Edited by Anita Hermannstädter,
Ina Heumann and Kerstin Pannhorst

Translated by Patricia Newman

The NATURE of THINGS

Stories from a Natural History Museum

MUSEUM FÜR NATURKUNDE BERLIN

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The Nature of Things – Stories from a Natural History Museum

The idea for this book, first published in 2015, came out of a research project called *Wissensdinge*, conducted at the Museum für Naturkunde Berlin from 2013 to 2015. Funding was provided by the German Federal Ministry of Education and Research (BMBF).

Bibliographic information of the Deutsche Nationalbibliothek:
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic information can be accessed at http://dnb.de.

Cover photo: Dry specimen of a Japanese bulleye, *Cookeolus japonicus*, preserved c. 1805, Langsdorff Collection, ZMB 427, Museum für Naturkunde Berlin. Photograph by Carola Radke.

Editors: Anita Hermannstädter, Ina Heumann and Kerstin Pannhorst

German copy-editing: Anita Hermannstädter, Ina Heumann, Kerstin Pannhorst, Johanna Lessing, Ronja Drews and Marna Schneider

Translations: Patricia Newman, Brad Hagen and Dorothy Newman

Copy-editing of translations: Linda Jayne Turner

Copy-editing of English originals: Patricia Newman and Dorothy Newman

Design, typesetting and final artwork: Thomas Schmid-Dankward

Photography and preparation for print: Hwa Ja Götz and Carola Radke

Paper: LuxoArt Samt, 135 g/m²

Fonts: Trade Gothic and Sabon

Printing: Westermann Druck Zwickau GmbH

First (German-only) edition published 2015 by Nicolai Verlag, Berlin.

Second, updated and expanded edition

http://www.reimer-verlag.de

Printed in Germany
ISBN 978-3-496-01651-9


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PRIACANTHE du Japon.
PRIACANTHUS japonicus.n.
Werner del.
Impr. de Langlois.
Plée f.a. sculp.

A collection of this kind is made to last and, although the places where it's kept and the types of institutions it belongs to may change over time, it is regularly maintained. The bigeye and its fellow fishes are cleaned and dusted, periodically restored by taxidermists and relabelled. Fish – like other aquatic animals – are typically preserved in alcohol. Dry specimens are rarer and require more care, especially when they've been selected for the job of cover model, like the bigeye here. After first being carefully prepared in the taxidermy workshop, it was shot under the lights of the museum photography studio and then returned to its shelf in the collection. Travels like this are nothing new for the bigeye: it has been sent to many different institutes and scientists for research purposes and, when the collection moves again at some point in the future, the bigeye will move with it.

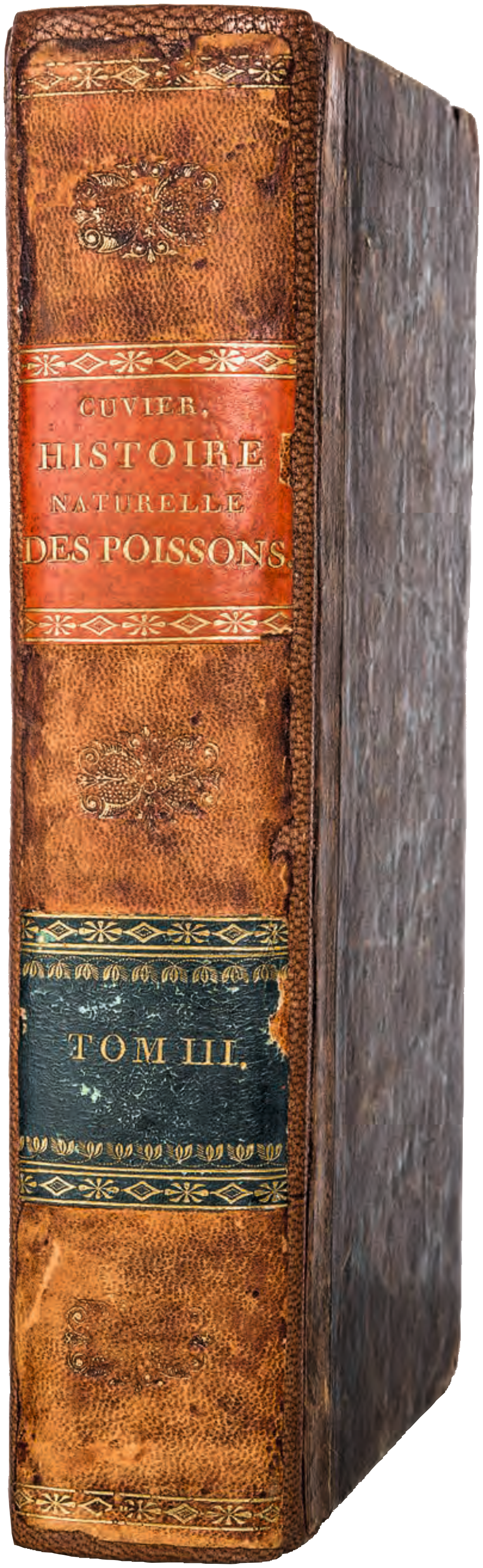
We don't know whether, on its rounds through the museum, the bigeye has ever made it to the exhibition rooms. Earlier, when it was stored in the university building on Unter den Linden (a major boulevard in central Berlin), it was available to researchers and to curious laypeople on museum tours. It was not until the museum was moved into its own building in Invalidenstraße that its holdings were divided into an exhibition collection and a research collection. Today the Museum für Naturkunde exhibits only a fraction of the 30 million items in its custody. Most of these are kept in various cabinets, drawers and cases in the research collection.

