or the Smithsonian Institution (Smithsonian Conservation Biology Institute, Front Royal, and National Zoological Park, Washington DC, USA).

7. Subdivisions of IZW

Department of Evolutionary Ecology

[26.9 FTE, thereof 12.9 FTE Research and scientific services, 4.3 FTE Doctoral candidates, and 9.7 FTE Service staff]

The department evaluates the adaptability of free-ranging wildlife populations to environmental changes such as land use and climate changes. It uses hypotheses embedded in evolutionary theory to investigate the influence of social, ecological and anthropogenic environments on the behaviour, physiology, survival and reproductive success of wildlife species.

Research focuses on long-term field studies in Europe and Africa, where the department investigates multiple generations of individuals with known life-histories. It performs classical behavioural observations, collects biological samples using minimally invasive methods and employs high-throughput GPS and biologging telemetry for spatial tracking and behaviour recording, respectively. Field work is often complemented by experimental work in captive individuals, e.g., by using the IZW field research stations. Its laboratory core expertise lies in stable isotope and nutritional analyses. Ultimately, it aims to develop

science-based conservation solutions for mitigating human-wildlife conflicts. Its close interaction with stakeholders enables the department to identify relevant research questions and ensure a wide acceptance of conservation related findings.

As most important results the department refers to the following:

- Male philopatry and dispersal can result from a single process of habitat selection (with Dept Evolutionary Genetics).
- Social support drives female dominance in the spotted hyena (with Dept Evolutionary Genetics).
- Experienced bats integrate the sun's position at dusk for navigation at night.
- European common noctule bats are partial and differential migrants (with Dept Ecological Dynamics).
- The lower troposphere is an important bat habitat that deserves international conservation efforts.
- Immunity of cheetahs is higher than previously thought, despite their low variability at the major histocompatibility complex (with Dept Wildlife Diseases).
- The cause of the past canine distemper virus epidemic in Serengeti carnivores was a novel virus strain, facilitating the invasion of non-canid lymphatic tissues (with Dept Wildlife Diseases).
- The mating system of Southern white rhinoceros causes inbreeding when spatially confined (with Dept Evolutionary Genetics).
- Leading the first international guidelines for bat conservation with outdoor lighting projects within the UNEP/EUROBATS agreement.
- Contract with the Namibian Ministry for Environment and Tourism to determine the cheetah and leopard densities in preselected biomes in Namibia.

2017–2019 the department published 129 articles in peer reviewed journals, 21 stakeholder publications as well as 13 individual contributions to edited volumes. 40 publications were compiled in cooperation with other departments. In the same period, the department had € 2.9m in institutional funding. Also, it received third-party funds amounting to approx. € 3.8m. Of these € 1.6m were obtained from national and international foundations, € 0.70m from the federal government, and € 0.49m from the DFG. Furthermore, the department gained € 0.14m as revenues from services. 23 academic degrees and 14 doctoral degrees were supervised successfully.

In the coming years the department plans to expand its long-term field studies. To improve communication with local stakeholders and also to comply with international biodiversity treaties (e.g. Nagoya and CITES), it aims to install a scientific manager and local field workers for its field sites in Africa. Also, in response to the overall geographic focus of IZW, it wants to establish long-term field sites in Southeast Asia. Furthermore, the department plans to intensify and complement its field work with next-generation high-throughput biologgers and transmitters, and envisages satellite-based remote access to behavioural

and physiological data of individuals also applying artificial intelligence and new visualisation tools.

Department of Evolutionary Genetics

[14.05 FTE, thereof 8.7 FTE Research and scientific services, 1.75 FTE Doctoral candidates, and 3.6 FTE Service staff]

The department elucidates how past conditions have shaped current mammalian diversity and how that diversity may change in decades to come. Four facets of mammalian evolutionary diversity are in focus: adaptive genetic, neutral genetic, epigenetic, and life-history variation. Studies especially include species of conservation interest (tiger, Eurasian lynx, Asian elephant), species of IZW long-term research projects (spotted hyaena, cheetah, hedgehog), and species particularly rich in historical data (domestic horses).

Also, the department develops methods to study the evolutionary diversity of wildlife, e.g., to monitor demographic changes in non-model species using genetic, isotopic as well as phenotypic markers. Beyond the publication of scientific papers and contributions to open source software it administrates, together with five regional partners, the *Berlin Center for Genomics in Biodiversity Research* (BeGenDiv). It curates two large reference sample collections: the Genome resource bank ARCHE and the European Association of Zoos and Aquaria (EAZA) Biobank.

As most important results the department refers to the following:

- A revised tiger taxonomy combined ecological, genetic, and phenotypic characteristics of current and extinct tiger populations and reduced the number of subspecies from nine to two (with Dept Evolutionary Ecology).
- Heritable epigenetic modifications allow wildlife to respond quickly to environmental changes and are passed across the male line to the next generation (with Depts Reproduction Biology, Reproduction Management, and Evolutionary Ecology).
- Demographic changes can trigger the expression of chronic diseases caused by genes under antagonistic pleiotropy.
- Low variability found in the Y chromosome of horses is the result of continuous selection exerted by humans.
- Wild horses survived the Pleistocene megafauna extinction by evolving black coat colour as adaptation to new forest habitats
- The Vertebrate Genomes Project develops new bioinformatics pipelines and aims to generate near error-free reference genomes of ~70,000 extant vertebrate species.
- Development of a new R package for the management of camera trap data — used by researchers all over the world (with Junior Research Group).
- Validation of a new protocol that improves the use of degraded DNA (e.g., from museum specimens) for genetic or genomic analyses.
- A new workflow that overcomes several biases introduced by current MHC genotyping methods using next-generation sequencing.

– An easy to follow explanation of epigenetics, its mechanisms and its role in evolution which also resulted in an invitation to design the "Epigeneum" exhibition at Rostock Zoo in spring 2020 (with Science Management).

2017–2019 the department published 70 articles in peer reviewed journals, seven stakeholder publications as well as five individual contributions to edited volumes. 21 publications were compiled in cooperation with other departments. In the same period, the department had almost € 2.5m in institutional funding. Also, it received third-party funds amounting to approx. € 1.1m. Of these € 0.53m were obtained from the *Berlin Consortium for Genomics in Biodiversity Research*, € 0.26m from the Leibniz Competitive Fund, and € 0.18m from the EU. Furthermore, the department gained € 41k as revenues from services. 11 academic degrees and three doctoral degrees were supervised successfully.

In future the department will continue to focus on the four main facets of mammalian diversity, putting a greater emphasis on epigenetics, comparative genomics and the interplay between demography and selection. In the context of projects already obtained it aims to elucidate the epigenetic mechanisms underlying responses to environmental changes in spotted hyenas also implementing a model which combines demography and genetics (a demogenetic model) of a spotted hyena population.

Department of Wildlife Diseases

[20.4 FTE, thereof 7.1 FTE Research and scientific services, 3.8 FTE Doctoral candidates, and 9.5 FTE Service staff]

Work in this department addresses the evolutionary, ecological and anthropogenic factors which drive pathogen adaptation and host responses to wildlife diseases. The department studies diseases relevant to free-ranging and captive wildlife, distinguishing species-specific factors from general principles of infection biology.

The scale of research ranges from the individual (case studies) to populations and species level. Analysis ranges from gross anatomical evaluation to detailed molecular (-omics) approaches, combining veterinary medical and biological sciences, with the majority of projects representing long-term studies and often including fieldwork. A major focus is to investigate the factors influencing immunity and general host defence including adaptation of hosts to different environments and pathogens. The department's research focuses on pathogen-host relationships and therefore, many projects require the study of multiple hosts and complex pathogen-host transmission networks.

As most important results the department refers to the following:

– Discovery of a novel mammalian genomic anti-viral defence.
– Immunity of cheetahs (through innate immunity) is higher than previously thought, despite their low variability at the major histocompatibility complex (with Dept Evolutionary Ecology).
– Demonstration of viral transmission through freshwater in Africa and Mongolia under conditions of seasonal water shortage (with Depts Evolutionary Genetics and Ecological Dynamics).

- Bat immunology: Hibernating and sick bats demonstrate protein expression profiles different to active and healthy bats (with Depts Evolutionary Ecology and Reproduction Biology).
- Vampire bat virology: there is strong selection against some viruses owing to host adaptations and, in contrast, remarkable ability to host some viruses.
- Although considered a mammalian pathogen, amphibians also suffer from brucellosis, caused by a novel *Brucella* species.
- A novel poxvirus can kill juvenile red squirrels in Germany.
- Wolves may increase parasite prevalence in their prey and parasite pressure on hunters' dogs.
- Grey wolf health assessment: Returning wolves are infrequent carriers of zoonotic bacteria and viruses.
- Autoimmune disease is the cause of death of Knut, a polar bear in Berlin Zoo, as revealed by combined efforts of biologists, veterinary scientists and medical specialists.

