

Zoological Collections of Germany

The Animal Kingdom in its Amazing Plenty at Museums and Universities



Natural History Collections

Series editors

Lothar A. Beck

Department of Biology, Zoological Collection, Philipps-University of Marburg, Marburg, Germany

Hans-Dieter Sues

Department of Paleobiology, National Museum of Natural History, Washington, DC, USA

More information about this series at http://www.springer.com/series/15333

Lothar A. Beck Editor

Zoological Collections of Germany

The Animal Kingdom in its Amazing Plenty at Museums and Universities



Editor
Lothar A. Beck
Department of Biology, Zoological Collection
Philipps-University of Marburg
Marburg, Germany

Series Editors
Lothar A. Beck
Department of Biology, Zoological Collection
Philipps-University of Marburg
Marburg, Germany

Hans-Dieter Sues Department of Paleobiology National Museum of Natural History Washington, DC USA

ISSN 2510-1862 ISSN 2510-1870 (electronic) Natural History Collections ISBN 978-3-319-44319-5 ISBN 978-3-319-44321-8 (eBook) DOI 10.1007/978-3-319-44321-8

Library of Congress Control Number: 2017939361

© Springer International Publishing AG 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Cover pictures: "fossil leaf" "beetles" "ammonites" © Lothar A. Beck Cover pictures: "mollusk shells" "lion" "Ichthyosaurs" © Staatliches Naturhistorisches Museum Braunschweig, Germany

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Pai	rt I General Aspects	
1	In Past and Recent Times: On the Significance of Zoological Collections in Germany—An Introduction Lothar A. Beck	3
2	Germany's Zoological Collections: An International and Personal View on an Important Historical and Contemporary Scientific Resource	7
3	Research Collections in Germany: Modern Trends in Methods of Sorting, Preserving, and Research	17
4	National and International Collection Networks	29
5	Legal and Ethical Challenges: From Collection Management to Access and Benefit-Sharing	37
6	Modern Exhibition Concepts	49
Paı	t II The Collections	
7	ASCHAFFENBURG: The Collection of the Bavarian Royal National Academy of Forestry Aschaffenburg Is on Its Way to Becoming a Modern Museum of Natural History	61

vi Contents

71
83
89
23
35
41
53
83
97
13
19
2 3 4 4

Contents vii

19	CHEMNITZ: Museum of Natural History Chemnitz: Identity Through Tradition	231
20	DARMSTADT: The Zoological Collections of the Hessische Landesmuseum Darmstadt	237
21	DARMSTADT: The Zoological Collection at the Department of Biology/TU Darmstadt History and Present State of the Zoological Collection	245
22	DETMOLD: Lippisches Landesmuseum Detmold	253
23	DRESDEN / THARANDT: Zoological Collections Housed at the Institute of Forest Botany and Forest Zoology of Technische Universität Dresden	259
24	DÜSSELDORF: Aquazoo Löbbecke Museum Düsseldorf Sandra Honigs, Silke Stoll, and Elmar Finke	269
25	EBERSWALDE: Zoological Collections of Eberswalde: Like Phoenix from the Ashes? U. Schulz, A. Linde, and J. Möller	281
26	ERFURT: The Naturkundemuseum Erfurt	295
27	FLENSBURG: Naturwissenschaftliches Museum Flensburg: Natural History Museum Flensburg Werner Barkemeyer	311
28	FRANKFURT, DRESDEN, GÖRLITZ, MÜNCHEBERG: Senckenberg: Its Zoological Collections and Their Histories Michael Türkay, Uwe Fritz, Thomas Schmitt, Willi Xylander, Raffael Ernst, Uwe Kallweit, Klaus-Dieter Klass, Matthias Nuss, Martin Päckert, Christian Schmidt, André Reimann, Katrin Schniebs, Clara Stefen, Andreas Weck-Heimann, and Axel Zarske	317
29	GIEßEN: University Collections: Justus Liebig University Gießen Eva Diehl, Birgit Jauker, Christian Albrecht, Thomas Wilke, and Volkmar Wolters	373
30	GÖTTINGEN: The Zoological Museum of Göttingen University Rainer Willmann	383

viii Contents

31	GÖTTINGEN: Collections in the Departments of "Wildlife Sciences" and "Forest Zoology and Forest Conservation" Bernhard Weißbecker, Gerrit Holighaus, and Niko Balkenhol	391
32	GREIFSWALD: The Zoological Museum of the University Greifswald: Past, Present, and Future	397
33	HALBERSTADT: Museum Heineanum	405
34	HALLE-WITTENBERG: The Zoological Collection of the Martin Luther University in Halle-Wittenberg	417
35	HAMBURG: Back to the Future: The Centrum für Naturkunde on Its Way Toward Reestablishing a Natural History Museum in Hamburg	435
36	HEIDELBERG: The Zoological Museum of the University of Heidelberg Volker Storch	463
37	JENA: The Scientific Zoological Collections at the Phyletisches Museum in Jena: Historical Development and Conservational Challenges	467
38	JENA: The Teaching Collection at the Zoological Institute of the University of Jena: Its Importance, Value and Conservational Problems	477
39	KAISERSLAUTERN: Zoological Collection of the University of Kaiserslautern	485
40	LEIPZIG: Naturkundemuseum Leipzig: Museum of Natural Sciences	495
41	LEIPZIG: The Zoological Study and Research Collection of the University of Leipzig	499
42	LÜBECK: Museum of Nature and Environment, Lübeck, Zoological Collections	507

Contents ix

43	MAINZ: The Zoological Collections of the Mainz Natural History Museum/State Collection of Natural History of Rhineland Palatinate Carsten Renker, Bettina Henrich, and Uwe Hildebrand	519
44	MARBURG: Zoological Collection of the Philipps University of Marburg	529
45	MÜNCHEN: The Zoologische Staatssammlung München (ZSM) of the Staatliche Naturwissenschaftliche Sammlungen Bayerns (SNSB)	541
46	MÜNSTER: The Zoological Collections of the LWL-Museum of Natural History in Münster	551
47	OLDENBURG: 180 Years of Local Collection and Research in Oldenburg	559
48	POTSDAM: Naturkundemuseum Potsdam: Natural History Museum of Potsdam Documentation of Regional Biodiversity and 50 Years of Experience with a Freshwater Aquarium Detlef Knuth, Ina Pokorny, and Dirk Berger	571
49	ROSTOCK: The Zoological Collection of the University of Rostock	583
50	SCHIFFWEILER: Zentrum für Biodokumentation des Saarlandes (ZfBS)	591
51	SIEGEN: University of Siegen Zoological Collections Teach Biodiversity Better than Books and Bytes Klaudia Witte, Sven Dienstbach, Urs Christian Gießelmann, and Arndt Horst Johann Wellbrock	599
52	STRALSUND: The German Oceanographic Museum	609
53	STUTTGART: The Zoological Collections of the Stuttgart State Museum of Natural History	621
54	WAREN: Müritzeum with the Natural History Collections for the State of Mecklenburg-Vorpommern	647

x Contents

55	WESTLAUSITZ: The Zoological Collection of the Museum der Westlausitz Kamenz by Olaf Zinke	659
5 6	WIESBADEN: Museum Wiesbaden: Natural History Collections [MWNH]	667
57	WÜRZBURG: The Zoological Study Collection at the Theodor-Boveri-Institute, Biocenter, Julius-Maximilians-University of Würzburg Dieter Mahsberg and Gerhard Kneitz	675
58	KARLSRUHE: The Zoological Collections of the State Museum of Natural History Karlsruhe Hubert Höfer, Albrecht Manegold, Alexander Riedel, Robert Trusch, and Manfred Verhaagh	683
Ind	ex	707