Description and naming

The fish itself was not the only thing that had to be protected from the ravages of time; all the information associated with the specimen was carefully preserved as well. Without knowing where and when the fish had lived,

it would be of little scientific value. Langsdorff himself noted the place and date of the find as best he could, given the circumstances. Back in Berlin, this information was recorded in a catalogue in the Fish Collection and later, in 1860, transferred to a new leather-bound accession book. The entry for our bigeye, written in an elegant, sloping hand, lists it under accession number 427. This number can also be seen on the hand-written, blue-bordered label hanging from its tail fin. Considering that the fish collection now numbers over 100,000 specimens, it takes only a glance at this number – a mere three digits long – to know that the object it refers to must be very old indeed. The handwriting on the label itself is modern, dating from the second half of the twentieth century. This indicates there must have been older versions of the label whose original contents were transferred to this one. Nowadays, all the information on this specimen is also recorded in a digital database.

One thing that any animal needs in order to be recorded in the museum's various lists and catalogues is a name. *Priacanthus japonicus* is written on the label above the accession number, followed by two notations that are generally understood only by zoologists: an asterisk and the abbreviation "C. V." The asterisk identifies the bigeye as a uniquely important specimen: a 'type specimen' or 'name-bearing type'. It is on the basis of this specimen that the new fish species *Priacanthus japonicus* was described. From the moment type specimens are named and described, they become especially valuable for zoological research. The letters C and V are references to the scientists who did the naming, French naturalists Georges Cuvier and Achille Valenciennes. They included the bigeye in the third volume (published in 1829) of their extraordinarily ambitious *Histoire naturelle des poissons* (Natural history



The bigeye was first described in *Natural history of fishes.*

of fishes) – a 22-volume compendium of the world's fishes that covers thousands of species. They gave the bigeye its scientific name, described its distinguishing features and provided a colourful drawing of the specimen. Both the description and illustration were based solely on the dry specimen and the notes Langsdorff had made; none of the men involved in the production – neither Cuvier, Valenciennes nor the illustrator – had ever seen a living specimen themselves. By the time the artist saw it, the dry specimen had long since lost its natural colouration, and so he selected his palette based on Langsdorff's original description. He relied on his imagination to supply some of the finer details.

The bigeye is drawn in brilliant red, with wide yellow eyes. Its fins appear disproportionately large and at the same time oddly fragile. Looking at it, it is easy to be moved by its baby-like features. Unlike the dry specimen, it appeals to us on an aesthetic level, too. *Priacanthus japonicus*, as drawn in this picture, is a bright and elegant creature. Fish experts can tell at a glance what the fish's natural habitat is. This species lives in deep waters, about 200 metres below the surface. It tends to prefer areas below rock outcroppings or reefs, where it hunts crabs and other prey. In this almost completely dark environment, the brilliant red of its scales provides excellent camouflage. Red light does not penetrate to the ocean depths, making red appear grey and enabling the fish to blend into the background. In fact, at these depths there's very little light from anywhere on the spectrum, and the bigeye needs its large eyes to capture as much of it as possible.