2017–2019 the department published 92 articles in peer reviewed journals, 13 stakeholder publications and four individual contributions to edited volumes. 35 publications were compiled in cooperation with other departments. In the same period, the department had almost € 3m in institutional funding. Also, it received third-party funds amounting to approx. € 2.1m. Of these € 0.68m were obtained from the Leibniz Competitive Fund, € 0.26m from the DFG, and € 0.18m from the federal government. Another € 0.74m derived from congresses, workshops and other events. 12 doctoral degrees were supervised successfully.

In the coming years the department aims to intensify its collaborations with zoonosis oriented research groups in Berlin via the *Center of Infection Biology and Immunity* (ZIBI). Also, in maintaining its participation in the Leibniz Research Alliance "Infections '21", it envisages to work on pathogen transmission from water and other environmental sources. Furthermore, it plans to extend several research activities in the fields of Genomics/Bioinformatics as well as Proteomics and Diagnostics.

Department of Reproduction Biology

[13.8 FTE, thereof 5.4 FTE Research and scientific services, 3 FTE Doctoral candidates, and 5.4 FTE Service staff]

The main focus of this department is to understand the evolution of reproductive traits and the impact of environmental factors on fertility. The department investigates the generation and maturation of germ cells, their functional interactions in the male and female genital tract as well as the endocrine regulation of reproductive processes. The implementation of cell-based techniques bridges the gap between the genetic and organismic level of research and allows comparative experimental investigations across species in vitro.

The departments uses its expertise on gamete biology to continuously develop and refine assisted reproduction techniques (ART), in particular cryopreservation of gametes and reproductive tissues, for a variety of species. Based on the long-term access to wildlife

samples, it curates the IZW bio-cryobank and cryopreserved individual samples from 102 species with a special focus on felids (37 species). Its endocrine laboratory fosters new approaches for non-invasive hormone assessment and uses metabolomics to unravel reproductive processes and assess the allostatic load in wildlife. The department's methods are validated for a great variety of species also providing expertise on non-invasive assessment of sexual and 'stress' hormones.

As most important results the department refers to the following:

- Development of a method for the non-invasive diagnosis of pregnancy in carnivores based on PGFM in big cats and on placental oestrogens in the giant panda.
- Unravelling of the physiological persistence of *corpora lutea* (CL) in lynx (with Dept Reproduction Management). These CL are characterised by a high intraluteal prostaglandin E_2 level.
- Establishment of luteal cell cultures of two cell types of domestic cat *corpora lutea*, allowing the investigation of the peculiarities of luteal life cycle regulation in feline species *in vitro*.
- Identification of key molecules for gametogenesis as prerequisites for fertility assessment and future *in vitro* approaches.
- Demonstration of the impact of seminal fluid (missing in sperm from epididymis) on the sperm-oviduct interaction by a first *in vitro* oviduct cell culture assay in felids (with Dept Wildlife Diseases).
- New insights in molecular properties of feline seminal fluid to protect sperm (lipids) from oxidative stress indicate options for extender mediated lipid repair mechanisms in semen.
- Development of field-suited methods for cryobanking of gametes and reproductive tissue from felids that can be applied by non-skilled persons (with Dept Wildlife Diseases).
- Mathematical modelling of sperm transit in the female genital tract was developed as a new tool to predict key factors for reproductive success without animal experiments.
- Generation of the first lion blastocysts *in vitro* and participation in the generation of the first cubs by nonsurgical artificial insemination in an Asiatic golden cat.
- Establishment and validation of the use of hair for non-invasive detection of hormones for different species (with Dept Evolutionary Genetics).

2017–2019 the department published 35 articles in peer reviewed journals and one edited volume/monograph. 16 publications were compiled in cooperation with other departments. In the same period, the department had almost € 2.2m in institutional funding. Also, it received third-party funds amounting to approx. € 0.55m. Of these € 0.34m were obtained from the DFG and € 0.12m from national and international foundations. Furthermore, the department gained € 54k as revenues from services. Two academic degrees, two doctoral degrees and one habilitation were supervised successfully.

The department's future strategy will be further developed by the new department head who will replace the retiring head in December 2020. The position is currently advertised as a joint W3 professorship with the Technical University of Berlin in cellular reproduction biotechnology and will cover basic and applied aspects of cellular biology with emphasis on reproduction.

Department of Reproduction Management

[16.6 FTE, thereof 9.3 FTE Research and scientific services, 1.5 FTE Doctoral candidates, and 5.3 FTE Service staff]

The department investigates reproductive strategies and human-induced reproductive disorders in wildlife. It develops new conservation strategies, including advanced assisted reproduction technologies and stem cell associated techniques. These research activities are interlinked with animal welfare and ethical research.

State-of-the-art imaging techniques are used in synergy with methods of evolutionary morphology and comparative anatomy. The department generates basic knowledge on anatomy, morphology and reproductive physiology to develop new techniques in assisted reproduction. Specifically, it pioneers artificial insemination, gamete collection, *in vitro* embryo production and embryo transfer for endangered and critically endangered wildlife species. Also, the department collects and manages frozen sperm samples from more than 45 endangered or even extinct species as well as a collection of cryopreserved tissues and fibroblast cultures from more than 150 endangered species as a contribution to the IZW and other European cryobanks. It also holds a collection of induced pluripotent and embryonic stem cell lines from 9 endangered species.

As most important results the department refers to the following:

- Successful *in vitro* production of embryos and embryonic stem cells as a model for new conservation measures to rescue critical endangered mammals such as the white rhinoceros.
- Cryopreservation of spermatozoa and oocytes derived from wildlife species building a wildlife sperm bank – the basis for research and development of assisted reproduction technologies.
- Experimental studies on delayed implantation using artificial insemination, embryo transfer (e.g. roe deer, giant panda) and xenogenic inner cell mass transfer in roe deer.
- Naked mole rats have evolutionary traits responsible for extraordinary longevity and are a suitable model for human healthy ageing.
- 1st Int Wild Animal Welfare Award, 1st Conservation Legacy Award and appointment of the department head as an Hon Member *Society of Reproduction & Fertility*.
- Appointments of the department head as a Professorial Fellow (2016–2021) at Melbourne University, Melbourne, Australia, and of adj assoc Prof Hermes at Sydney University, Australia.
- Anatomy of the larynx and physical mechanisms explain infrasonic vocalisations in elephants and low pitched mating calls in koalas.

– Innovative approach to modulate host immunity against specific endoparasites.
– Computed Tomography Research Center – state of the art imaging technology for basic and applied research and diagnostics in wildlife medicine.
– Development of new TB diagnostics in elephants and rhinoceroses using innovative imaging techniques, implemented in current EAZA TB diagnostic guidelines.

2017–2019 the department published 40 articles in peer reviewed journals and ten stakeholder publications. Seven publications were compiled in cooperation with other departments. In the same period, the department had almost € 2.5m in institutional funding. Also, it received third-party funds amounting to approx. € 1.6m. Of these € 0.92m were obtained from the federal government, € 0.31m from zoological gardens and associated institutions, and € 0.27m from national and international foundations. Furthermore, the department gained € 0.24m as revenues from services. One academic degree was supervised successfully.

In future the department will strive to combine the wildlife *in vitro* fertilisation centre established in late 2019 with state-of-the-art stem cell laboratories. This will come along with the reallocation of resources away from evolutionary morphology towards advanced assisted reproduction technology in order to strengthen expertise in wildlife reproduction medicine and conservation. Also, the department aims to further initiate discussions on new methods to safeguard biodiversity as well as to develop measures to quantify wild animal health and well-being in captive wild animals.

Department of Ecological Dynamics

[25.1 FTE, thereof 10.3 FTE Research and scientific services, 9.5 FTE Doctoral candidates, and 5.3 FTE Service staff]

The department elucidates ecological dynamics in space and time and across gradients of human-altered environments. It uses spatio-temporal extrapolation and spatially-explicit dynamic modelling to understand and better forecast wildlife responses to challenges at the population and community level. The department was established in January 2018 to strengthen ecological modelling, including simulation and biostatistics, in line with a key recommendation of the previous evaluation.

More specifically, the department investigates how the fitness consequences of processes acting at the individual level, such as social behaviour, movements, competition, predator-prey or host-pathogen interactions shape population and community dynamics. By integrating these multi-level perspectives into its research framework, it aims at achieving a holistic view of ecological dynamics and their evolutionary consequences. Ultimately, it aims at forecasting the future viability of wildlife in the Anthropocene and improve planning for conservation on the landscape scale.

As most important results since its establishment the department refers to the following:

– A global meta-analysis showed that vertebrates adapt to climate change, but that phenological traits cannot keep up with the faster changing climate (with Dept Evolutionary Genetics).

