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“Two and a half auks” – the history of the Great Auks, *Pinguinus impennis*, at the ZSM

(Charadriiformes, Alcidae)

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In the 19th century, two stuffed skins of the Great Auk *Pinguinus impennis* came to the Alte Akademie and were mentioned and described by different authors. The last person who noted both specimens was Diesselhorst in the 1970s. Since then only one Great Auk was known in the collection of the ZSM. Comparing it with two old slides of the specimens of the Alte Akademie showed that it is none of them. While it was restored, it became clear that it is a replica, made out of skin parts, wings and legs from different bird species. The Great Auk egg turned out to be a replica, too. Both replicas were signed by Gustav Küsthardt, taxidermist at the Alte Akademie from 1900 to 1934. In January 2013, both original Great Auk specimens were rediscovered at the ZSM in a good condition.

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Introduction

The Great Auk, *Pinguinus impennis* (Linnaeus, 1758), the largest member of the Alcidae (standing up to 85 cm tall), was a flightless offshore bird of the northern hemisphere. The protonym *Alca impennis* gives a hint at its closest relatives, while in many languages a modified form of its valid genus name *Pinguinus* Bonnaterre, 1791 was given later to the flightless birds of the southern hemisphere. Therefore, the French name for the Great Auk “Grand Pingouin” still causes confusion now and then (Fuller 1999).

Great Auks were social birds which nested in colonies and were neither shy nor fast walking; thus it was easy for humans to kill large numbers of them in a short time when they were ashore. Not only their dunes, feathers, flesh and oil, but also the eggs were used. With each female laying only one single egg per year, it was just a question of time when this species, too, would be “as dead as a Dodo”.

Sailors even found ‘amusement’ in clubbing them to death, sometimes without using the dead bodies at all (Fuller 1999). While the populations

were in decline, many museums and individuals tried to get at least one Great Auk for their collections. In 1844 the last two birds were killed on the rocky isle of Eldey (SW Iceland). Thereafter some uncertain sightings are known. Today, 78 stuffed and conserved birds, 75 eggs (Fuller 1999), and some skeletons, skulls and bones are all that is left of the Great Auk.

In the monograph “Ausgestorbene Vögel der Welt” (Extinct birds of the world; Luther 1970), Diesselhorst (curator of the ornithological section at the Bavarian State Collection of Zoology (ZSM) from 1951 to 1973) mentioned two Great Auk specimens in our collection: a mounted male “Iceland, 1833” from the famous Leuchtenberg collection that had come to the ZSM in 1858 and according to Fuller (1999) was called the “Duke of Leuchtenberg’s Munich Auk”, and a formerly mounted female “Eismeer, 1836” (Iceland?), the “Munich Auk” (Fuller 1999). Since the 1990s, only one mounted specimen was known to still exist (Fuller 1999).

In 2010, two 9 × 12 cm glass photographs showing both mounted auks were found (Figs 1, 2), but

the specimen remaining in the collection (Fig. 4a) was not one of those in the photos. So, was there an unknown Great Auk? And what had happened to the other two?

Evidence

For the exhibition “Einblicke – Ausblicke. 200 Jahre ZSM”, shown in 2011 at the “Museum Mensch und Natur” (Museum of Man and Nature, MusMN), one of our partners among the Bavarian Natural History Collections (SNSB), it was planned to present some rarities from the ZSM’s holdings. The mounted Great Auk in the ornithological collection seemed appropriate, except that its label held no information other than the name “Küsthardt”. Gustav Küsthardt worked as a taxidermist at the ZSM between 1900 and 1934. He is well known for having prepared the ZSM’s mount of an extinct form of zebra, the Quagga, *Equus quagga quagga* (see Huber 1992).

Moreover, the mounted Auk’s condition had deteriorated over the years; the plumage had become dirty and dusty, some feathers loose, the neck was broken, and the head was close to falling off. To stop this decomposition Dieter Schön, taxidermist at MusMN, began to restore this Great Auk, and in the process he found out what it was all about.