List of Figures

Fig. 2.1	Specimen of <i>Boa constrictor</i> (I2013A3) from the Linck Collection in the Naturalienkabinett Waldenburg. This specimen was figured in a plate by Scheuchzer in 1735 and is one of the oldest spirit-preserved reptiles in the world	
	(see Bauer and Wahlgren 2013)	10
Fig. 2.2	Syntype (ZMB 1276) of <i>Lacerta serpens</i> (syn. <i>Lygosoma quadrupes</i>), an Asian skink. The species was described by Marcus Bloch in 1776 and was part of the foundation collection of the Berlin Museum. A large number of Bloch's specimens have survived the centuries (see Bauer 1999; Bauer and Günther	
Fig. 2.4	Holotype (ZMB 2583) of <i>Coluber irregularis</i> (= <i>Boiga irregularis</i>). This specimen was originally part of the collection of Willem Janssen and had been studied by the famous zoologist Blasius Merrem at Marburg. It eventually reached the Berlin Museum in 1818. Despite being a common, widespread species as well as an important invasive species, its presence in the Berlin collection was not recognized until 2013 (Bauer and Günther 2013) (Photo: © with Frank Tillack)	12
Fig. 6.1	(a, b) Wiesbaden Museum: A view of the "Color" room (Photo: © with Bernd Fickert, 2015) and drawing boards to promote precise observation (Photo: © with Annette Scheersoi)	50
Fig. 6.2	(a, b) Zoological Research Museum Koenig: Collection boxes and "Species nova" (Photos: © with Thomas Gerken, ZFMK)	51
Fig. 6.3	(a, b) Natural History Museum Mainz: Collection item (Photo: © with Naturhistorisches Museum Mainz, Herbert Lutz) and the "stone puzzle" (Photo: © with Naturhistorisches Museum Mainz, Thomas Engel)	53
Fig. 6.4	Natural History Museum Basel: hands-on element and audio installation (Photos: © with Annette Scheersoi)	54

xii List of Figures

Fig. 6.5	(a, b) Display rooms: Übersee-Museum Bremen (Photo: © with Übersee-Museum, Matthias Haase) and Museum für Naturkunde Berlin (Photo: © with Museum für Naturkunde Berlin, Carola Radke)	55
Fig. 6.6	(a, b) Ruhr Museum: mammoth skeleton and "study room" in the "Terra cognita" exhibition; preserving jars, filled with soil samples polluted by heavy metal in the "Down and Under" exhibition (Photos: © with Ruhr Museum, Michael Rasche)	57
Fig. 10.1	Façade of the Museum für Naturkunde with main entrance (with permission from: Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity Science; photo: A. Dittmann)	91
Fig. 10.2	Skeleton of <i>Brachiosaurus brancai</i> , one of the icons of the museum (with permission from: Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity Science; photo: A. Dittmann)	93
Fig. 10.3	Python sebae ZMB 1478, a specimen traced back to the collection of Albertus Seba (with permission from: Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity Science; photo: F. Tillack)	96
Fig. 10.4	ZMB_Aves_14578, <i>Coracopsis vasa vasa</i> , the pet parrot of Alexander von Humboldt (with permission from: Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity	97
Fig. 10.5	Science; photo: C. Radke)	98
Fig. 10.6	Steamer "Valdivia" on the German Deep Sea Expedition (1898–1899) (with permission from Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity Science. Museum für Naturkunde Berlin, Historische Bildů. Schriftgutsammlungen (Sigel: MfN, HBSB), Bestand:	
Fig. 10.7	Zool. Mus., Signatur: B VI/3164)	101
Fig. 10.8	Biodiversity Science; photo: C. Radke)	103 104

List of Figures xiii

Fig. 10.9	Internal stairs intended for visitors' access to the upper floors (with permission from Museum für Naturkunde—Leibniz Institute for Evolution and Biodiversity Science; photo: H.J.	
Fig. 10.10	Götz) New eastern wing under construction in 2008 (with permission	105
	from Museum für Naturkunde—Leibniz Institute for Evolution	100
Fig. 10.11	and Biodiversity Science; photo C. Radke) Eastern wing ground floor with visitor walkway (with	106
11g. 10.11	permission from Museum für Naturkunde—Leibniz Institute for	
	Evolution and Biodiversity Science; photo: C. Radke)	107
Fig. 10.12	Partly destroyed façade of eastern wing supplemented by	10,
C	concrete casts (with permission from Museum für	
	Naturkunde—Leibniz Institute for Evolution and Biodiversity	
	Science; photo: H.J. Götz)	108
Fig. 10.13	Series of study skins in the bird collection (with permission	
	from Museum für Naturkunde—Leibniz Institute for Evolution	
T: 1011	and Biodiversity Science; photo: H.J. Götz)	110
Fig. 10.14	Pinned specimens of the giant wasp <i>Megalara garuda</i> and other	
	species of Hymenoptera (with permission from Museum für	
	Naturkunde—Leibniz Institute for Evolution and Biodiversity Science; photo: C. Radke)	112
Fig. 10.15	Visualization of the skull and teeth of <i>Odontobatrachus natator</i>	112
11g. 10.13	(ZMB 78203) from μCT data, lateral aspect (with permission	
	from Museum für Naturkunde Berlin—Leibniz Institute for	
	Evolution and Biodiversity Science, visualization by M. Barej,	
	μCT scanning by K. Mahlow)	113
Fig. 11.4	Wall chart depicting the anatomy and ontogeny of water	
11g. 11.4	bears (Tardigrada) after Ernst Marcus. Drawn at the	
	Zoological Institute (1934) probably by the illustrator Erika	
	von Bruchhausen	129
Fig. 11.6	The large installation by Mark Dion at the exhibition	
	"WeltWissen" (World Knowledge) at the Martin Gropius Bau,	
	Berlin (2010/2011). Many objects from the zoological teaching	
	collection were used	131
Fig. 11.7	View of the display of pictures of historical microscopic slides	
	from the exhibition "Die Ästhetik des Kleinen" (The Aesthetics	
	of the Small) at the Humboldt-Universität zu Berlin (2012)	132
Fig. 13.1	This picture has been taken from the "Magazin für die gesamte	
	Thierheilkunde," 1846, which Gurlt published along with Prof.	
	Carl Heinrich Hertwig. Pictured is the entire janus-shaped,	
	deformed body of a goat (Octopus janus G.)	143
Fig. 14.1	The main building of the Zoological Research Museum	
Ü	Alexander Koenig in Bonn harbors all exhibitions and part of	
	the collections of the Vertebrate Department. The architecture	