- The recovery of the spotted hyena population to an epidemic of canine distemper virus was slow and boosted by the demographic contribution of high-ranking females.
- High loads of energetically costly (hookworm) parasites have negative fitness consequences for juvenile spotted hyenas, particularly for offspring of low-ranking mothers.
- Seasonality and long distance movements drove patterns of a long-term infection with Classical Swine Fever in wild boar at the landscape and individual level; this result contributed to deriving management actions.
- Dynamic modelling revealed an unexplained mortality, likely caused by illegal hunting, which threatens the long-term viability of the European lynx population in the Bavarian forest.
- Hunting is a more immediate threat to ground-dwelling mammal and bird communities than forest degradation caused by selective logging in Southeast Asia.
- Rediscovery of the silver-backed chevrotain – first photos and videos of a small endemic mouse-deer from Southeast Asia that was last recorded decades ago.
- Assessing ecological stability in natural communities and populations requires measuring multiple properties.
- Establishment of a laboratory, bioinformatics and analytical pipeline to pave the way for the transition from ad-hoc species detections to systematic biodiversity surveys using environmental DNA.
- Over 200 rangers, national parks wardens, research assistants and undergraduate and doctoral students trained during workshops, field trainings and statistical boot camps in long-term field sites in Southeast Asia and Tanzania.

2018–2019 the department published 60 articles in peer reviewed journals, four individual contributions to edited volumes and ten stakeholder publications. 23 publications were compiled in cooperation with other departments. In the same two-year period, the department had almost € 1.5m in institutional funding. Also, it received third-party funds amounting to approx. € 1.7m. Of these € 0.85m were obtained from the federal government, € 0.26m from the Leibniz Competitive Fund, and € 0.24m from the DFG. Six academic degrees and three doctoral degrees were supervised successfully.

In the coming years the department will pursue its objective to understand and forecast wildlife responses to challenges in space and time across the three levels of organisation (individual, population and community level) by linking and fostering empirical and theory-based modelling approaches in order to strengthen its conceptual focus: 1) At the individual level, the department will focus on understanding early life effects to predict fitness outcomes using social network analyses. 2) It will expand the dynamic, mechanistic modelling approach to predict population dynamics by including traits and genetics. 3) It will increase the level of meta-analyses or global analyses to generalise species distributions across scales and to understand biodiversity dynamics. At the same time, the department aims to continue to integrate its methodological expertise in inter-departmental collaborations.

8. Handling of recommendations from the previous evaluation

IZW responded as follows to the nine main recommendations of the last external evaluation (highlighted in italics, see also statement of the Senate of the Leibniz Association issued on 20 March 2014, pages B-2/B-3):

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."*

   According to IZW it has strengthened strategic alignment of existing and new projects: In regular workshops, all staff scientists and postdocs present their work specifically in the context of how they contribute to the institute's strategy. Also, important third-party funding proposals are examined with regard to how they fit into the strategy of IZW. The institute has also conducted a multi-step discussion process involving all IZW staff to refine its Programme Goals which permitted IZW to develop a new structure to clarify the core of its work (cf. chapter 2).

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."*

   As IZW points out, it explicitly included expertise in modelling in funding applications and successfully acquired such positions. It also applied for (2015) and was granted (2017) additional funding to strengthen the field of "Computational Biology" in order to enhance its expertise in theoretical modelling, programming and biostatistics. Using these funds, IZW established a new department "Ecological Dynamics" in 2018 (cf. chapter 3).

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."*

   On its own account, IZW has established or expanded long-term projects on several European wildlife species: temperate zone bats, hedgehog, grey wolf, Iberian and Eurasian lynx and white-tailed eagle. In order to maintain its long-term projects at the state-of-the-art and using their full potential IZW is planning to apply for additional funding to strengthen these projects and secure their continuity (cf. chapter 3).

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."*

   As IZW emphasises, it routinely uses equipment for multiple depreciation cycles since current investment funding does not allow to replace existing equipment at regular intervals. In recent years, the *de facto* decline in the institute's ability to cover accelerating

costs has forced IZW to compensate salary increases and expenditures from investment funding. This has reduced the amount available to replace or procure new equipment.

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."*

   IZW notes that it has more than doubled third-party fund-raising from 2012 to 2019, whilst simultaneously honing its strategy and examining new projects with regard to their fit to strategy. EU funding has only increased modestly because, as the IZW points out, it is largely directed outside its research fields – with EU funding for environmental research focusing on agriculture, forestry, aquatic bodies or technology initiatives, and health-related programmes being dedicated to the health and welfare of people and livestock, not wildlife. Also, funding for biodiversity research is often targeted at taxonomy and monitoring purposes, not the questions IZW studies in terms of adaptability of wildlife to global change.

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."*

   Since 2012, as IZW points out, it has increased the number of publications, their median impact factor and the proportion of articles in high-ranking multidisciplinary journals, both in absolute terms and on a per capita basis. IZW is publishing its results in open access journals whenever feasible, thereby substantially increasing the proportion of open access publications since the last evaluation.

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."*

   According to IZW, it has improved accessibility of its collections since 2013. As part of the additional funding acquired in 2017, IZW has developed a web-based interface to two collections and digitised their metadata. Scientists, zoological gardens and conservation organisations are able to contact the institute and will be provided with samples and/or information pertaining to specific research questions.

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."*

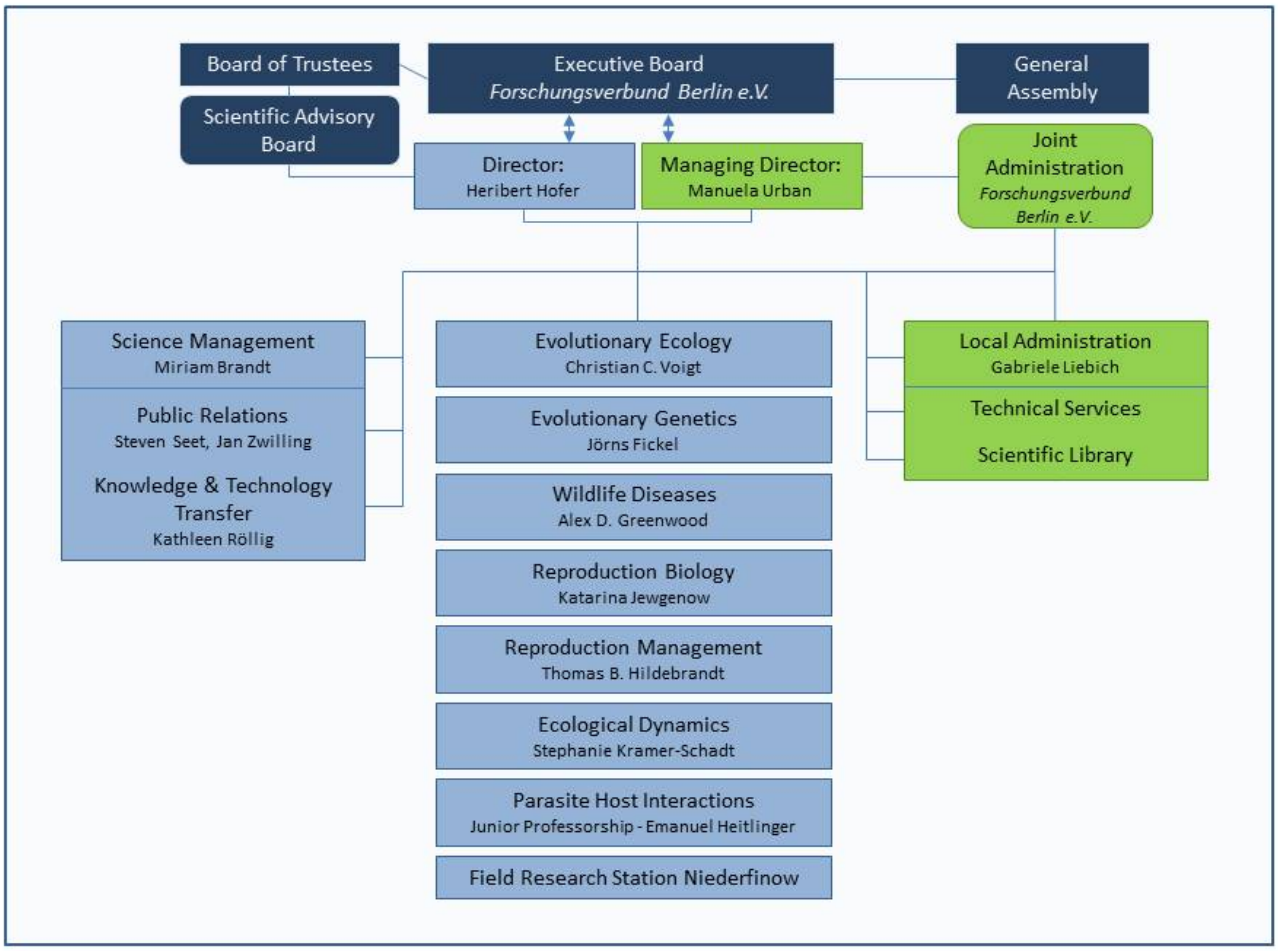
IZW has included funding for one postdoc and one doctoral position for each department in the application for additional funding ("Computational Biology") that was approved in 2017 and established the positions as recommended in the last evaluation. Due to the difficult financial situation of the institute, it had to stop filling these positions in 2018.