When we compare the drawing of the fish, which looks so vivid and real, with the dry specimen in the museum, we see the toll exacted by time and taxidermy. These changes have radically transformed the creature, and we react to it quite differently than to the drawing. That's not surprising – after all, we are looking at something that has been preserved for more than 200 years beyond its death. Its name, on the other hand, did not last. These days, zoologists refer to the fish as *Cookeolus japonicus*. Almost a hundred years after it was first described, it was reassigned to a different genus. This is not unusual for an animal that's been the subject of scientific study for 200-plus years. It has gone by many names over the course of its existence. Langsdorff christened it *Polyprion japonicus*. The Japanese at that time were said to have called it *Horranda mebaru*; today, it is known as *Chikame-kintoki*. Our English names for it – big-fin bigeye, longfinned bullseye or simply bulleye – are inspired by its saucer-like eyes and oversized pectoral fins.

We don't know where the specimen was stored between the end of the Russian expedition in 1806 and 1821, when it was donated to the natural history collection of the University of Berlin. Nor do we know where, exactly when, or even how Cuvier and Valenciennes examined it. One thing is certain, however: this old, dry fish has been on a very long journey. It continues to be used for research purposes, both as a valuable historical specimen and, more specifically, as a type specimen. It is quite delicate now, though, and unlike other zoological specimens, it is no longer lent out to researchers and institutes on the other side of the world. Instead, it and its fellow fishes in the Langsdorff Collection – one of the world's oldest collections of Japanese fishes – receive their admirers here at the museum. Recently, biologists from Japan came to Berlin to study them. Their story of how the fish ended up in the Langsdorff Collection is one of many stories told in this book.

The fish and other things of nature

Our Japanese visitors weren't the only ones interested in this fish. We, too, were impressed by its history, its scientific significance and its striking looks. That's why we've chosen it for the cover of this book, as a representative of all the other things of nature. Like our fish, every object in the museum's collection has a history, a story waiting to be told. These stories have much to tell us about the nature of things; they show us how the natural world works, and also how our human world works. They give us insight into the theoretical and practical aspects of collecting, researching, exhibiting and interpreting specimens; and they also reveal the greater political, social, economic and cultural contexts in which those specimens are embedded.

Inside the old fish room at the Museum für Naturkunde, before 2010

Captain Cook and the Ou

Perhaps you have never heard of an Ou before, but you will be familiar with the name of the man who shared its fate. Captain James Cook, a famous explorer and navigator who sailed the world and charted the seas, had one thing in common with the Ou – a little green-feathered, yellow-headed bird – and that was their tragic end on the western coast of Hawaii in 1779. This specimen of *Psittirostra psittacea*, a member of the family of Hawaiian honeycreepers, was discovered in January 1779 in the hills overlooking Kealakekua Bay. Cook's crew promptly captured, killed and preserved it. At the same spot just three weeks later, Captain Cook suffered the same fate: he was killed by the islanders, and parts of his body were preserved as cult objects. His chest was stripped of its flesh, and the bones were cleaned and kept. The bird was mummified by placing it in a small oven to dry out immediately after it was killed. This preservation technique dates back to the Middle Ages and remained a common practice in the scientific study of birds until the late eighteenth century. Later, particularly for museum specimens, the skin and feathers were stretched over a wire framework stuffed with dry material such as flax, straw or cotton. The wires in Cook's Ou were not inserted until after the ships returned to England in 1780. They made it possible for the bird to be displayed as though perched on a branch. A second Ou specimen, currently in Vienna's Natural History Museum, was also completely mummified and stabilised with wires inside the body. Perhaps the stuffed birds once sat side by side on the same perch?