xiv List of Figures

	was designed in the first decade of the twentieth century. The	
	institute consists of several buildings, e.g. for the arthropod	
	collection or for the Center for Molecular Biodiversity Research	
	(Photo: © with C. Koch)	154
Fig. 14.2	The two lectotype specimens of the Canary Island Kestrel	
118.1.12	(Falco tinnunculus canariensis), a taxon described by	
	Alexander Koenig in 1889. They represent an example for the	
	numerous type specimens kept in the ZFMK's ornithological	
	collection, making them a valuable resource for taxonomic	157
E: 142	research (Photo: © with J.F. Struwe)	157
Fig. 14.3	Mounted specimen of a Sacred Ibis (<i>Threskiornis aethiopicus</i>),	
	collected in 1910. This bird not only exemplifies the fine	
	taxidermic quality of many early bird specimens of the ZFMK	
	but also demonstrates their enduring scientific value because of	
	the meticulous labeling (Photo: © with J.F. Struwe)	158
Fig. 14.4	A major strength of the ZFMK's ornithological collection lies in	
	the existence of local series of study skins of many bird species.	
	Being the most requested preparation type in bird collections,	
	study skins are not only useful for a wealth of morphological	
	approaches but have also gained tremendous interest as	
	resources for historical DNA during the last two decades.	
	Combined methods thus form the basis for the current research	
	foci in the Section Ornithology of the ZFMK (Photo: © with	
	J.F. Struwe)	159
Fig. 14.5	Clutches of Golden Eagles (Aquila chrysaetos). The ZFMK's	
	egg collection is the largest of its kind in German museums. It	
	offers a wide range of study opportunities, including ongoing	
	three-dimensional assessments of intrapopulational size and	
	shape variability in avian eggs (Photo: © with J.F. Struwe)	160
Fig. 14.6	A glimpse into the collection of Christian Ludwig Brehm held at	
J	the ZFMK. These Bluethroats (<i>Luscinia svecica</i>) illustrate the	
	enormous scientific value of this collection since most of their	
	specimens were collected close to just a single locality in	
	Thuringia. Compiled in the first half of the nineteenth century,	
	such rare local series allow for unique comparisons of	
	population structures across times scales that usually cannot be	
	covered due to the poor preservation of specimens from these	
	days (Photo: © with J.F. Struwe)	161
Fig. 14.7	A small part of the very large collection of Lacertidae of the	101
11g. 14.7		163
Eig 149	Museum Koenig conserved in alcohol (Photo: © with C. Koch)	103
Fig. 14.8	Holotypes of some Varanidae described by scientists of the ZFMK. <i>Varanus yemenensis</i> (<i>middle</i>) was discovered during	
	· · · · · · · · · · · · · · · · · · ·	166
Eig 140	a television documentary in 1985 (Photo: © with C. Koch)	166
Fig. 14.9	25 million-year-old holotype of <i>Sphaerodactylus dommeli</i>	167
	encased in amber (Photo: © with C. Koch)	167

List of Figures xv

Fig. 14.10	Part of the collection of herpetological dry skeletal preparations	168
Fig. 14.11	(Photo: © with C. Koch)	169
Fig. 14.12	Ultra-frozen DNA samples in the ZFMK Biobank. For each sample, a voucher specimen is kept in the taxonomic collections (Photo: © with J.J. Astrin)	173
Fig. 16.1	Selection of type Gastropoda in the Geosciences Collection of the University of Bremen. (a-c) Acrotoma (Acrotomina) semicincta, paralectotype of Clausilia (Acrotoma) semicincta; GSUB g31801. Northwest Caucasus, Georgia. (d-f) Phaedusa (Phaedusa) hainanensis, paralectotype of Clausilia (Pseudonenia) hainanensis; GSUB g31798. Isle of Hainan, southeast China. (g) dito, original illustration of the lectotype by Yen (1939). (h-j) Likharevia gustavi, paralectotype of Clausilia (Oligoptychia) gustavi; GSUB g31803. Astara spring, northwestern Iran. (k-l) Georissa regularis, SEM image of paralectotype; GSUB g31814 and g31815. Isle of Busuanga Philippines. (m-o) Macrophaedusa frankei, holotype of Clausilia (Hemiphaedusa) frankei; GSUB g10295. Kiangsi province, China. (p-r) dito, original illustration refigured. (s-u) Quadriplicata lederi gradata, syntype of Clausilia (Euxina) gradata; GSUB g9989. upper River Kura area, southern Russia. (v-x) original illustration refigured. (y-aa) Leptachatina (Leptachatina) brevicula, paratype of Heliceras (Leptachatina) brevicula; GSUB g31813. Kauai County, Hawaii, USA. (ab-ad) Palaina (Palaina) quadrasi, SEM image of paralectotype of Diplommatina (Palaina) quadrasi; GSUB g31817, g31818, g31819. Rizal province NE of Manila, Isle of Luzon, Philippines. (ae-af) dito, original illustration refigured. (ag-ai) Paludina pyramidata von dem Busch in Philippi, 1844, holotype; GSUB g13012. Probably Isle of Palawan, Sri Lanka. (aj) dito, original illustration refigured. If not stated otherwise all photographic images are compiled by focus stacking technique; GSUB is the acronym of Geosciences Collection of the University of Bremen	204
Fig. 16.2	A display board of the diversity and evolution module featured in the current public exhibit "Experience the sea" (German title "MeerErleben") on display in a shopping mall in Hamburg, Germany, in 2012	208
Fig. 16.3	Gastropod shell association testifying the major tsunami in Asia in December 2004. Terrestrial, limnic, and marine species are originating from different habitats, having been transported into	

xvi List of Figures

	the sea by the tsunami wave first, and subsequently its empty shells were washed upon the beach. An example of a current topic that was touching people's life has been involved in the public understanding of science activities of the collection. All specimens belong to a series from Polhena Beach near Matara, Sri Lanka. Registered as (upper row, from left to right): GSUB g31824 (Achatina cf. marginata), g31828 and g31832 (both Acavus haemastoma); and (lower row, from left to right): g31821 (Pomacea cf. paludosa: L), g31826 (Cyclophorus involutus), g31834 (Bullinidae ampulla: M), g31794 (A. cf. marginata), g31820 (Pythia reeveana: M), g31793 (A. cf. marginata). Geosciences Collection of the University of Bremen. Leg. Martha Meyer. Environmental assignment: M marine, L limnic, all others are terrestrial taxa	209
Fig. 18.1	Hugo Schauinsland in Qufu (China), 1913 (with permission from: Übersee-Museum Bremen)	220
Fig. 18.2	Parts of the ornithological type collection (with permission from: Übersee-Museum Bremen; photo: M. Haase)	224
Fig. 18.3	Parts of the entomological type collection (with permission from: Übersee-Museum Bremen; photo: M. Haase)	225
Fig. 18.4	In the exhibition of the Übersee-Museum: Rice cultivation in Southeast Asia (with permission from: Übersee-Museum	
Fig. 18.5	Bremen; photo: M. Haase)	228228
Fig. 19.1	Interior of the zoological collection as part of the King Albert Museum, Chemnitz, about 1909 (with permission from: Museum für Naturkunde Chemnitz; photo: MfNC)	232
Fig. 19.2	Historical collections highlighting the ecological shift of the entomofauna due to growing urbanization in the area of Western Saxony (with permission from: Museum für Naturkunde	233
Fig. 19.3	Chemnitz; photo: MfNC)	234
Fig. 20.1	Southern view of the museum building of the Hessische Landesmuseums Darmstadt in 2014 (with permission from HLMD; photo: Steffen Harms)	238
Fig. 20.2	View of the right part of the historical Asia diorama in 2014, briefly after its restoration (with permission from HLMD; photo: Wolfgang Fuhrmannek)	239