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."*

Since the last evaluation IZW employed additional staff: a bioinformatician, a facility manager and an IT specialist. By encouraging IZW's senior IT administrator to become an apprentice instructor, the institute secured additional capacities in IT by educating vocational trainees in this field.

Appendix 1

Organisational Chart



Appendix 2

Publications and patents

	Period		
	2017	**2018**	**2019**
Total number of publications	**138**	**153**	**160** (25)
Articles in peer-reviewed journals [1)]	115	114	128 (25)
Articles in other journals	1	–	1
Individual contributions to edited volumes	3	10	11
Editorship of edited volumes (and monographs)	3	1	4
Stakeholder publications [2)]	16	28	16

Industrial property rights [3)]	**2017**	**2018**	**2019**
Patents (granted/applied)	5 / 1	5 / 1	0 / 2
Other industrial property rights (granted/applied)	1 / 0	1 / 0	2 / 0
Exploitation rights / licences (number)	0 / 3	0 / 3	0 / 3

[1] Contributions that have been accepted for publication but not yet appeared are added in parenthesis.
[2] Publications for specific interest groups: These could be guidelines published as separate brochures, or articles in non-scientific journals read by particular stakeholders (e.g. hunting magazines).
[3] Concerning financial expenditures for revenues from patents, other industrial property rights and licences see Appendix 3.

Appendix 3 Revenue and Expenditure

Revenue		2017			2018			2019 [1]		
		k€	% [2]	% [3]	k€	% [2]	% [3]	k€	% [2]	% [3]
Total revenue (sum of I., II. and III.; excluding DFG fees)		13,893.1			14,464.0			14.856.6		
I.	**Revenue (sum of I.1., I.2. and I.3)**	**13,770.6**	**100 %**		**13,980.3**	**100 %**		**14,328.7**	**100 %**	
1.	INSTITUTIONAL FUNDING (EXCLUDING CONSTRUCTION PROJECTS AND ACQUISITION OF PROPERTY)	9,335.5	68 %		9,542.1	68 %		9,481.7	66 %	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	9,335.5			9,542.1			9,481.7		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	–			–			–		
2.	REVENUE FROM PROJECT GRANTS	4,310.0	31 %	100 %	4,266.8	31 %	100 %	4,665.7	33 %	100 %
2.1	DFG	634.4		15 %	434.1		10 %	419.1		9 %
2.2	Leibniz Association (competitive procedure)	454.7		11 %	606.4		14 %	445.2		10 %
2.3	Federal governments	1,359.9		32 %	1,180.2		28 %	1.841.0		39 %
2.3	State ministries (*Länder*), regional administrations	71.2		2 %	68.3		2 %	17.3		0 %
2.4	EU	103.6		2 %	2.9		0 %	102.5		2 %
2.5	Industry, commercial enterprises and business	86.8		2 %	142.4		3 %	116.0		2 %
2.6	Foundations (national and international)	769.4		18 %	717.4		17 %	786.9		17 %
2.7	NGOs (national and international)	163.7		4 %	197.3		5 %	139.1		3 %
2.8	Zoological Gardens and associated institutions	168.2		4 %	147.1		3 %	172.9		4 %
2.9	Congresses, Workshops, IZW Academy, events	280.3		7 %	533.1		12 %	355.5		8 %
2.10	German Academic Exchange Service (DAAD)	15.9		0 %	91.3		2 %	89.7		2 %
2.11	Berlin Consortium for Genomics in Biodiversity Research	201.9		5 %	146.3		3 %	180.5		4 %
3.	REVENUE FROM SERVICES	125.1	1 %		171.4	1 %		181.3	1 %	
3.1	Revenue from commissioned work	124.1			171.1			179.7		
3.2	Revenue from publications	1.0			0.3			1.6		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models etc.)	–			–			–		
3.4	Revenue from exploitation of intellectual property without industrial property rights	–			–			–		
II.	**Miscellaneous revenue** (e.g. membership fees, donations, rental income, funds drawn from reserves)	122.5			145.7			245.9		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* governments, EU structural funds, etc.)	–			338.0			282.0		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		**13,519.6**	**14,489.7**	15,158.5
1.	Personnel	8,648.1	9,325.0	9,303.7
2.	Material expenses	4,130.1	4,035.7	3,898.7
2.1	*Proportion of these expenditures used for registering industrial property rights (patents, utility models etc.)*	5.4	4.5	5.3
3.	Equipment investments	261.2	289.9	1.155.1
4.	Construction projects, acquisition of property	–	258.8	361.2
5.	Other operating expenses	480.2	580.3	439.8
DFG fees (if paid for the institution – 2.5% of revenue from institutional funding)		231.5	237.9	236.3

[1] Preliminary data: yes (expected to be very modestly different to the final figures).
[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 "Revenues from Services".
[3] Figures I.2.1 to I.2.7 add up to 100 %. The information requested here is thus the percentage of the various resources of "Revenue from project grants".

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31.12.2019)

	Full time equivalents		Employees		Female employees		foreig-ners
	Total	on third-party funding	Total	on tem-porary contracts	Total	on tem-porary contracts	Total
	Number	Percent	Number	Percent	Number	Percent	Number
Research and scientific services	**63.9**	**39.1 %**	**79**	**63.3 %**	**41**	**63.4 %**	**29**
1st level (scientific directors)	1.0	–	1	–	–	–	–
2nd level (department leaders or equiv.)	6.0	–	6	–	2	–	1
3rd level (group leaders or equiv.)	23.8	4.2 %	24	20.8 %	14	21.4 %	7
Junior research group leaders	1.0	–	1	100 %	–	–	–
Further academic staff in executive positions (head of Science Management)	1.0	–	1	–	1	–	–
Scientists in non-executive positions (A13, A14, E13, E14 or equivalent)	20.3	83.0 %	26	92.3 %	13	92.3 %	9
Doctoral candidates (A13, E13, E13/2 or equiv.)	10.8	65.9 %	20	100 %	11	100 %	12
Doctoral candidates still being supervised already earning salaries elsewhere	(7.5)	(100 %)	(15)	(100 %)	(8)	(100 %)	(6)
Service positions	**55.0**	**13.0 %**	**65**				
Laboratory (E9 to E12,upper-mid-level service)	23.7	6.3 %	27				
Laboratory (E5 to E8, mid-level service)	8.5	30.9 %	11				
Animal care (E5 to E7, mid-level service)	3.0	–	3				
Library (E9 to E12, upper-mid-level service)	1.4	–	2				
Information technology (E9 to E12, upper-mid-level service)	3.0	–	3				
Information technology (E5 to E8, mid-level service)	1.0	–	1				
Conference organisation (E9 to E13, senior service)	1.3	36.1 %	2				
Conference organisation (E7)	0.5	36.1 %	– [1]				
Knowledge & technology transfer, citizen sci. (E13)	2.8	63.6 %	3				
Public relations (E13, senior service)	1.6	–	2				
Public relations (E7, mid-level service)	1.4	35.6 %	2				
Facility manager, car pool service (E5 to E9, mid-level / upper-mid-level service)	2.9	–	3				
Secretary to the Director, Department assistants (E13, senior service)	0.5	–	1				
Secretary to the Director, Department assistants (E6 to E9, mid-level / upper-mid-level service)	3.5	3.7 %	5				
Administration	**7.5**	**9.3 %**	**9**				
Head of the administration	1.0	–	1				
Staff positions (E9 to E12, upper-mid-level service)	0.7	100 %	1				
Internal administration (financial administration, personnel etc.) (E7 to E9, mid-level service)	5.8	–	7				
Student assistants	**2.7**	**91.6 %**	11				
Trainees	**6.0**	**–**	6				
Scholarship recipients at the institution	**12.0**	**100 %**	20		9		19
Doctoral candidates	8.0	100 %	16		6		15
Post-doctoral researchers	4.0	100 %	4		3		4

[1] This person is 50% conference organisation, 50% administration and counted under administration.

19 October 2020

Annex B: Evaluation Report

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

Contents

1. Summary and main recommendations

The Leibniz Institute for Zoo and Wildlife Research (IZW) researches the adaptability of wildlife in the context of global change and aims to contribute to the enhancement of the survival of viable wildlife populations. For this purpose, it investigates the diversity of life histories of wildlife species, the mechanisms of evolutionary adaptations and their limits, including diseases, and the interrelationships of wildlife populations with their environment and with people.

IZW is an active research institute working at the interface between fundamental biological investigation and wildlife conservation. It covers a broad spectrum of relevant research and has a clear strategic niche within the research landscape of Germany. IZW is a hugely important and impressive institution in both the national and international arenas, and the work it does to aid conservation of wildlife *in situ* and in captivity in particular is greatly appreciated. IZW is seen as a reference centre for its long-term studies in Africa, its completed studies in South America and, increasingly, in Southeast Asia, its conservation activities in reproduction, and the way it combines ecological and wildlife health and management approaches.