Once in England, almost all of the birds that Cook brought back from the third voyage were taken to John Montagu, the fourth Earl of Sandwich and inventor of the eponymous lunch. As First Lord of the Admiralty, the voyage took place under his purview. He later gave a collection of Hawaiian birds to his friend Sir Ashton Lever to be displayed in Lever's private London museum. Among them were four Ous, displayed in groups of two, each pair on a wooden base. Lever invested more and more money in new specimens, and the museum soon found itself in financial difficulties. In 1786, he sold it all – the building and its contents – by lottery. Lever kept three quarters of the lottery tickets for himself, perhaps hoping to draw the winning ticket and use the earnings from ticket sales to

X-ray showing metal rods inserted to stabilise the mummy, 2004

MUMMIFIED SPECIMEN OF A HAWAIIAN HONEYCREEPER

Ou, *Psittirostra psittacea*, collected in 1779 near Kealakekua Bay, Hawaii, by the crew of James Cook's third voyage. Bird Collection: ZMB AVES 6946 keep the museum afloat. Instead, the ticket went to James Parkinson, a real estate agent, who paid a pittance for it and won an entire museum.

The museum did not prosper any better under new ownership, not even when Parkinson moved it to the other bank of the Thames. He struggled to keep it going for another twenty years and finally put the collections up for auction in 1806. The Ous were sold off in lots of two. One pair – a male and a female – were acquired by Edward Smith Stanley, thirteenth Earl of Derby, for his private museum. The other pair – two males – were bought by mineralogist Leopold von Fichtel for the Vienna Royal Museum of Natural History.

Fichtel immediately resold one of the birds to William Bullock, a goldsmith from Liverpool. Bullock subsequently moved to London and took his private museum with him, but as the collection expanded and ran out of space, he sold it in 1819. Martin Hinrich Carl Lichtenstein took this opportunity to acquire the Ou for the Zoology Museum in Berlin. The only remaining indication of provenance is the name "Bullock" on the label.

The name 'Ou' comes from the Hawaiians' name for the bird: ʻōʻū. Birds had a special place in early Hawaiian culture. Their feathers were used to create cloaks and capes (giving rise to the German name *Kleidervogel*, literally 'clothes bird'). The most popular feathers were red

and yellow, like those on the head of the male Ou. There are several specimens in the Museum für Naturkunde today. With the exception of Cook's bird, however, all of them are from the late nineteenth century. They are the last of their species. Since 1989, no more Ous have been recorded. The only remaining specimens from the eighteenth-century population are the four that Cook's expedition brought back from their third voyage, as well as a fifth 'unofficial' bird taken home by a crew member. These specimens can be seen in museums in Liverpool, Leiden (the Netherlands), Vienna and Berlin. They take us back in spirit to the eighteenth century, when Europeans were just beginning to explore Hawaii. Ous were more common then; the population had not yet been threatened by the rats and snakes that arrived on explorers' ships. Nor had their numbers been decimated by bird malaria (introduced by bird traders) and deforestation.

Cook's Ous represented the first formal evidence of the new species and so they were the basis for its scientific name and species description. These Ous are among the approximately 2,000 bird specimens from the eighteenth century that still exist around the world today. By 1823, Lichtenstein had sold many of the duplicate specimens from the museum's zoology collection but, happily, the Ou was not among them – after all, Cook's Ou was the only one he possessed at the time.

Frank D. Steinheimer

“And Adam called by their names all living things”

Adam’s first act in Paradise was to name the animals. The bestowing of a name is no trivial matter: it involves an acknowledgment of the other, the hope of meeting again, and the creation of order in the world. Natural history museums institutionalise this act of naming. They are places where biodiversity is archived, named and exhibited.

The insect drawers in museums are kept hidden from public view. And yet, of all the collections, they contain the greatest variety of living (or once living) creatures. This was already known back in the time of Carl Linnaeus, the Swedish naturalist and author of *Systema Naturae*, a masterwork of taxonomy that grouped nature into classes, orders, genera and species. He saw himself as following in Adam’s footsteps, leading his contemporary Albrecht von Haller to refer to him, tongue in cheek, as the “second Adam”. The 2,000 insect species described in the 10th edition of Linnaeus’s famous work, published in 1758, made up half of all animal species known at that time. Today we distinguish between more than one million different species of insects, and they are now thought to constitute two thirds of all animal species.