List of Figures xvii

Fig. 20.3	Historical holotype specimen of <i>Eurycantha rosenbergii</i> (Phasmatodea) described by Johann Jacob Kaup in 1871 (with permission from HLMD; photo: Jürgen Krebs)	240
Fig. 20.4	Painting of the northern gannet (<i>Sula bassana</i>) by Johann Conrad Susemihl for the publication <i>Teutsche Ornithologie</i> (1800–1817) at the left and historical original specimen	240
	used as model for the respective painting at the right (HLMD-A-528) (with permission from HLMD; photos: Wolfgang Fuhrmannek)	241
Fig. 20.5	Original painting of the "Jung-Koch-Quentell'sche Lehrtafel" on the anatomy of the honey bee (with permission from HLMD; photo: Wolfgang Fuhrmannek)	242
Fig. 20.6	View of the huge new showcase (16 m × 4.6 m) on species diversity on display in the permanent zoological exhibition since September 2014 and containing about 800 specimens (with permission from HLMD; photo: Wolfgang Fuhrmannek)	242
Fig. 24.15	Historical diving camera case (with permission and photo credit: Franz Rothbrust)	279
Fig. 25.1	The founder of applied entomology J.T.C. Ratzeburg (<i>left</i>) and the Dean of the Eberswalde Faculty B. Danckelmann with a European Owl (<i>Bubo bubo</i>) from the historical zoological collection of Eberswalde in 1869 (historical fundus of the library of Eberswalde, HNEE)	282
Fig. 25.2	Ornithologist B. Altum and parts of the historical zoological collection (historical fundus of the library of Eberswalde,	283
Fig. 25.3	HNEE) The historical zoological collection of Eberswalde in 1930 (Hilf and Schubert 1930)	284
Fig. 25.4	Historical inventory lists of the former zoological collections of Eberswalde (© with U. Schulz)	285
Fig. 25.6	The new zoological collection (2015) in the same room like Fig. 25.3: the original zoological collections were destroyed, dispersed, or lost in the years 1945 and 1963 (© with U. Schulz)	288
Fig. 25.7	Insect display cases for student courses in 2015 (© with R. Schlepphorst)	290
Fig. 25.8	Part of today's collection of mollusks (© with R. Schlepphorst)	291
Fig. 25.9	Part of today's collection of Odonata (© with R. Schlepphorst)	291
Fig. 25.10	White-tailed sea eagle (<i>Haliaeetus albicilla</i>) as example for a species relevant for nature conservation in the new zoological	
	collection of Eberswalde (© with U. Schulz)	292
Fig. 25.11	Great cormorant (<i>Phalacrocorax carbo</i>) as example for a species in the new zoological collection of Eberswalde which is	

xviii List of Figures

	controversially discussed in conflicts of various landscape users (© with U. Schulz)	292
Fig. 26.1	Ponds on open landscape, view in the exhibition floor 2 (with permission from: Archive NME; photo: F. Behr)	296
Fig. 26.2	View on exhibition part "Noah's Arc—The Conservation of Diversity" (with permission from: Archive NME; photo:	297
Fig. 26.4	F. Behr) The black morph of common hamster (<i>Cricetus cricetus</i> L., 1758) is limited in Central Europe at the Thuringian Basin, but here the morph is often encountered (with permission from: Archive NME)	297
Fig. 26.5	Laotian rock rat <i>Laonastes aenigmamus</i> . First described for science in 2005 and is very rarely represented in collections. Photo: S. Brandt (with permission from: Archive NME)	299
Fig. 26.6	Some warbler skins (<i>Phylloscopus</i>) in the bird collection (with permission from: Archive NME)	300
Fig. 26.7	View in the collection of lark skins (with permission from: Archive NME)	300
Fig. 26.8	Bearded tit (<i>Panurus biarmicus</i>) as full mount in the bird collection (with permission from: Archive NME; photo: F. Behr)	301
Fig. 26.9	Galapagos land iguana (<i>Conolophus subcristatus</i> Gray, 1831), leg. Juan Foerster, 1959; estate of the firm Schlüter (with	
Fig. 26.10	permission from: Archive NME; photo: F. Behr)	301
Fig. 26.11	Detail of the collection part "Coleoptera" (with permission from: Archive NME)	303
Fig. 28.2	Smerithus ocellata (Sphingidae) (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	322
Fig. 28.3	Tropic Nymphalide butterflies (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	322
Fig. 28.4	Above: Lycaena sp. possibly Lycaena hippothoe; below: Polyommatus sp. possibly Polyommatus bellargus (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	323
Fig. 28.5	Dr. Wolfgang Nässig, curator of the Senckenberg Entomology II (Lepidoptera) (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	323
Fig. 28.6	Drawers from the beetle collection (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo:	- - -0
	Sven Tränkner)	324

List of Figures xix

Fig. 28.7	Dr. Damir Kovac, curator of the Senckenberg Entomology I (Coleoptera, Thysanoptera, Strepsiptera) (with permission	
	from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	324
Fig. 28.8	Specimens from Senckenberg's important collection of Phillipine land snails (with permission from: Senckenberg	02.
Fig. 28.9	Forschungsinstitut und Naturmuseum; photo: Sven Tränkner) Views from Clausiliidae Clausiliiden (with permission from:	325
	Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	326
Fig. 28.10	Preserved material from hydrothermal vents (with permission from: Senckenberg Forschungsinstitut und Naturmuseum)	326
Fig. 28.11	Above: Dr. Peter Jäger, curator of the arachnid collection, please shift; below: Steginoporella buskii Harmer, 1900 from the north coast of Socotra, Yemen. Belongs to bryozoans (with permission from: Senckenberg Forschungsinstitut und	
Fig. 28.12	Naturmuseum; photo: Sven Tränkner)	328
	Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	329
Fig. 28.13	<i>Uca tetragongon</i> from the Red Sea. Belongs to the crustacean collections (with permission from: Senckenberg	
	Forschungsinstitut und Naturmuseum; photo:	329
Fig. 28.14	Sven Tränkner)	329
11g. 20.14	Senckenberg Forschungsinstitut und Naturmuseum; photo:	220
Fig. 28.15	Sven Tränkner)	330
	Celleporaria agglutinans (Hutton, 1873), Otago shelf, New Zealand (with permission from: Senckenberg	
	Forschungsinstitut und Naturmuseum; photo:	221
Fig. 28.16	Sven Tränkner)	331
118. 20110	overgrown with several cyclostome and cheilostome bryozoan	
	species (with permission from: Senckenberg Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	332
Fig. 28.17	Harpadon erythraeus (with permission from: Senckenberg	
	Forschungsinstitut und Naturmuseum)	332
Fig. 28.18	Above: Chauliodus pammelas; below: Trypauchen raha. Both refer to the "Fish Collections" (with permission from:	
TI 20 10	Senckenberg Forschungsinstitut und Naturmuseum)	333
Fig. 28.19	Dr. Eduard Rüppell (with permission from: Senckenberg Forschungsinstitut und Naturmuseum)	333