IZW's overall concept is logical and coherent, exhibiting an attractive vision. Its focus on long-lived mammals and selected target regions is understandable. The mission and vision of the IZW are clear but should reflect the mammal focus of the institute's strategy more explicitly. In the context of loss of biodiversity, habitat destruction and climate change, it also encompasses important goals of considerable societal significance.

The institute's scientific performance is commendable and it offers a considerable number of highly skilled and fairly niche services and expertise. It is very committed to knowledge transfer and this has resulted in a wide range of highly visible activities. Of particular importance are IZW's long-term projects, which are one of its most valuable assets. IZW would reap even greater benefits from them if it enhanced strategic planning of studies conducted within the framework of these projects.

Following a recommendation from the last evaluation, IZW has developed well in structural and organisational terms. It has strengthened the role of its departments which is also manifested in an increase in the number of joint appointments of department heads – from two (2013) to six in the near future. It has restructured its programme areas and also introduced ten new programme goals. This structural framework must now be fleshed out if it is to have an impact and achieve the desired improvement in inter-departmental coherence. This is also important against the backdrop of scarce resources, to which the institute refers again, as it did back in 2013. IZW is required to respond to this challenge in an appropriate manner and needs to strategically review and prioritise its work planning for the coming years. IZW intends to apply for a large extraordinary item of expenditure in order to secure the necessary additional funds to implement its high-tech approach. This is clearly an important step that will be subject to a separate evaluation procedure.

IZW's collaborative relationships with numerous partners, including the three Berlin universities and the University of Potsdam, as well as regional consortia, are very prolific.

IZW participates in EU-wide initiatives and networks and is also firmly established in multiple networks on an international level. The impressive number of collaborations in the field of zoo and wildlife research should be further assessed from a strategic point of view.

Quality management and control at IZW are appropriate and well organised. Young academics have an excellent research environment to work in. The institute's gender equality measures are very encouraging and have been highly successful. IZW's commitment to create a culture of equality is commendable.

Special consideration should be given to the following main recommendations in the evaluation report (highlighted in **bold face** in the text):

Overall concept, activities and results (chapter 2)

1. It is acknowledged that the institute has achieved an increase in publications since 2013. Some very impressive and important publications have been produced. With regard to the number of peer-reviewed papers, there is still scope for improvement, however. IZW is also advised to further strengthen its efforts to publish results in high-profile journals.
2. IZW is advised to develop appropriate instruments to measure the impact of its work in conservation management so it can better map the pathways that yield results.

Changes and planning (chapter 3)

3. The long-term projects are one of IZW's most valuable assets. They constitute a cornerstone of much of the departments' activities and generate high rewards in terms of high-impact publications and value for stakeholders. IZW would benefit even more from this with more strategic planning of studies within the long-term projects, which currently seem rather random. Also, even though these projects are of major significance, IZW needs to take care to ensure that there is a good balance in future between long-term projects, which are often expensive and tie up human resources, and short-term projects to take up novel challenges.
4. The strengthening of the role and importance of the departments at IZW is a positive development. In principle, with its refined programme areas and newly formulated programme goals of the past few years, IZW also has achieved a promising structure for steering cooperation at the institute. Both programmes and goals are logical, elaborate and well formulated. This structural framework must now be fleshed out in order to have an impact and achieve the sought-after improvement in inter-departmental coherence. This has not yet been fully achieved, as the new programme goals are currently still underpinned by a wide range of different, but in part loosely interconnected projects.

Controlling and quality management (chapter 4)

5. Overall, there is clearly room for improvement in the portfolio of third-party funds, especially with regard to competitive DFG and EU grants. IZW is advised to refine the relevant strategic documents to make the most of grants awarded in competitive procedures.

Human resources (chapter 5)

6. In recent years, IZW has reduced and in parts suspended in-house funding for postdocs and doctoral students and positions for apprentices. Moreover, the position for a junior professorship introduced in 2014 (to be filled in a fixed-term arrangement by changing junior scientists) will not be continued after 2024. Given that such positions are of utmost importance for IZW as well as to the careers of young researchers in the field of zoo and wildlife research, the institute should develop a sustainable funding strategy to resume financial support for these posts. This should also encompass the establishment of junior research groups. Alongside more concerted efforts to secure competitive grants, this might also include a reintroduction of in-house financing for PhD and postdoc positions.

Cooperation and environment (chapter 6)

7. Overall, IZW has an extensive list of collaborating institutes providing an impressive network of national and international contacts, which is also testament to the institution's reach far beyond the region. It is recommended that IZW strategically reviews these collaborations, looking specifically at which of them really strengthen IZW's work.

2. Overall concept, activities and results

IZW researches the adaptability of wildlife in the context of global change and aims to contribute to the enhancement of the survival of viable wildlife populations. For this purpose, it investigates the diversity of life histories of wildlife species, the mechanisms of evolutionary adaptations and their limits, including diseases, and the interrelationships of wildlife populations with their environment and with people.

IZW is an active research institute working at the interface between fundamental biological investigation and wildlife conservation. It covers a broad spectrum of relevant research and has a clear strategic niche within the research landscape of Germany. IZW is a hugely important and impressive institution in both the national and international arenas, and the work it does to aid conservation of wildlife *in situ* and in captivity in particular is very much appreciated. IZW is considered to be a reference centre for its long-term studies in Africa, its completed studies in South America and, increasingly, in Southeast Asia, its conservation actions in reproduction, and the way it combines ecological and wildlife health and management approaches.

IZW's overall concept is logical and coherent, exhibiting an attractive vision, in part similar to many other institutes or departments working in the field of zoo and wildlife research. Its focus on long-lived mammals and selected target regions is understandable. The mission and vision of the IZW are clear but should also reflect the mammal focus of the institute's strategy more explicitly. In the context of loss of biodiversity, habitat destruction and climate change, it also encompasses important goals of considerable societal significance.

Research

The institute's scientific performance is remarkable in many areas. Since 2013, IZW has achieved a notable increase in both the quantity and quality of its publications, resulting in a very good publication record. IZW has succeeded in publishing more results in high-profile journals, particularly results arising from its long-term projects – a unique feature that would not be possible in a university-based or similar institute. A high number of publications also resulted from strong interdepartmental collaborations. The intensified support for Open Access publications is welcomed and is in line with the way science is moving. It is worth noting that there has also been a small rise in the number of publications specifically targeted at stakeholders in the zoo and wildlife conservation community.

It is acknowledged that the institute has achieved an increase in publications since 2013. Some very impressive and important publications have been produced. With regard to the number of peer-reviewed papers, there is still scope for improvement, however. IZW is also advised to further strengthen its efforts to publish results in high-profile journals.

Provision of research infrastructure and methods

Research infrastructure activities are appropriate to accomplish IZW's general mission.

The institute provides a respectable range of methods and tools to support research at IZW and elsewhere. A considerable range of highly skilled and fairly niche services and expertise is offered, e.g. in the area of reproductive examination of zoo animals.

Transfer

Conservation of endangered animal species and their habitats is a core IZW goal which is also likely to become increasingly important for the planet, for funding bodies and for policymakers in the future. However, it can be difficult to capture the impact of conservation, which may not become evident until many years after publication of the underlying science. Based on IZW's documents, it remains unclear what impact it is having on conservation action, or how this has changed over the years. **IZW is advised to develop appropriate instruments to measure the impact of its work in conservation management so it can better map the pathways that yield results.**

IZW has organised and hosted an impressive number and variety of conferences, workshops and seminars. Since 2013, there has also been a notable increase in IZW's commitment to engaging the public in research activities, which is commendable. IZW is very active in public events, e.g. offering various school projects. It is involved in various forms of stakeholder dialogue, both at home and at its field sites abroad. The establishment of a PR office and a standalone Science Management Unit are welcome developments and reflect the importance IZW attaches to knowledge transfer activities. IZW should now expand its online communication offerings, such as online courses and webinars.

In general, the strengthening of IZW's knowledge transfer activities is a very positive development and reflects what has happened in other similar institutes. While there is potential to further increase activities in this field – to position the institute as a reference centre in Germany and Europe, gain stakeholder support and increase income from services provided to public and private institutions and businesses – this should not come at the expense of IZW's research mission.

3. Changes and planning

Development since the previous evaluation

IZW has developed positively since its last evaluation in 2013. It has increased its capabilities, modified its organisational structure and improved its research indicators to an acceptable degree (cf. chapter 2). A move towards more strategic planning has evidently been initiated, with more weight now being given to outreach activities and research method development.

Thematic development

There has been a shift towards climate change research, a timely topic of great relevance; this includes the establishment of a junior research group, which is a welcome development. IZW has broadened the topics it covers, from species to community and ecosystem level, a move that delivers more transferable insights. This was accompanied by a number of controlled experiments under captive conditions, which supplemented field studies in conservation efforts. IZW's renewed focus on biobanking is particularly pleasing. Furthermore, new activities have been planned to include Southeast Asia and the urban area of Berlin as study regions, showing a broad approach to very different, but equally urgent issues that concern both local and global nature conservation.