Overall, Schön described the specimen as good work. The body mount is carved out of a peat board. However, the first sign that something might be wrong was the rather sloppy fixation of the artificial (!) bill (Fig. 4c). The same applied to the glass eyes, as eyelids were totally absent. These findings do not fit with the professional preparation style of Gustav Küsthardt, which raised the possibility that another person had altered those parts later – or that Küsthardt had had to work very fast. But the biggest surprise was yet to come.

Due to the specimen’s presumed high zoological as well as historical value, its restoration was initially planned without any exchanges or additions of parts, i. e. was limited to repairing the bill, head and neck, and cleaning the plumage. However, findings during the early restoration steps made it necessary to modify that plan.

First the bird was detached from its base. Then the broken neck and head were separated from the body. During subsequent cleaning with detergent solution, it became clear that the head contained numerous parts of skin fixed together with needles and/or gluten. This made it necessary to disassemble the entire head. When the body was soaked, it also proved to be composed of separate parts. From each part, small skin or feather samples were taken to attempt DNA barcoding. Most likely, parts of

different individuals and even different species had been used to ‘recreate’ a Great Auk.

For remounting the skin without using too much skin from other species, it was necessary to make the peat model slimmer. Also the connection from bill to forehead was adapted. New glass eyes and eyelids (the latter previously missing) were attached. After fixing head and neck together, the skin parts were stuck on the peat model with dextrin gluten. Some parts of foreign material (from *Phalacrocorax* spec., *Alca torda*) had to be added.

The base was also restored, and after a gentle drying procedure using soft tissue bandages, the bird was reinstalled on it. The colouring of some bare skin parts was the last step before the Great Auk finally found its place in the exhibition (Fig. 4b).

The whole restoration process has been documented in detail (Fig. 4d).

Several aspects indicate that this mounted specimen does not constitute a true Great Auk, but is a conglomerate replica instead.

1. It is a composite of many skin parts (Table 1).
2. Skin parts evidently are from different individuals and species, recognizable in
 - a. diverse feather structures
 - b. diverse leather structures
 - c. diverse gloss of plumage
 - d. skin parts which do not fit
3. Comparison with pictures of other specimens shows some differences; for example, position and shape of the white patch over the eye, missing commissure at the root of the bill, extension of the white feathers to the throat, asymmetric plumage patterns, primaries and secondaries, tail feathers, length of the tarsi and size of the feet.
4. Lack of information (e.g. on date, locality and collector).
5. Time of production (the last Great Auk was killed in 1844; Küsthardt worked in 1900–1934).

To determine which bird species were used, genomic DNA was extracted and purified from feather tissue using the Qiagen DNeasy® tissue kits (Qiagen, Hilden, Germany). DNA samples were then used to conduct amplifications by PCR of COI (Cytochrome oxidase 1) with bird specific primers (BirdF1_t1-COI/birdR2_t1 – used as in Guelph, Canada).

The following PCR program was used for amplification: Initial denaturation at 94 °C for 2 min, 5 cycles of 94 °C for 30 s, annealing at 50 °C for 40 s, and extension at 72 °C for 1 min, 35 cycles of 94 °C for 30 s, annealing at 55 °C for 40 s, and extension at 72 °C for 1 min, final extension at 72 °C for 10 min. Hold at 4 °C (or 10 °C).

After PCR of the subsamples of replica material, no positive amplification could be detected using

gel-electrophoresis. Likely due to the specimen's age and to chemical processes during its tanning, it proved impossible to extract any useful DNA from the samples taken during restoration. However, comparing the different plumage parts with study skins in our ornithological collection allowed reasonable conclusions on the various taxa Küsthardt used to create his replica (Table 1).

Another piece in our 'Great Auk puzzle' is an egg with the label "Ei des Riesenalk" (Great Auk egg, Fig. 3a) but without any other details. This egg has distinctly visible tool marks; especially its narrower pole has been manipulated. At this position an inscription in green ink was found that was indecipherable at first. With an image editing application that enabled freshening the green pigments, the inscription could be read as: "G. Küsthardt fec. aus einem Schwanen Ei" (Fig. 3b). So, Küsthardt used the egg of a Mute Swan (*Cygnus olor*) for his Great Auk egg reconstruction. Blasius (1884) has pointed out that this was a common way to make such replicas.