xx List of Figures

Fig. 28.20	PD Dr. Gunter Kohler, curator of the Senckenberg	
	herpetological collections Frankfurt (with permission from:	
	Senckenberg Forschungsinstitut und Naturmuseum; photo:	
	Sven Tränkner)	335
Fig. 28.21	Above left: Dr. Robert Mertens (1894–1975), curator of the	
8	herpetological collections from 1920 to 1960. Above right:	
	Oskar Boettger (1844–1910), head of the division from 1875 to	
	1910. The fish belongs to "The Fish Collections". Credit: <i>Labeo</i>	
	coubie Rüppell, paratypus (with permission from: Senckenberg	
		226
Ein 29 22	Forschungsinstitut und Naturmuseum)	336
Fig. 28.22	Dr. Gerald Mayr, curator of the Senckenberg ornithological	
	collections Frankfurt (with permission from: Senckenberg	227
E: 20.22	Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	337
Fig. 28.23	Middle: Dr. Gerald Mayr with the tiny skeleton of a	
	hummingbird; <i>left</i> : drawer with skeletons of kingfishers. Both	
	refer to "The Ornithological Collections", Frankfurt.	
	Right: Centropyx paulensis. Belongs to "The Herpetological	
	Collections", Frankfurt (with permission from:	
	Senckenberg Forschungsinstitut und Naturmuseum; photo:	
	Sven Tränkner)	337
Fig. 28.24	Both pictures show <i>Theropithecus gelada</i> . Both specimens were	
	presents from Eduard Rüppell. Refer to the Senckenberg	
	Mammal Collections, Frankfurt (with permission from:	
	Senckenberg Forschungsinstitut und Naturmuseum)	338
Fig. 28.25	Above: Panthera leo tigris; below: Canis simensis. Both pictures	
	refer to the Mammal Collection Frankfurt (with permission	
	from: Senckenberg Forschungsinstitut und Naturmuseum)	339
Fig. 28.26	Equus quagga quagga. An extinct species. The Senckenberg	
	Natural History Museum shows one of the yet 24 worldwide	
	existing specimens (with permission from: Senckenberg	
	Forschungsinstitut und Naturmuseum)	339
Fig. 28.27	The photo on top in the middle shows a staff member in the	
	Frankfurt mammal collection. The one <i>left</i> under it shows	
	Pagurus bernhardus from the Dogger Bank in the North Sea.	
	This belongs to the crustacean collections (with permission	
	from: Senckenberg Forschungsinstitut und Naturmuseum;	
	photo: Sven Tränkner)	340
Fig. 28.29	(left) Heinrich Gottlieb Ludwig Reichenbach (1793–1879),	
	long-term director of the Royal Natural History Museum at	
	Dresden; (right) Adolf Bernhard Meyer (1840–1911),	
	influential director of the Dresden Museum in the late	
	nineteenth century (with permission from: Senckenberg	
	Naturhistorische Sammlungen Dresden (SNSD))	343
Fig. 28.30	A. B. Meyer Building, one of the new research and collection	
	facilities of the Senckenberg Natural History Collections	

List of Figures xxi

	Dresden (with permission from: Senckenberg Naturhistorische	246
Fig. 28.36	Sammlungen Dresden (SNSD))	346
11g. 20.30	(with permission from: Senckenberg Museum für Naturkunde	
	Görlitz)	355
Fig. 28.37	Specimen from Görlitz bird collection (with permission from:	555
8: : : :	Senckenberg Museum für Naturkunde Görlitz; photo: Ekkehard	
	Mättig)	357
Fig. 28.38	Skull collection of small rodents (with permission from:	
8	Senckenberg Museum für Naturkunde Görlitz)	358
Fig. 28.39	By Dr. Bernhard Seifert (with permission from: Senckenberg	
C	Forschungsinstitut und Naturmuseum; photo: Sven Tränkner)	360
Fig. 28.40	Caught in act: a mating pair of slugs. Sexual behaviour may be	
	used for species differentiation (with permission from:	
	Senckenberg Museum für Naturkunde Görlitz; photo:	
	J.M.C. Hutchinson)	361
Fig. 28.41	A spring tail (Collembola): Folsomia sexoculata (with	
	permission from: Senckenberg Museum für Naturkunde	
	Görlitz; photo: HJ. Schulz)	362
Fig. 28.42	Pseudoscorpion (with permission from: Senckenberg Museum	
	für Naturkunde Görlitz; photo: Volker Hampe)	363
Fig. 28.43	A moss mite (Oribatida): <i>Scutovertex</i> (with permission from:	
	Senckenberg Museum für Naturkunde Görlitz; photo: Volker	
	Hampe and Birgit Lang)	363
Fig. 28.44	View of the SDEI building in Müncheberg (with permission	
	from: Senckenberg Deutsches Entomologisches Institut (SDEI);	
	photo: Christian Kutzscher)	365
Fig. 29.1	Sample regions for the collections of the Justus Liebig	
	University Gießen: nature reserve Hoher Vogelsberg	
	(left, source: V. Mader) and the ancient Lake Malawi	
	(right, source: C. Albrecht)	374
Fig. 29.3	Exhibits from the Justus Liebig University Gießen Zoological	
	Collection (from <i>left</i> to <i>right</i>): a bluethroat (<i>Luscinia svecica</i>) of	
	the year 1907, a Eurasian pygmy shrew (Sorex minutus), and a	
	rook's clutch (Corvus frugilegus, source: Justus Liebig	
	University Gießen)	375
Fig. 29.4	Exhibition and storage of the Teaching Collection: taxidermy	
	mounts in glass cabinets accessible to the public (left) and	
	vertebrate skulls in drawers underneath (<i>right</i> , source: Justus	2==
F: 20.5	Liebig University Gießen)	377
Fig. 29.5	Storage and handling of the University of Gießen Systematics	
	and Biodiversity Collection: specimens from the Wet Collection	
	stored permanently in 80% ethanol in polycarbonate/	
	polypropylene containers (<i>left</i>) in explosion-proof freezers in	
	the underground collection room (<i>middle</i>) and DNA preps in cryotubes (<i>right</i> , source: C. Albrecht)	277
	ci yotubes (rigiii, source, C. Albiecht)	311