It is pleasing to see that IZW has continued with its long-term projects and, following a recommendation in 2013, has also added new ones, focussing in particular on European species, as suggested, thereby increasing its Eurocentric research. Focusing even more on establishing research lines and activities in Germany and Europe would make IZW a reference centre for wildlife research in the national and continental arenas.

The long-term projects are one of IZW's most valuable assets. They constitute a cornerstone of much of the departments' activities and generate high rewards in terms of high-impact publications and value for stakeholders. They are to be retained as much as possible, maintaining and taking advantage of the strategic position in Africa and Southeast Asia. **IZW would benefit even more from this with more strategic planning of studies within the long-term projects, which currently seem rather random. Also, even though these projects are of major significance, IZW needs to take care to ensure that there is a good balance in future between long-term projects, which are often expensive and tie up human resources, and short-term projects to take up novel challenges.**

Structural and organisational development

One of the recommendations in 2013 was to align IZW's large number of projects more systematically with its overarching strategies and objectives in order to achieve greater coherence. IZW addressed this recommendation by strengthening the role of its departments, the last evaluation having concentrated on 'research foci'. The focus on departments is also manifested in the fact that IZW now aims to link all heads of department to a W3 professorship within the framework of a joint appointment procedure with universities in Berlin and Brandenburg. Whereas, in 2013, only two of the then five department heads were appointed jointly, this number rose to four as of 31 December 2019. Two further appointment procedures are currently being finalised, so that in future there will be six joint appointments with universities (cf. chapter 5).

The strengthening of the role and importance of the departments at IZW is a positive development. In principle, with its refined programme areas and newly formulated programme goals of the past few years, IZW also has achieved a promising structure for steering cooperation at the institute. Both programmes and goals are logical, elaborate and well formulated. This structural framework must now be fleshed out in order to have an impact and achieve the sought-after improvement in interdepartmental coherence. This has not yet been fully achieved, as the new programme goals are currently still underpinned by a wide range of different, but in part loosely interconnected projects.

In 2018, IZW established a new Department of Ecological Dynamics, seizing on a recommendation from the institute's last evaluation to enhance its expertise in theoretical modelling, programming and biostatistics. This development is welcomed. The now six departments differ in size, however, with some being substantially larger than others. Also, the divisions between some of the departments appear arbitrary in places, as in the case of the Departments of Evolutionary Ecology and Evolutionary Genetics. The departmental profiles should be further clarified (cf. chapter 7).

Strategic work planning for the coming years

In general, work planning for the coming years in the individual departments is well explained and aligns with the main mission chosen by the institute. IZW's focus on the epigenetics of traits is admirable but challenging in non-model organisms and will also require strong bioinformatics expertise. Likewise, the modelling focus is extremely important for understanding the stochasticity and multidimensionality of population responses, especially in threatened species.

Overall, IZW's future remit seems quite broad, covering a large number of topics and research areas. The institute has plans for a variety of studies, making use in particular of advanced techniques. However, as much of the proposed equipment is expensive to install, and the data is complex to analyse and interpret, these plans depend to a large extent on the availability of resources. In view of its tight financial situation (see below), IZW intends to apply for a large extraordinary item of expenditure to secure the necessary additional funds to implement its high-tech approach. This is clearly an important step that will be subject to a separate evaluation procedure.

4. Controlling and quality management

Facilities, equipment and funding

IZW has good facilities and equipment available. The number of structures (e.g. labs and field station) it has at its disposal to conduct research is impressive. Its success in securing additional resources for a new lab building at IZW, including equipment for cellular techniques and biobanking, is applauded. However, there is a need to ensure adequate maintenance of equipment and facilities in order to continue providing services at the current level also in future.

Third-party funding of IZW has increased steadily since the last evaluation and is now at a reasonable level, with a 31.6 per cent share (average 2017–2019) of the total budget. Currently, almost a third of this income is raised at state level, in particular at the Federal Ministry of Education and Research (BMBF). **Overall, there is clearly room for improvement in the portfolio of third-party funds, especially with regard to competitive DFG and EU grants. IZW is advised to refine the relevant strategic documents to make the most of grants awarded in competitive procedures.** This process could also be accompanied by more centralised assistance for grant applications, e.g. from the Science Management Unit, an appointed grant officer or a new standing committee for funding opportunities.

IZW has successfully increased its revenues from services since the last evaluation, but there is still scope for further improvement. IZW is advised to use its services more intensively to generate additional revenues, as this would also serve to further IZW's positioning (cf. also comments on departments in chapter 7).

In its documents, IZW points to its inability to meet costs that have risen since the last evaluation, leading to a gap between institutional funding and actual costs. The consequences of the subsequent financial constraints include the recent suspension of financing for doctoral students and postdocs, the termination of residency programmes for trainee veterinarians and a reduction in resources available for the maintenance of facilities and the replacement of equipment. In the medium-term, IZW runs the risk, however, of losing its scientific capacity. The institute therefore needs to respond to this challenge in an appropriate manner and to strategically review and prioritise its work planning for the coming years.

Organisational and operational structure

IZW exhibits an appropriate organisational structure, with a good team guiding operations and strategy. The division of responsibilities at IZW is clearly structured and follows the expectations for a Leibniz institute. It seems to be well led, managed and maintained, thanks to a strong directorate. There are clear responsibilities and joint decision-making by the directors and department heads. Consequently, decision-making processes are also well structured and feature a good balance between bottom-up and top-down procedures.

The budgeting and personnel management software programs available at IZW are effective.

Quality management

Quality management and control at IZW is appropriate and well organised. It is run by a number of different institutions and committees, which coordinate IZW's activities with other institutions, optimise the use of shared equipment and samples, and uphold internal control mechanisms. There are good working protocols for most aspects of scientific and research practice.

IZW's internal Committee for Ethics and Animal Welfare reviews plans for all projects involving animal experiments. Its tasks should be widened to encompass an ethical review of any research involving live animals. In line with best international practice on animal-use committees in research institutes, it is recommended that impartial, independent outsiders also be included on the committee in future.

IZW's publication strategy is well thought through, with some rewards being offered for high-impact publications as part of a performance-based bonus system.

Quality management by advisory boards and supervisory board

The Scientific Advisory Board (SAB) participates actively and on a regular basis in decision-making, from strategic planning to personnel recruitment. According to SAB minutes, it appears to carry out these duties with a high level of commitment. As requested by the Leibniz Association's Senate, a comprehensive audit was conducted in 2017.

The SAB is composed of a good mix of scientists and stakeholders, which also helps to ensure that the work IZW does is relevant to the outside world. The institute could, however, consider strengthening representation of the field of conservation on the SAB in future.

5. Human resources

Staff in leading positions

Recruitment of staff to leading positions follows Leibniz Association procedures, with competitive procedures, international advertisements and the involvement of the relevant committees. Currently, four jointly appointed professorships are established at IZW, of which three have been appointed together with universities in open procedures since 2013. In two of these cases, the appointees were for the first time also entrusted with the management of a department; in another case the former head of department was upgraded to a university professorship. Two further joint appointment procedures are currently underway, so that in future there will be a total of six jointly appointed professorships at IZW, which is a welcome development. IZW's current efforts to convert two W2 professorships to W3 level are logical and commendable.

Staff

IZW employs highly skilled and qualified staff who conduct research of global importance. There is an appropriate ratio of researchers to non-scientific staff.

In recent years, IZW has reduced and in parts suspended in-house funding for postdocs and doctoral students and positions for apprentices. Moreover, the position for a junior professorship introduced in 2014 (to be filled in a fixed-term arrangement by changing junior scientists) will not be continued after 2024. Given that such positions are of utmost importance for IZW as well as to the careers of young researchers in the field of zoo and wildlife research, the institute should develop a sustainable funding strategy to resume financial support for these posts. This should also encompass the establishment of junior research groups. Alongside more concerted efforts to secure competitive grants, this might also include a reintroduction of in-house financing for PhD and postdoc positions.

Postdoctoral staff

Postdocs at IZW are provided with a wide range of experience both inside and outside academia. At present, there is an appropriate level of 'informal' support and mentoring, as evidenced also by the international success of a number of former postdocs in recent years (e.g. professorships or lecturer positions at renowned universities or research museums). IZW's plans to further institutionalise its support for this group of staff in the framework of a more structured postdoc mentoring programme are positive and should be implemented as soon as possible. This is important as EU-funded activities also require structured programmes.