After the recognitions discussed above, the only remaining Great Auk piece belonging to the ZSM was a skull (possibly the same that can be seen at the bottom of Fig. 1). Since the beginning of the 1980s the whole bird skeleton collection has been on loan to an institute of the Ludwig-Maximilians-University in Munich.

Discussion

How could it come to this?

Unfortunately, no one with direct knowledge of the ZSM's two original and complete Great Auks is still around to answer questions, and all possibly pertinent documents were destroyed in WW II. The following notes are an attempt to reconstruct the history of these two specimens.

Around 1833, both Great Auk specimens were bought in Iceland by Karl Michahelles (born in 1807, died in 1834); one of them entered the famous natural-history collection of Eugène de Beauharnais, the Duke of Leuchtenberg in Eichstätt, the other one came in 1836 (that is why the label is dated 1836) to the "Zootomisch-zoologische Sammlung" at the "Alte Akademie", the old museum of natural history in Munich (Blasius 1884).

In 1858, the Leuchtenberg collection was moved from Eichstätt to the Alte Akademie. Preyer (1862) mentioned both specimens in his list "Der Brillenalk (*Plautus impennis*) in Europäischen Sammlungen", as follows:

"4) in München in der Akademie (zootomisch-zoologische Sammlung), ein sehr schönes Exemplar mit der Etiquette: *Alca impennis* Linn. Mare glacial. 1836;

5) ebenda, aus der Leuchtenbergischen Sammlung stammend, ein Exemplar mit den Namen: *Alca impennis* Lin. Grand Pingouin. Grosser Alk. Grönland."

18 years later Blasius (1884) gave a detailed description of both specimens. Somewhere between the first and third decade of the 20th century, both specimens were photographed (Figs 1, 2). In 1928, five new exhibition rooms were opened at the Alte Akademie, one of them for "extinct and endangered species", with only one Great Auk (Kraft & Huber 1992). Most likely, Küsthardt made the replica to have a less valuable Great Auk specimen for this permanent exhibition. His signature on the label is a hint in that direction, because it was made at least 56 years after the extermination of the last known living members of the species. The date of origin and if it was used in the exhibition is not fully clear, but the replica is at least 80 years old.

In the night from April 24 to 25 in 1944, the Alte Akademie was hit by bombs, and most of the exhibition was destroyed. However, other irreplaceable

Table 1. The Great Auk replica contains at least 26 parts, which are listed here.

Parts of the mounted auk	Used parts	Used species
head + neck	1 bill	artificial
	12 skin parts	<i>Phalacrocorax</i> spec.
	2 skin wedges in the head/neck region	<i>Gavia</i> spec.
breast + belly	1 ventral skin part with tail	<i>Gavia</i> spec.
	2 lateral skin parts	
back	1 upper skin part with scapular feathers	<i>Anas</i> spec.
	1 lower skin part	<i>Gavia</i> spec.
	2 additional skin parts with scapular feathers	<i>Anas</i> spec.
extremities	2 wings	<i>Alca torda</i>
	2 legs	<i>Gavia</i> spec.