xxii List of Figures

Fig. 29.6	Voucher specimens from scientific studies: wild bees from flowering fields (<i>left</i> , source: D. Warzecha), ground beetle <i>Poecilus cupreus</i> (<i>middle</i> , source: V. Mader), and selected endemic mollusk species from the ancient Lake Prespa, Balkans (<i>right</i> , source: C. Albrecht)	378
Fig. 31.1	Display cabinet showing the avifauna of a coniferous forest (Photo: © with Richard Schütz)	393
Fig. 31.2 Fig. 31.3	Parasitic wasp (Ichneumonidae) collected by J.T.C. Ratzeburg (Photo: © with Gerrit Holighaus)	394 395
Fig. 32.2	Upper row, C.F. Hornschuch, W. Schilling, R. Buchholz, and A. Gerstaecker; middle row, G.W. Müller, R. Keilbach, I. Groth, and G. Müller-Motzfeld; and lower row, the collection of skeletons including marine mammals before the third academic reform in 1968 (left) and the insect collection after this reform packed in a little room by destroying parts of the old cabinets (right)	400
Fig. 33.1	Volumes of the collection catalogue 'Museum Heineanum' and the front page of the first volume of Cabanis (1851)	407
Fig. 33.2	Cover of the type catalogue of the Museum Heineanum with the type specimens of bird collection (Quaisser and Nicolai 2006)	408
Fig. 34.1	Exterior view of the late classicist building at the Domplatz in Halle (Saale), in which the Zoological Collection has been housed since 1886 (Photo: © with Frank Steinheimer 2012)	419
Fig. 34.2	Taxidermy specimen of the beaver subspecies <i>Castor fiber birulai</i> Serebrennikov, 1929, from Central Asia. This preserved specimen is probably the only one worldwide to be found in a collection outside the region (Photo: © with Markus Scholz	
Fig. 34.3	2015)	419
Fig. 34.4	Bannerfish (<i>Heniochus</i> sp.) from the collection of Marcus Élieser Bloch (1723–1799). Bloch was the first scientist to systematically preserve tropical fish. His main collection is located at Berlin's Museum of Natural History and is regarded as the world's oldest still existing fish collection. The specimen originates from the Indian Ocean and came to Halle (Saale) before 1800 (Photo: © with Frank Steinheimer 2012)	420
Fig. 34.5	Microscopic slide box with material from the insect order Phthiraptera (chewing lice) of O. Taschenberg (1854–1922): the	

List of Figures xxiii

	shown family of Goniodidae is especially rich in types; the collection was reworked by S. Kéler in 1935 (Photo: © with	
	Markus Scholz 2015)	421
Fig. 34.6	Insect box of Carl Hermann Conrad Burmeister's collection from South America, here showing the scarab beetle family	
	(Scarabaeidae). All animals with red labels are so-called types,	
	the first of their kind to have ever been described (Photo: © with	
	Markus Scholz 2015)	422
Fig. 34.7	View into one of the two large halls of the educational and display magazine in the ambience of the late nineteenth century	
	(Photo: © with Markus Scholz 2012)	423
Fig. 34.8	Detail from Dietrich von Schlechtendal's gall collection.	
	This exceptionally rare collection shows plant galls and their	
	originator (Photo: © with Markus Scholz 2015)	424
Fig. 34.9	Today most mammalian and avian specimens are stored, to save	
	space, as so-called skins in sealable tongue and groove boxes.	
	The photo shows representatives of the Mongolian gerbil	
	species Meriones meridianus (Pallas, 1773) (Photo: © with	
	Markus Scholz 2015)	425
Fig. 34.10	Max Schönwetter's eggshell collection is one of the three most	
	important collections of its kind worldwide. The photo shows a	
	box of blown eggs of various species from the American bird	40.0
E: 0444	family Tyrannidae (Photo: © with Hans-Jürgen Altner 2011)	426
Fig. 34.11	This historic collection specimen is the only exemplar of the	
	Fisher's Estuarine Moth <i>Gortyna borelii</i> (Pierret, 1837) from	
	the city of Naumburg. This butterfly species is on the verge of	407
E: 24.12	extinction today (Photo: © with Joachim Händel 2015)	427
Fig. 34.12	The wealth of material in the training courses at the	
	Zentralmagazin Naturwissenschaftlicher Sammlungen (ZNS)	
	is rarely equalled at other universities in Germany. The	
	taxidermy course teaches various taxidermy and preservation	
	techniques for natural history collections (Photo: © with	420
E:- 24.12	Joachim Händel 2010)	428
Fig. 34.13	The collection "Anderwelten" (Other Worlds) by the fashion	
	designer Pia Fischer makes creative use of animal biodiversity.	
	The individual garments tell a story of strength and fragility,	
	individuality and blemishes, in the form of a fable. Fashion	
	photographer Marco Warmuth illustrated the relationship	
	between these costumes and the Zoological Collection (Photon © with Moreo Warmuth 2012)	429
Ein 24 14	(Photos: © with Marco Warmuth 2013)	429
Fig. 34.14	View into the room dedicated to the special exhibition	
	Cicadas—An Electromechanical Sound Installation on	
	Evolution from the year 2012. In the foreground, real cicada collection objects, in the healtground the colonies of artificial	
	collection objects; in the background, the colonies of artificial	
	cicadas by internationally renowned Argentinean sound artist	

xxiv List of Figures

	(Photo: © with Markus Scholz 2012)	430
Fig. 35.1	The <i>Naturhistorisches Museum</i> , or Museum of Natural History, in Hamburg designed in Italian renaissance style opened in 1891 (CeNak Archive)	438
Fig. 35.2	The main exhibition hall of the <i>Naturhistorisches Museum Hamburg</i> , with large whale skeletons on display until the 1940's (CeNak Archive)	438
Fig. 35.3	The ruins of the <i>Naturhistorisches Museum Hamburg</i> , (a) destroyed by the bombing of the city's center on 30 July 1943 and (b) shortly before its final removal in 1951 (CeNak Archive)	439
Fig. 35.4	The Zoological Museum Hamburg as part of the newly founded <i>Centrum für Naturkunde</i> (CeNak) in its university building from the early 1970's (CeNak Archive)	440
Fig. 35.6	A view of the collection Invertebrates I of the Centrum für Naturkunde (CeNak Archive)	446
Fig. 35.7	Organigramm, or composition of the positions and personal in the Centrum für Naturkunde Hamburg (CeNak)	450
Fig. 35.8	View of the exhibition of the Centrum für Naturkunde Hamburg (CeNak)	452
Fig. 35.9	The increase of visitors in the exhibition of the Zoological Museum of the Centrum für Naturkunde Hamburg (CeNak)	453
Fig. 35.10	The number of new species described by scientists from the Zoological Museum of the Centrum für Naturkunde Hamburg within the past 15 years (CeNak)	454
Fig. 35.11	The number of publications by staff members of the Centrum für NaturkundeHamburg (CeNak), for the period 2012–2016 in the three categories as given	457
Fig. 35.12	A view of the Malacology collection, Centrum für Naturkunde Hamburg (CeNak)	459
Fig. 37.1	The first zoology building in Wilhelminian style was opened in 1883. On the <i>left</i> , the second zoology building from 1912 which houses the zoological teaching collection until today (Photo: © with G. Brehm 2015)	469
Fig. 37.3	The entomological collection of the museum comprises many now regionally extirpated species such as the Hermit [Chazara briseis (L.)] and the Grayling (Hipparchia semele L.). Inventory number PMJ Hex 81 (complete drawer) (Photo: © with G. Brehm 2015)	471
Fig. 37.4	The kakapo from New Zealand (<i>Strigops habroptilus</i> Gray, inventory number PMJ Aves 503) is one of the rarest bird species on Earth and critically threatened by invasive species such as the stoat (<i>Mustela erminea</i> L.) (Photo: © with G. Brehm 2013)	471
	5.0 m (17 m 5.0 m c 17 m 10 m d 10 m 10 m 10 m 10 m 10 m 10 m	713