Doctoral candidates

Doctoral students have an excellent research environment to work in at IZW. All PhD students are enrolled at one of the three Berlin universities or the University of Potsdam, with access to high-calibre institutions such as the Dahlem Research School. In addition, they are integrated into a common structured doctoral training programme at IZW, which includes an advisory committee for each student. The quality of education and supervision is very good. Due to the discontinuation of positions financed in-house, the number of doctoral students has decreased in the past few years. IZW's departments would clearly benefit from increasing these numbers again (see above) and it is strongly recommended that the institute strives to achieve this, e.g. by participating in third-party funded research training programmes. In the meantime, it will be important to maintain the high quality of the transversal PhD programme during the inevitable period when there are relatively few doctoral students passing through the system.

Non-scientific staff

There is a broad range of professional training available for non-scientific staff.

In the past, IZW provided good opportunities for apprenticeships. In recent years, trainee positions have been cut, leaving only apprenticeships in zoo keeping and lab assistance. This trend should be reversed.

Equal opportunities and work-life balance

IZW's gender equality measures are very encouraging and have been highly successful, with the result that, among scientists, female employees outnumbered male employees at

the majority of levels on the reporting date of 31 December 2019. Two out of six scientific departments are currently headed by women, one of whom was appointed in 2018 as head of a newly established department. IZW is encouraged to continue with this positive development.

Increased diversity among students is good, including the recruitment of young foreign scientists, which clearly sets IZW apart from some of the more parochial European research institutions. Building on this, IZW should also aim to recruit more international staff at the top level.

IZW's policies to help disabled employees and those with young children are commendable, as is its commitment to create a culture of equality and inclusion for its staff and students. It is positive that numerous measures have been put in place at IZW to reduce stress levels at work and improve the work-life balance of employees.

6. Cooperation and environment

IZW cooperates very intensively and productively with the universities in the Berlin-Brandenburg region and has considerably strengthened its ties since the last evaluation. Of special importance are the institute's joint professorships, which ensure close links and also enable access to infrastructure, numerous possibilities for teaching undergraduates and Masters students, and outreach, as well as facilitating collaborative research projects.

Furthermore, IZW is an active member of regional consortia like the Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB) and the Berlin Center for Genomics in Biodiversity Research (BeGenDiv). Increasing these activities in the past has turned IZW into a reference centre for wildlife research and management advice in Berlin, Brandenburg and Germany. Members of staff are represented in most of the regional and national research bodies that are relevant for wildlife and zoo studies across a broad spectrum.

Within the Leibniz Association, IZW participates in various programmes, such as the Leibniz Research Alliance on Biodiversity, which also provide connections to the Museum für Naturkunde (Berlin), the Senckenberg Museum and the Zoological Research Museum Alexander Koenig (Bonn). It is worth noting that IZW collaborates with some non-academic partners.

IZW is part of several EU-wide initiatives and networks, especially in areas like nature conservation and citizen science, which also provide scope for increasing such activities in the future. Enhancing such activities, as was already suggested seven years ago, would both help to close the gap between the transcontinental activities und the regional and national activities, which have developed strongly in the past few years, and would further strengthen IZW's European profile and status beyond its current reach. Although most of the Horizon 2020 and expected Horizon Europe calls may be tangential to the core business of the institute, there are a number of actions for IZW to follow that have a wider scientific remit and permit collaborators from abroad.

On an international level, IZW is firmly established in several networks, as evidenced by the numerous guests, its involvement in previous and ongoing projects, and long-term

research projects abroad. Also, IZW cooperates closely with conservation organisations and government institutions at its field sites in Africa and Southeast Asia in order to translate its scientific findings into local management strategies. It is firmly established in the international zoo research community that targets breeding programmes as part of *ex situ* species conservation projects. IZW has a strong international standing and a reputation for the quality of its research and its contribution to conservation biology, and compares favourably with the nearest organisations with somewhat similar interests.

Overall, IZW has an extensive list of collaborating institutes providing an impressive network of national and international contacts, which is also testament to the institution's reach beyond the region. Some are clearly of strategic importance; others are useful because of potential for joint funding, and others provide important connections to stakeholder or professional organisations. **It is recommended that IZW strategically reviews these collaborations, looking specifically at which of them really strengthen IZW's work.** In this context it may be useful to concentrate time on partners that are involved in joint funding applications or in performing work that is likely to make it into high-ranking journals or act as the basis for future funding applications.

7. Subdivisions of IZW

Department of Evolutionary Ecology

[26.9 FTE, of whom 12.9 FTE research and scientific services staff, 4.3 FTE doctoral candidates, and 9.7 FTE service staff]

The Department of Evolutionary Ecology researches the adaptability of free-ranging wildlife populations to environmental changes. The topics pursued are timely and interesting and also serve urgent societal needs. The department applies a broad range of field- and lab-based methodology. It is amongst the leading departments in Germany in the use of stable isotopes in animal ecology, and also in the development of high-throughput animal movement-tracking approaches. Plans for future research are promising. Altogether, the department exhibits a dynamic and productive profile.

The department has been very successful in securing third-party funds in recent years. Its publication output is impressive and has been continually increasing in terms of quantity as well as quality, with papers being published in good to excellent journals. The department is very visible in the media and efforts to include more citizen science in its research are highly commendable.

The department in its present state was redefined in 2018 after the new Department of Ecological Dynamics (see below) was established. There are still close interconnections between the two departments. While these links are important, the head of department, who is currently being appointed professor at the University of Potsdam in an *ad personam* procedure, is encouraged to sharpen the department's profile in the coming years.

Department of Evolutionary Genetics

[14.05 FTE, of whom 8.7 FTE research and scientific services staff, 1.75 FTE doctoral candidates, and 3.6 FTE service staff]

The Department of Evolutionary Genetics investigates how past conditions have shaped current mammalian diversity and how that diversity may change in future. Research activities cover a wide range of questions which are well thought through and it is encouraging to see so much weight given to epigenetic research in wildlife. In particular, it benefits tremendously from the long-term hyena project as well as its involvement in the Berlin Consortium for Genomics in Biodiversity Research (BeGenDiv). In addition, the decision to host the German hub of the European Association of Zoos and Aquaria (EAZA) Biobank has been a good strategic move. There is fruitful collaboration, especially with the Departments of Evolutionary Ecology and Ecological Dynamics.

Science outputs are generally of high quality. Although strong, both the number of publications and the amount of third-party funding raised are below the achievable level, given the number of scientific staff. Both need to be further increased in the coming years. With its children's book on epigenetics the department has achieved a remarkable result.

Overall, the department complements IZW's research environment effectively. It has a good leader. Its strategic focus on enhancing its capacity to study epigenetics is both exciting and (technically) challenging and there is an opportunity to become an internationally recognised and leading group in this field. In the coming years, however, the department should aim to analyse more precisely how each of its activities helps IZW to achieve its mission. Also, it might be worthwhile considering adding new target species to the research agenda as this could help widen the scope and impact of the research.

Department of Wildlife Diseases

[20.4 FTE, of whom 7.1 FTE research and scientific services staff, 3.8 FTE doctoral candidates, and 9.5 FTE service staff]

The Department of Wildlife Diseases studies evolutionary, ecological and anthropogenic factors governing pathogen adaptation and host responses to wildlife diseases. Its work is very wide ranging and of a high quality. Much of it is conducted in collaboration with other research departments inside and outside IZW, and this is also reflected in a high number of shared publications. In general, the group's publication profile is impressive: it has produced very good papers with high-impact articles contributing to IZW's overall highlights. In doing so, the group also succeeds in reaching out beyond its own field of expertise to neighbouring specialist areas.

The department has considerable third-party funding available. However, with a major project coming to an end, the relevant funds dropped markedly in 2019 and should be brought back up quickly to the level of the previous years. The group does not currently raise revenues from services and is encouraged to make much more of this potential revenue source.

In the coming years the department aims to focus its research activities on developing methodologies using new technologies to enable a more proactive response to disease

emergence. It remains to be clarified, whether this line of research will also include work on the understanding of the mechanisms of disease emergence, as well as on their modifications to mitigate disease emergence. A further task will be to better align research with the strategic core of the department.

Department of Reproduction Biology

[13.8 FTE, of whom 5.4 FTE research and scientific services staff, 3 FTE doctoral candidates, and 5.4 FTE service staff]

The department concentrates on the evolution of reproductive traits and the impact of the environment on fertility, in particular in felids. In doing so, it is increasingly using cell-based techniques and assisted reproduction techniques (ART). Its key project is the reproductive biology of lynx species and a number of projects involve lynx and related species. Some of the work is interesting and, as a consequence, has been published in respectable journals. More than half of the department's publications derive from long-term projects, and almost as many were prepared in collaboration with other departments. Overall, however, there is an apparent potential for further increases, both in terms of publication numbers and higher-ranking publication outlets.

The department aims to identify markers for spermatogonial stem cells and primordial or primary follicles. This work has the potential to form the basis for future projects as well as funding applications. However, currently the associated goals are rather unclear and should be further developed. This also applies to cell-based techniques in general and how these help to further the strategic aims of the group.

Revenue from project grants has fallen since 2017, a trend that should be reversed to meet the institute's self-imposed targets. In contrast, provision of services resulted in a slight increase in corresponding revenues. Building on this, the group should determine whether there is scope for expanding the service capacity of the endocrinology lab. It has established an extensive cryobank of reproductive cells and material.