Flies are one of the larger orders of the class of insects, and within the order of flies is a large family called Mycetophilidae. Some specimens of Mycetophilidae can be found in this drawer. Their scientific name derives from the names of genera introduced by Johann Wilhelm Meigen in 1800 and 1803, respectively: *Fungivora*, meaning ‘fungus-eating’, and *Mycetophila*, meaning ‘fungus-loving’. Meigen made major contributions to the classification of species. He was not content to rely on the characteristics of a small number of body parts such as mouthparts, but instead considered an entire complex of features. This approach revolutionised the taxonomy of flies and earned him the title of ‘father of dipterology’. (Dipterology, for any non-entomologists, is the study of flies.)

When an animal previously unknown to science is discovered, a formal species description is written comparing the new species with a known species and identifying the distinguishing features that characterise the new species. Thus, the species description not only identifies the new specimen but establishes the criteria used to identify and classify future specimens. This is one of the key responsibilities of natural history museums: they help define the categories used to group nature into different classes, orders and species; and, for every single creature, they tell us what group that creature belongs to.

Georg Toepfer

INSECT DRAWER CONTAINING MYCETOPHILIDAE

Mycetophila, mounted c. 1800.
Hymenoptera Collection: ZMB DIPT C009.D01

The labels for these blow flies (Calliphoridae) illustrate the careful work that goes into naming new species.

Fish

FLYING FISH, PRESERVED IN ALCOHOL
Exocoetus volitans [evolans],
collected between 1815 and 1818
by Adelbert von Chamisso
near Radack, Marshall Islands.
Fish Collection: ZMB PISC 2902

or Fowl?

November 1815. Stormy winds were blowing over the Tropic of Cancer in the Atlantic. The brig *Rurik* had left Santa Cruz, Tenerife, a few days earlier. This was one of very few stops it had made since starting from St Petersburg several months previously. It was on an expedition to circumnavigate the globe and would ride the waves for a total of three years – a time that would prove challenging for many of those on board.

The *Rurik* had scarcely crossed the Tropic of Cancer when, suddenly, strange and unfamiliar creatures began hitting the wooden hull of the ship. For the superstitious sailors, who had never ventured beyond the seas of northern Europe, they were an omen of evil to come. These odd animals had the bodies of fish but the wings of birds. They even flew up onto the ship's deck, where they landed with a thud and lay flopping on the wooden planks, their wings useless outside the water. A feeling of dread overcame the sailors, who had never witnessed such an "inversion of nature". They took one of the creatures and silently cut it into pieces. Hoping to ward off evil, they returned the bloody pieces to the sea, solemnly throwing them in all directions.

On board the ship were, in addition to the crew, natural scientist Adelbert von Chamisso, the ship's doctor Johann Friedrich Eschscholtz, and painter Louis Choris. All three were experienced naturalists. They conducted botanical and zoological research during the expedition, collecting, preserving, describing and drawing a variety of species, most of them unknown to Europeans at the time. Chamisso was familiar with the strange animals from the works of Linnaeus and knew they were a kind of flying fish named *Exocoetus volitans*. He explained to the seamen that the flying appendages were adapted fins which the fish used to propel themselves out of the water. In his *Voyage Around the World*, Chamisso described their anatomy and flying technique. He observed that since the fish have no obstacles on the flat sea, they do not require the excellent vision birds typically have, and he concluded that they landed on the ship for the simple reason that it was in their way.

The longer the sailors were at sea and the further south the expedition moved, the more flying fish they saw. They learned to appreciate them, especially after discovering how good they tasted. Chamisso preserved two of the fish in alcohol. One of these specimens, which he brought back from the Marshall Islands, is still with us over 200 years later.

Yvonne Maaß

Zombified

Your classic ant has six legs and two antennae, but this giant queenless ponerine ant has a little something extra. In addition to the standard extremities, it has two long antenna-like structures extending from the hips of its first pair of legs. It looks as if someone pulled a wire through its thorax, bent the ends upwards and stuck brown brushes on the tips.