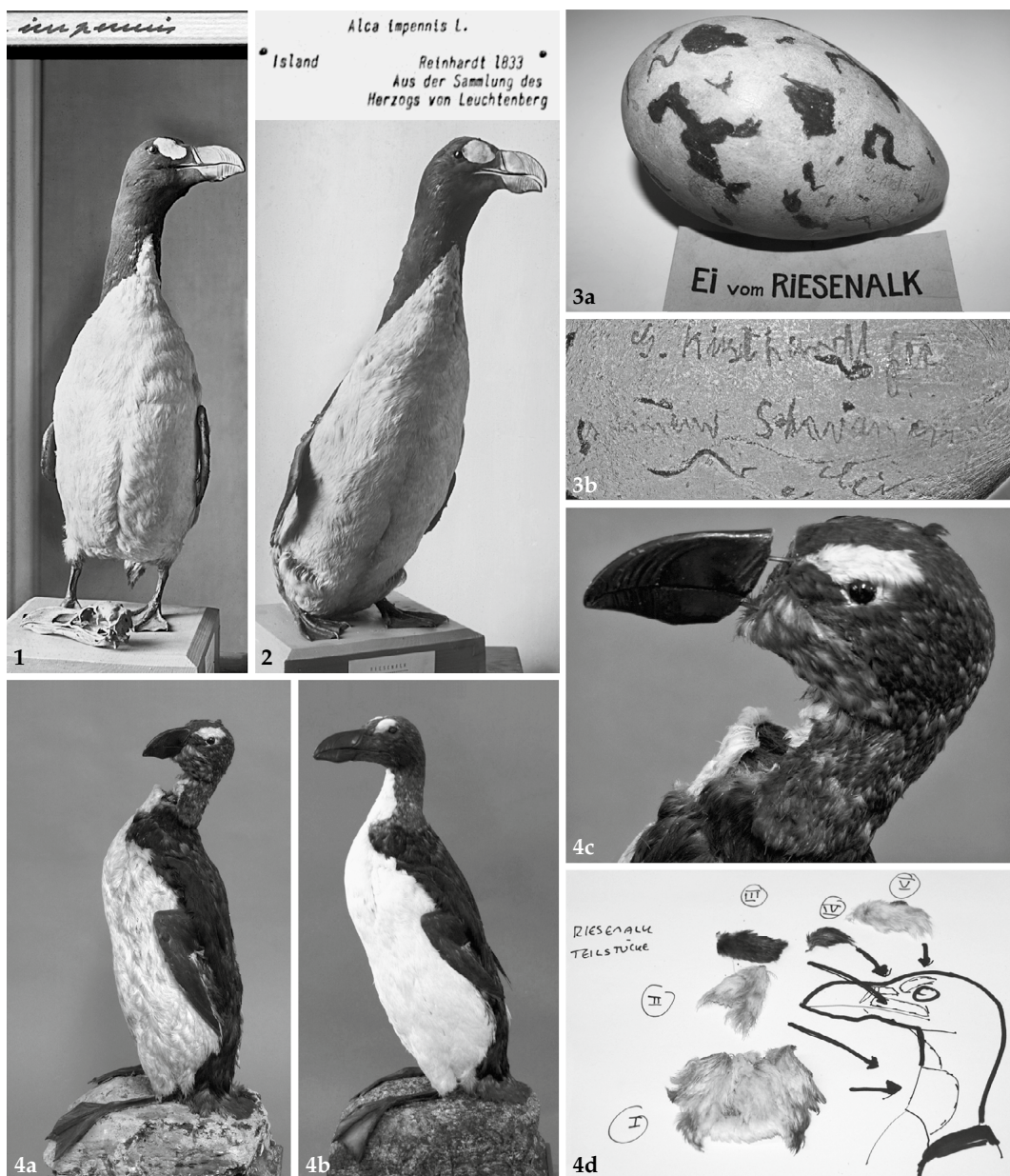


Fig. 1. Early 20th century photograph of the “Munich Auk”, the “Eismeer” specimen; note the Great Auk skull at the bottom (photo reproduction by M. Müller).

Fig. 2. Early 20th century photograph of the “Duke of Leuchtenberg’s Munich Auk” and of the inscription on the base (photo reproduction by M. Müller).

Fig. 3. a. Replica of a Great Auk egg made from a modified Mute Swan’s egg (*Cygnus olor*). b. Inscription on the egg replica: “Küsthardt fec. aus einem Schwanen Ei”.

Fig. 4. Great Auk replica at ZSM (all photos by D. Schön). a, b. Before and after restoration. c. Head and neck; note the fixation of the false bill. d. Parts of the plumage and sketch of their respective positions.

specimens – like the Quagga, a Thylacine (*Thylacinus cynocephalus*) and an egg of the Madagascan Elephant Bird (*Aepyornis maximus*) – had been taken to safe storage in 1943 (Kraft & Huber 1992). It seems questionable that one of the Great Auks would have been destroyed along with the exhibition, while the replica was saved.