The current head of department will retire in December 2020. Currently, IZW and the Technical University of Berlin are conducting a joint appointment procedure for the new head of department in the field of cellular reproduction biotechnology. It will be the responsibility of the new head of department to further develop the department's strategy, in particular addressing the issues mentioned above.

Department of Reproduction Management

[16.6 FTE, of whom 9.3 FTE research and scientific services staff, 1.5 FTE doctoral candidates, and 5.3 FTE service staff]

The department develops novel assisted reproduction techniques (ARTs) and cell-based reproduction techniques in conservation. The group is very well known and respected for its expertise in the practical management of zoo animal reproduction. As a result, it has had some headline successes and considerable media attention in the past, e.g. in relation to the northern white rhinoceros conservation programme. All in all, this work is a highly successful line of research.

In addition, the group is also involved in various other research activities with some excellent outcomes for some species. However, it remains unclear how some activities fit into the department's strategy. It should align these projects more closely with its overarching mission or consider transferring some of them to other groups at the IZW. The proposed shift away from evolutionary morphology towards advanced ART seems well timed. It is recommended that this should be paired with similar plans for the Department of Reproduction Biology and that close collaborative projects between the two departments be established on this basis.

The department runs an extensive cryobank. It provides pretty niche veterinary services and there are important links to research projects. It is also very important for stakeholder engagement with zoos and wildlife parks. Members of the department have been involved in various workshops and other training activities and are heavily engaged in capacity-building and knowledge transfer. Particularly commendable are the department's wildlife welfare activities in rescue centres in war zones.

The department has made significant advances in terms of high-impact publications and media impact, with almost one third of its publications having been prepared with other departments. The publication output is respectable, although there is potential for further improvement. The group has considerable funding at its disposal. Revenues from services have been substantial in recent years and the department should determine whether there is scope for generating more income to support staffing or research.

Department of Ecological Dynamics

[25.1 FTE, of whom 10.3 FTE research and scientific services staff, 9.5 FTE doctoral candidates, and 5.3 FTE service staff]

The Department of Ecological Dynamics explores ecological dynamics in space and time and along a gradient of anthropogenically altered environments, making use of various modelling approaches to understand and better forecast wildlife responses to a changing environment, e.g. climate change, infection chains, and how animals adapt to stress and external factors. It was established in 2018 on the basis of recommendations from the previous evaluation.

This department is operating in a highly innovative and exciting research landscape. The newly appointed leader is building a strong reputation and the productivity and impact of the department in 2020 alone is already impressive. The group is already showing a strong research output, exhibiting a very good publication record and excelling in numerous transfer activities, e.g. with the World Wide Fund for Nature, in the training of rangers and in its media activity. The establishment of an eDNA lab is applauded.

The future plans of the department seem well suited to making an impact in the field, and a combination of individual-based and population-based models is likely to yield multiple new insights of both a biological and technical nature. The focus on global meta-analyses is especially important for yielding high-impact outputs and has already paid dividends. The future is therefore very bright for this area of research within IZW and the group has the potential to become a leading research team at a European level. There are obvious

collaborative opportunities with all research arms of the institute, which should be exploited.

8. Handling of recommendations of the last external evaluation

IZW has addressed the recommendations made by the Leibniz Association Senate in 2013 in an appropriate manner (see status report, p. A-23f). The recommendations regarding publication output and in the area of third-party funding, in particular EU funding, remain relevant.

Appendix

1. Review board

Chair (Member of the Leibniz Senate Evaluation Committee)

Konrad **Fiedler**	Department of Botany and Biodiversity Research, Division of Tropical Ecology and Animal Biodiversity, University of Vienna

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Bernd **Hansjürgens**	Helmholtz Centre for Environmental Research – UFZ, Leipzig

Reviewers

Marco **Apollonio**	Department of Veterinary Medicine, University of Sassari, Italy
Mike **Bruford**	School of Biosciences, Cardiff University, UK
Andrew **Cunningham**	Institute of Zoology, Zoological Society London, UK
Kathrin **Dausmann**	Institute of Zoology, Functional Ecology, Universität Hamburg
Catherine **Graham**	Biodiversity and Conservation Biology, Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland
Jorge Ramón **López Olvera**	Department of Wildlife Ecopathology, Universitat Autónoma de Barcelona
Jane **Morrell**	Department of Clinical Sciences, Division of Reproduction, Swedish University of Agricultural Sciences, Uppsala
Carsten **Rahbek**	Center for Macroecology, Evolution and Climate, GLOBE Institute, University of Copenhagen, Denmark
Tom **Stout**	Department of Equine Sciences, Utrecht University, The Netherlands

Representative of the Federal Government (Member of the Leibniz Senate Evaluation Committee)

absent with apologies	Federal Ministry of Education and Research, Bonn

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

Sigrid **Hemming**	Ministry of Education, Science and Cultural Affairs of Schleswig-Holstein, Kiel

3 November 2020

Annex C: Statement of the Institution on the Evaluation Report

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

The IZW would like to thank the members of the Review Board for their comprehensive assessment of our institute and for providing us with insightful and important recommendations. We feel that our efforts were recognised by the commission's conclusion that our research is relevant and "hugely important in both the national and international arena". We are pleased that our vision is seen as attractive and our strategy as coherent and encompassing "important goals of considerable societal significance".

In the following we would like to comment on some insights offered by the Review Board:

1) The Review Board recognises the potential of our strategic plan for the future. It applauds our focus on new, advanced techniques and recognises that the introduction and long-term use of such techniques will be expensive. We welcome this positive response to our future plans and see it as an endorsement of our application to the government for additional resources to make their implementation and sustainable use feasible.

2) The evaluation report recognises that the gap between institutional funding and actual costs poses a challenge for the future development of the IZW, as indicated by our lack of in-house funding for doctoral students, postdocs and junior research groups, and the difficulty to acquire new and adequately maintain existing equipment and facilities in the long term. The Review Board expresses concern that in the medium term, the IZW runs the risk of losing its current scientific capacity, and recommends that we strategically review and prioritise our work planning for the coming years. We agree with the commission's assessment and are committed to refine our strategy for dealing with the tight financial situation in a way that mitigates the consequences of the deficit. We will follow up our in-house discussions with deliberations at our Scientific Advisory Board meetings and earnest discussions with our public funding representatives at the Senate Chancellery in Berlin and the Federal Ministry for Education and Research (BMBF).

3) The Review Board recommends we should more explicitly incorporate our taxonomic focus on mammals in our mission and vision. In doing so, we need to account for the fact that our long-term projects are focused on mammals, whereas short-term projects cover a greater taxonomic breadth, allowing us to acquire new methods and insights, respond flexibly to topical issues of societal relevance and transfer knowledge gained from work with mammals into practical conservation applications also in other taxa. The interplay between mammals and non-mammals sometimes also has an influence on our work with mammals.

4) In terms of strategic development, the commission emphasises that our recently refined strategic framework needs to be fleshed out to further inter-departmental coherence and interconnections between projects. With the approval of the Review Board for our refined strategy as a promising structure for steering cooperation at the IZW, we intend to cultivate and further refine our work within this framework. This will be done by continuously examining the balance between the sometimes conflicting requirements a) of achieving coherence between the departments whilst at the same time strengthening their clearly defined roles and profiles, and b) of jointly developing projects towards the strategic goals whilst maintaining flexibility to take on novel challenges. An example of the implementation of the latter can be seen in the internal com-

petition and collaborative development of project proposals within the IZW for the Leibniz Competitive Fund. This procedure strongly reflects the refined strategic framework of the institute whilst simultaneously utilising the multidisciplinarity the institute encompasses.

5) The report advises us to develop appropriate instruments to measure the impact of our work in conservation. Assessing impact is recognised as a challenge for all scientific institutions, as there are many direct and indirect influences, different time frames and the contributions of multiple actors in the field to consider. We agree with the commission that it is important to monitor the practical significance of our work in order to identify the most effective pathways. We have informally started to explore ways of documenting outputs, outcomes and impacts using both quantitative and qualitative methods. We are currently completing a research project in which we investigate to what extent the collaboration of citizens in scientific projects enhances their willingness and critical facility to understand scientific results from wildlife research. In short, assessing impact will become an important task in the future.

We look forward to implementing the recommendations of the Review Board in partnership with our collaborators and our government funders. We would like to explicitly acknowledge the guidance provided to us by the Leibniz Evaluation Department and thank the members of the Leibniz Senate Evaluation Committee (SAE) for their engagement and continuous support. We would also like to express sincere thanks to all IZW staff for their extraordinary commitment, expertise, dedication and enthusiasm, which were the basis for the IZW's achievements. Finally, we thank the Senate Chancellery of the Land Berlin and the BMBF not only as our institutional funders, but also for providing encouragement, facilitating developments, opening up new opportunities and seeking constructive ways to improve the work that we can do at our institute.