GIANT QUEENLESS PONERINE ANT

Dinoponera sp., collected between 1920 and 1926
by Günther Tessmann in Monte Alegre, Peru.
Hymenoptera Collection: Cabinet No. 148, Drawer No. 2

When this giant queenless ponerine ant – or *Dinoponera* – was first identified, scientists initially mistook it for a bullet ant. Also known as the 24-hour ant, the bullet ant has one of the most excruciating stings of any insect known to humankind. A sensation of burning pain radiates from the site of the sting and is said to last a full day – hence the name. Both species measure about three centimetres long, ranking them among the largest ants in the world. The sting of *Dinoponera*, however, is no more painful than that of a honeybee. But enough about stings – let's return to the strange antenna-like appendages.

Don't they look a bit like mushrooms? No? Well, perhaps not. But that description is more apt than it seems. In the ancient forests of South America, there lives a peculiar family of parasitic fungi called Ophiocordycipitaceae (members of the phylum of Ascomycota, which includes morels and truffles). Ophiocordycipitaceae infiltrate their hosts as spores; these hosts include other fungi (specifically those belonging to the deer truffle genus) as well as insects like grasshoppers, flies and ants. Several Ophiocordycipitaceae species are specialists that attack a single kind of host. A certain species parasitises ants. This species not only takes over the body of its host, it radically reprograms its behaviour, forcing it to stagger and weave its way up a nearby plant to a height where conditions are optimal for the growth of the fungus. Once the ant reaches the top of the plant, it bites down on a leaf and locks its jaw shut. After a while, the 'fruiting body' of the fungus (in the case of edible mushrooms, this is the part that we like to eat) starts growing out the back of the ant's head like an antenna. It then releases spores in order to reproduce. Healthy ants avoid areas where the fungus has spread and, to protect their colony, they will not hesitate to carry any infected ants far away from the nest.

Our *Dinoponera* clearly suffered this same fate – the fungus grew inside it, spreading steadily throughout its body until it died. The fruiting body of the fungus then broke through the delicate skin of the ant's 'shoulder' joint. Now at the museum, this ant provides evidence of the interaction between two very different life forms and holds fascinating lessons for taxonomists and ecologists alike.

Christina Kuhlman

“Tu-whit, tu-whoo”

TAPE RECORDING OF A TAWNY OWL

Strix aluco, recorded by Günter Tembrock in the courtyard of the Museum für Naturkunde on 31 October 1951, from 5.45 p.m. to 6.15 p.m. Animal Sound Archive: Strix_aluco_V0003_01

Sharp calls of "tu-whit, tu-whoo" cut through the static – and occasionally, in the background, a dull thumping sound can be heard, perhaps footsteps. In addition to the calls of the tawny owls, the loud noise made by the equipment itself is clearly audible in this recording, made in the early evening of 31 October 1951. The footsteps belonged to Konrad Herter, then director of the Zoology Institute at Berlin's Humboldt University. This tape is the oldest surviving recording of an animal call in the museum's collection. It laid the foundation for today's Animal Sound Archive, which comprises over 120,000 recordings and is among the world's largest collection of animal recordings.

The magnetic tape is wound on a spool and wrapped in an unremarkable paper cover bearing only the catalogue number "V3". Back in 1950, magnetic tapes were the most advanced sound recording technology there was. And the machine used by Günter Tembrock to record the tawny owls was rarer still: it was made specifically for the Zoology Institute of the Humboldt University. It was not ideal for field work, however, given that it weighed 40 kilos (almost 90 pounds) and required a mains connection in order to work. To test the device, it was placed on a window at the institute and used to record the owls kept in a courtyard next to the west wing of the museum. Attracted by the calls of the two birds in the aviary, another tawny owl flew over from the Tiergarten (a large park in the centre of Berlin). This unexpectedly turned their trial recording into a real recording of a wild bird.

It is still possible to play the original tape, but very few facilities still possess the requisite equipment, which has not been manufactured for many years. To ensure that future generations will still be able to hear the tawny owls and all the later recordings, the tapes have been digitised. Now anyone with an internet connection – people all over the world – can listen to the recording on the website of the Animal Sound Archive. The animal sound collection, started by Günter Tembrock, has been part of the Museum für Naturkunde since 1995. The recordings are used in a broad range of ways, from biodiversity inventories and studies on acoustic animal communication to exhibitions and art projects. The collection is continuing to grow, as more and more new recordings are added: birds and mammals, naturally, as well as fishes, amphibians, reptiles and invertebrates.

Karl-Heinz Frommolt