It is very likely that Küsthardt produced both, the dermoplastic and the egg, for the standing exhibition at the Alte Akademie, so that the original Great Auks could be protected (e. g. from bleaching). That Küsthardt's motives were not questionable ones seems to be indicated by his inscriptions on both replicas. May be, he even wanted to demonstrate this by making the dermoplastic realistic enough, to show what these impressive birds looked like, but not too perfect, like other taxidermists did. Herbert George Wells, for example, wrote in his novel "The Stolen Bacillus and Other Incidents: The Triumph of a Taxidermist" (1895): "Of course, what I tell you now will go no further. You know I have made some dodos and a great auk? No! Evidently you are an amateur at taxidermy. My dear fellow, half the great auks in the world are about as genuine as the handkerchief of Saint Veronica, as the Holy Coat of Treves. We make 'em of grebes' feathers and the like. And the great auk's eggs too!" It might be advisable to take a closer look at other extant Great Auk specimens (and skins of other rare species in general); may be, there are more – and better – as yet unrecognised replicas or fakes in other collections.

All's well that ends well

On 23 January 2013, the long mysterious story of the ZSM's Great Auks came to a surprising but happy ending. In a storage box labelled as containing "owls" but kept in another, non-ornithological part of the ZSM, the author found two Great Auks, both shrink-wrapped and unmounted, but in very good condition. The characteristics of both original specimens are listed in Table 2.

All larger bird specimens were treated with poison and then shrink-wrapped before the collections were moved from the ZSM's old site (Nymphenburg Castle) to its current facilities in 1985 (pers. comm. Prof. E.-G. Burmeister). During this voluminous and complex operation, the two auks must have been misplaced in the "owls" box – in which they then ended up out of sight for unsuspecting searchers and, thus, were considered as lost.

According to the labels, the smaller specimen in a standing position is the one from the Leuchtenberg collection. Following Blasius (1884), however, it should be the other one. The two old photographs (Figs 1, 2) do not show labels on the legs of the birds, but a sign with information on each base. There, the larger bird in a sitting position is labelled as the Leuchtenberg specimen. This specimen was still mounted when Diesselhorst gave the information to Luther (published in 1970). It is unknown when and why it was demounted and who reattached the labels wrongly. The original label of the Leuchtenberg specimen was covered with another label (very likely after the specimen had been moved to the Alte Akademie). The original label text is cited in Preyer (1862, see above).

This shows that Diesselhorst had both original Great Auks and recognized that the third one was a replica, when he gave the information to Luther (1970). After Diesselhorst's retirement, the ZSM's move to the new building and the disappearance of two specimens, only the replica was left and was thought to be one of the two original auks. Fuller (1999) was told in 1995 that only one of the two specimens was in the collection, thus he was partly right when he called it an unsolved mystery "whether one of the Auks has vanished in dubious circumstances or whether it is lying overlooked in the museum's store".

Table 2. Condition and characteristics of the original Great Auks of the ZSM.

	"Munich Auk"	"Duke of Leuchtenberg's Munich Auk"
original label of the Alte Akademie	<i>Alca impennis</i> L. Eismeer 1836	<i>Alca impennis</i> L. Island H. v. L.
size and position	smaller specimen, standing	larger specimen, sitting on its tarsi
eyes	glass eyes with brown iris	right eye black, left eye missing
bill	closed	slightly opened
plumage	in good condition	acid burn on both sides of the underbelly (see Fig. 2)

Outlook

Both original specimens are scheduled to be restored by Dieter Schön, and then to be shown in an exhibition along with the Great Auk replica and specimens of other extinct species such as the Passenger Pigeon, *Ectopistes migratorius*, the Huia, *Heteralocha acutirostris*, the Thylacine and the Quagga. This exhibition is envisioned for the new Bavarian Museum of Natural History (NaMu) that is being planned to succeed the MusMN in a few years' time.

Acknowledgements

Dieter Schön has restored the auk replica of the ZSM with great expertise, took pictures during its restoration and lifted some of its mysteries. Jérôme Morinière tried to extract DNA out of the sample pieces. Marianne Müller took pictures of the old slides. Martin Spies made many helpful suggestions on a manuscript draft.

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