List of Figures xxv

Fig. 37.5	Example of ethanol samples that were dried out before regular curation started. Scale bar: 1 cm (Photo: © with G. Brehm 2015)	473
Fig. 37.6	Insect magazine with cabinets integrated in the outer wall (<i>left</i>) and tightly sealing insect drawers (<i>right</i>). The preparation of a blue peafowl (<i>Pavo cristatus</i> L.) demonstrates the shortage of space in the museum (Photo: © with G. Brehm 2015)	473
Fig. 38.1	Storage room (next to the large lecture hall in the 1912 zoology building) for the teaching collection with the large skeleton of an African elephant (<i>left</i>) and the wet material collection (<i>right</i>). The most light-sensitive objects are stored in shade. Further, glass cabinets with skeletons and models are in the next room (Photo: © with G. Brehm 2015)	478
Fig. 38.2	Diverse zoological material stored in ethanol in the teaching collection (Photo: © with G. Brehm 2015)	478
Fig. 38.3	Damaged specimen of a gar species (<i>Lepisosteus</i> sp.). <i>Scale bar</i> : 10 cm (Photo: © with G. Brehm 2015)	480
Fig. 38.4	The historical wax model demonstrates the development of the skull of a short-beaked echidna (<i>Tachyglossus aculeatus</i>). <i>Scale</i>	401
Fig. 38.5	bar: 10 cm (Photo: © with G. Brehm 2015)	481 482
Fig. 38.6	A modern mounted skeleton of a goshawk (<i>Accipiter gentilis</i>) from the year 1996, equipped with a flexible steel wire (Photo: © with G. Brehm 2015)	482
Fig. 38.7	A folder of microscopic slides containing originals from the late nineteenth century from excursions made by Haeckel and students, e.g., to Messina/Italy. <i>Scale bar</i> : 10 cm (Photo: © with G. Brehm 2015)	483
Fig. 41.1	Eduard Friedrich Poeppig (with permission from Archives of the University of Leipzig)	500
Fig. 41.2	Rudolf Leuckart (with permission from Archives of the University of Leipzig)	501
Fig. 41.3	The entrance of the zoological institute (with permission from University of Leipzig. Photo: Marion Wenzel)	501
Fig. 41.4	Carl Chun. Archives of the University of Leipzig	502
Fig. 41.5	View into one of the exhibition rooms (with permission from University of Leipzig. Photo: Marion Wenzel)	503
Fig. 41.6	Southern two-toed sloth (<i>Choloepus didactylus</i>). Taxidermy mount made by ter Meer (with permission from University of Leipzig. Photo: Marion Wenzel)	504
Fig. 41.7	Hydractinia echinata. Glass model made by Blaschka (with permission from University of Leipzig. Photo: Marion Wenzel)	505
	11 VIII/VII	-7(1.)

xxvi List of Figures

Fig. 42.1	View on museum and cathedral from above (with permission from Museum für Natur und Umwelt, Lübeck; photo:	
Fig. 42.2	Susanne Füting)	508
	photo: Wolfram Eckloff)	510
Fig. 42.3	Entrance of the "Museum für Natur und Umwelt" (with permission from: Museum für Natur und Umwelt, Lübeck;	511
Fig. 42.4	photo: Susanne Füting)	511 511
Fig. 42.5	Former "Museum am Dom" showing art, applied art, ethnology and natural history (with permission from: Museum für Natur	512
Fig. 42.6	und Umwelt, Lübeck; photo: Susanne Füting)	
Fig. 42.7	Füting, original picture taken by Johannes Nöhring)	512
	Michael Haydn)	513
Fig. 42.8	Collection of P. Gussmann (with permission from: Museum für Natur und Umwelt, Lübeck; photo: Uli Schmidts)	514
Fig. 42.9	Skeleton of recent sperm whale in the yard adjacent to the cathedral (with permission from: Museum für Natur und	
Fig. 42.10	Umwelt, Lübeck; photo: Susanne Füting)	515516
Fig. 44.1	Chinese freshwater mussel with artificial figurines of Buddha covered by the mother of pearl (Photo: © with MZC: Beitz,	
Fig. 44.2	Mecke, Worth)	532
Fig. 44.3	platypus (Photo: © with MZC: Beitz, Mecke, Worth) This slow loris used to be a pet of a professor of the university, who donated it to the collection after the animal had passed	533
Fig. 44.4	away in 1995 (Photo: © with MZC: Beitz, Mecke, Worth) The skeleton of the Asian elephant from 1863, called "Jack",	533
	mounted in 2002 in one of the foyers of the Department of Biology (Photo: © with MZC: Beitz)	534
Fig. 44.5	A mummy skull of a child from Thebes with well-preserved hair. The skull is estimated to be about 2500–3000 years old (previously estimated to be 3500–3800 years old)	334
	(Photo: © with MZC: Beitz)	535

List of Figures xxvii

Fig. 44.6	One of the insect boxes with coleopterans from the collection of C. F. Riehl (moved to a new insect box) (Photo: © with MZC: Beitz, Mecke, Worth)	535
Fig. 44.7	Recently, the Marburg Zoological Collection was augmented by about 4500 gastropod specimens from the dissolved Marburg Geological-Paleontological Collection. Displayed is one of the specimens that were collected by Marburg geologist W. Dunker (Photo: © with MZC: Beitz)	536
Fig. 44.8	The term "crucifix fish" originates from the perceived resemblance with an image of Jesus on the cross. It is, in fact, the inner part of the cranium of a member of the fish family Ariidae. The object is a rather new addition to the collection and was provided by the student Veronika Machnik in 2013 (Photo: © with MZC: Beitz)	537
Fig. 44.9	Phrenological skull (female), nineteenth century. Phrenology was a pseudoscientific theory based on the morphology of skull areas which were said to be symptoms for the strength of characters or moral strength (after F. J. Gall 1758–1828) (Photo: © with MZC: Beitz)	538
Fig. 44.10	Roebuck with perruque head. The abnormal antler growth is caused by lack of testosterone (Photo: © with MZC: Beitz, Mecke, Worth)	538
Fig. 44.11	The collection's taxidermy cabinet with some recently received specimens from a secondary school collection in front (Photo: © with MZC: Beitz)	539
Fig. 45.1	The extraordinary building of the ZSM: external view/level 1/level 2 (from Michaela Ruthensteiner 1999 with permission of the author). The distance between the pillars is 5 m	544
Fig. 45.2	Outstanding examples from the collections of the ZSM: (a) The "Royal Armadillo" brought alive to Munich from her Brazilian expedition by IKH Therese von Bayern (see Ruppel and Donoughue 2012) (Photo: © with Marianne Müller, ZSM). (b) A specimen of a male of the extinct passenger pigeon, <i>Extopistes migratorius</i> L., 1766 (Photo: © with Marianne Müller, ZSM). (c) One of the smallest reptiles, the endangered pygmy chameleon <i>Brookesia micra</i> from Madagascar (Photo: © with Dr. Glaw, ZSM). (d) A view of the lepidopteran magazine of ZSM—the largest butterfly/moth collection on earth (Photo: © with Dr. Axel Hausmann, ZSM).	545
Fig. 45.3	Two focuses of research in the ZSM. (<i>left</i>) Barcoding tree of 3.500 Bavarian beetles, the largest barcoding data set of determined species ever done (from Hendrich et al. 2015 with permission). (<i>right</i>) 3D visualization of the mandibular apparatus of a longhorn beetle larva with cuticular element	575

xxviii List of Figures

	(blue) and muscles (pink/red) based on μCT technology (Courtesy of Dr. Bernhard Ruthensteiner, ZSM)	547
Fig. 46.1	View into the depository of the zoological collections (Photo: © with LWL/Steinweg)	553
Fig. 46.2	View into the depository of the zoological collections (Photo: © with LWL/Steinweg)	553
Fig. 46.3	Eurasian greenfinch, skins. For reasons of pest control, skins and mounted specimens are frozen regularly and otherwise stored under airtight conditions with transfluthrin (Photo: © with LWL/Steinweg).	555
Fig. 46.4	Two out of seven specimens of the grey partridges of the extinct subspecies <i>Perdix perdix sphagnetorum</i> (Altum, 1894) within the collection, female (<i>left</i>) and male (<i>right</i>). These dark phenotypes have been endemic in areas of heath and moorland in the northeastern Netherlands and northwestern Germany. They have become extinct in the late 1920's (Photo: © with LWL/Steinweg)	556
Fig. 47.1	Donation of the Russian Tsar Nicholas I.: Tufted Puffin (<i>Fratercula cirrhata</i> , inventory no. AVE4575) and presumptive Brandt's Cormorant (<i>Phalacrocorax cf. penicillatus</i> , inventory no. AVE974) (with permission from: Landesmuseum Natur und Mensch Oldenburg; photo: W. Kehmeier)	560
Fig. 47.2	The Landesmuseum Natur und Mensch Oldenburg at today's place (<i>white</i> building in the front, original museum; <i>pink</i> building in the background, former library) (with permission from: Landesmuseum Natur und Mensch Oldenburg; photo: W. Kehmeier)	561
Fig. 47.3	Syntypes of <i>Lycodon ruhstrati</i> (with permission from: Landesmuseum Natur und Mensch Oldenburg; photo: C. Barilaro)	563
Fig. 47.4	Insight into the collection of ground beetles (Carabidae) at the Landesmuseum Natur und Mensch Oldenburg (with permission from: Landesmuseum Natur und Mensch Oldenburg; photo: C. Barilaro)	565
Fig. 47.5	Snowy Egret (<i>Egretta thula</i>). First recorded in the Western Palaearctic (with permission from: Landesmuseum Natur und Mensch Oldenburg; photo: W. Kehmeier)	567
Fig. 49.1	The Zoological Institute where the collection is located in the center of the Hanseatic city of Rostock (Photo: © with	5 04
Fig. 49.2	Zoological Collection, University of Rostock)	584 585

List of Figures xxix

Fig. 49.3	The mounted polar bear "Churchill" at the opening of the special exhibition on the fauna of the polar regions in April 2014 (Photo: © with ITMZ, University of Rostock)	586
Fig. 49.4	The collection of mollusks is one of the oldest parts of our collection and holds around 50,000 specimens (Photo: © with ITMZ, University of Rostock)	587
Fig. 49.5	Collection of invertebrates arranged according to traditional systematics—from sponges to insects (Photo: © with Zoological Collection, University of Rostock)	588
Fig. 50.1	Center for Biodocumentation (with permission from: ZfBS)	592
Fig. 50.2	Dodo (Raphus cucullatus) (with permission from: ZfBS)	592
Fig. 50.4	Schnabeligel (<i>Tachyglossus aculeatus</i>) (with permission from: ZfBS)	594
Fig. 50.5	Schnabeltier (<i>Ornithorhynchus anatinus</i>) (with permission from: ZfBS)	594
Fig. 50.6	Typus von <i>Micropterix stuebneri</i> (Zeller, Werno & Kurz, 2013) (with permission from: ZfBS)	595
Fig. 50.7	Typus von <i>Pheles strigosa f. trichroma</i> (Staudinger, 1876) (with permission from: ZfBS)	595
Fig. 50.8	Typus von <i>Heliconius phyllis f. krügeri</i> (Neustetter, 1925) (with permission from: ZfBS)	596
Fig. 50.9	Typus von <i>Heliconius antiochus alba ab. trimaculata</i> (Krüger, 1933) (with permission from: ZfBS)	596
Fig. 50.10	Archiv Lepidoptera (with permission from: ZfBS)	598
Fig. 50.11	Ornithoptera alexandrae (Rothschild, 1907) (with permission from: ZfBS)	598
Fig. 51.1	At the <i>top</i> , Lepidopteran specimens (Zygaenidae, Arctiidae) of the Artur Franz Collection; <i>below</i> , one tray of the bird egg collection of Artur Franz showing eggs from different species of trushes and sylviid warblers (photos: © with S. Gierszewski)	605
Fig. 52.1	The DMM's parent house is located in St. Catherine's	003
115. 32.1	Monastery with its spacious hall church (with permission from: Stiftung Deutsches Meeresmuseum)	611
Fig. 52.2	Exhibition of marine biodiversity in the OZEANEUM in Stralsund; Source: Johannes-Maria Schlorke Photography (with	
Fig. 52.3	permission from: Stiftung Deutsches Meeresmuseum) The DMM's model of a coral pinnacle after the extensive revision during 2012–2014 (with permission from: Stiftung Deutsches Meeresmuseum)	611
Fig. 52.4	Hands on—the fin whale skeleton of 1825 is among the most spectacular exhibits of the museum (with permission from:	012
	Stiftung Deutsches Meeresmuseum)	614