

THE GREAT AUK, *PINGUINUS IMPENNIS* (L.) IN GREENLAND

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This paper presents all available archaeozoological, ethnohistorical, and historical evidence on the Great Auk, *Pinguinus impennis* (L.), in Greenland. Substantial new contributions are: (1) the presentation of 132 Auk bones from seven archaeological sites, and (2) a translation of Otto Fabricius's original handwritten notes on the Great Auk in Greenland.

A description of the Greenlandic Great Auk's zoogeography and biology is given as well as a description of the Inuit's Great Auk hunting methods and of their use of Great Auk products.

Main conclusions are: (1) *P. impennis* probably occurred further north in Greenland c. 2000 BC than in historical times; (2) c. 1500 BC *P. impennis* possibly nested in West Greenland; (3) Between 1350 and 1800 AD Great Auks originating from breeding colonies near Newfoundland or Iceland wintered on the banks off West Greenland from Cape Farewell in the south to Maniitsoq in the north; (4) Great Auks were breeding in Southwest Greenland in small numbers in the 1760's and 1770's; (5) The Great Auk was hunted by the Inuit through 4500 years. The first Inuit immigrants to West Greenland may initially have overexploited and depleted accessible breeding colonies, but the Inuit were not instrumental in the final extirpation of *P. impennis*; and (6) the last Great Auk recorded in Greenland was seen and killed in 1815.

KEYWORDS: Great Auk, *Pinguinus impennis*, Greenland, zoogeography, archaeozoology.

INTRODUCTION

One winter day in 1815 an Inuit kayak hunter returned to the West Greenland settlement of Qeqertarsuatsiaat with a precious hunting bag – a specimen of the Great Auk. This was probably the last Great Auk ever to be seen in Greenland. The incident took place only twenty-nine years before the final documented observation of Great Auks, when two individuals were killed in 1844 by three Icelandic hunters on the island of Eldey southwest of Iceland.

Among the Inuit of West Greenland the memory of *isarukitsoq*, “the stump-winged”, still lives, and it appears in their traditions as a welcome prey of the open sea. Only few Danish ministers and colonial administrators of the 18th century saw and commented on the Great Auk. One of them was the minister Otto Fabricius who, based primarily on his own observations, gave one of the most detailed descriptions of the Auk's biology known today. Many authors of the 19th and early 20th century discussed the occurrence and disappearance of the Greenlandic Great Auk, but nothing substantial was added until 1930 when twelve Auk bones were excavated in a 500 years old Inuit kitchen midden near Maniitsoq (Sukkertoppen) (Fig. 1). Since 1930 one archaeological excavation campaign that produced four Great Auk bones has

been published; however, 132 Auk bones from seven or eight other archaeological sites have remained unpublished. Most of the latter material has been excavated, identified, and curated by Jeppe Møhl of the Zoological Museum, Copenhagen, who generously placed it at my disposal for publication.

This paper is a presentation and a discussion of all available archaeological, ethnohistorical, and historical information that can throw light on the biology and zoogeography of the Greenlandic Great Auk and on the relations between the Auk and the Inuit in Greenland.

Table 1 Archaeological localities in Greenland with bones of *Pinguinus impennis* (L.)¹

Number	Name	Position	Dating	Number of bones	References
1	Unartoq	45°20'W 60°31'N	1700–1800 AD ²	1	Mathiassen and Holtved, 1936; ZMK ⁴
2	Gammel Frederikshåb	49°45'W 62°01'N	1400–1800 AD	1	Grønnow and Meldgaard, 1982; ZMK 72/1983
3	Kangeq	52°03'W 64°06'N	1600–> 1800 AD ³	10	Gulløv, 1983; Møhl, unpubl.; ZMK
4	Itivsalik	52°06'W 64°07'N	1700–1800 AD	20	Gulløv, 1983; Møhl, unpubl.; ZMK
5	Igdlorpait, house 3	52°06'W 64°07'N	1600–> 1780 AD ³	7	Gulløv, 1983; Møhl, unpubl.; ZMK
	house 9		1700–1720 AD	5	
	house 13		1740–1780 AD	7	
	midden		1500–> 1800 AD	71	
6	Håbets Koloni	52°05'W 64°08'N	1721–1728 AD	4	Møhl, 1979; ZMK 130/1970
7	Itivnera	50°24'W 64°23'N	c. 1500 BC	6	Meldgaard, 1961; Møhl, 1972; ZMK 114/1966
8	Umanát	53°23'W 65°52'N	1700–1750 AD ²	3	Mathiassen, 1931; Degerbøl <i>et al.</i> , 1931; ZMK 15/1930
9	Igdlutalik	53°22'W 65°52'N	1500–1650 AD	3	Mathiassen, 1931; Degerbøl <i>et al.</i> , 1931; ZMK 14/1930
10	Utorqait	53°14'W 65°52'N	1350–1500 AD	6	Mathiassen, 1931; Degerbøl <i>et al.</i> , 1931; ZMK 13/1930
11	Qeqertasussuk	51°05'W 68°36'N	2400–1600 BC	3	Meldgaard and Grønnow, 1986; ZMK
12	No locality		No dating	1	ZMK

¹ All the bones are listed in Appendix 1.

² Datings shown with a hyphen (e.g., 1700–1800) indicate that the bones date somewhere within the time interval.

³ Datings shown with an arrow (e.g., 1700–> 1800) indicate that the bones occur throughout the time interval.

⁴ ZMK refers to collections at the Zoological Museum, Copenhagen.



Figure 1 Map of archaeological localities where bones of the Great Auk *Pinguinus impennis* have been recovered. Numbers refer to Table 1.

THE ARCHAEOZOOLOGICAL MATERIAL

Since the 1860s, archaeological excavations have been carried out in all parts of Greenland by the Danish National Museum, Copenhagen, the Greenland Landsmuseum, Nuuk (from 1981), and the Zoological Museum, Copenhagen. Kitchen middens preserved in permanently frozen ground have yielded great quantities of

faunal material, especially bone. Most samples date from the Thule Culture and later periods (c. 900 AD and later), but in recent years large samples have been excavated from sites that date from the Saqqaq or Predorset Culture (2400–900 BC).

All relevant sites, with their geographical position, datings, number of Great Auk bones, and references are listed in Table 1. Appendix 1 gives a detailed list of the bones, in which they are also individually numbered. These numbers are referred to in the text and in the figures.

Datings are based on archaeological material or on ^{14}C -analysis. ZMUC: the Zoological Museum of the University of Copenhagen.

Previously Published Material

In 1930, Therkel Mathiassen excavated a number of prehistoric Inuit sites in the Maniitsoq district (Fig. 1; Mathiassen, 1931). Among the faunal material from three of the sites, Umanát, Igdlutalik, and Utorqait (1350–1750 AD), 12 Great Auk bones were identified (Degerbøl *et al.*, 1931). This was the first acknowledged proof that the Great Auk occurred in Greenland in prehistoric times.

In the 1970s, archaeological excavations were carried out at Håbets Koloni (1721–1728 AD) near Nuuk (Godthåb) (Gulløv and Kapel, 1979). Four Great Auk bones were identified from this site (Møhl, 1979).



Figure 2 The midden area of the archaeological site Igdlorpait, west of Nuuk (Godthåb). Fifty percent of all Great Auk bones found in Greenland come from the excavated trench shown. View to the west. (Photo H.C. Gulløv).

Previously Unpublished Material

The Thule Culture site Igdlorpait near Nuuk was excavated in 1968, 1972, and 1975 (Gulløv, 1983) (Fig. 2). Igdlorpait, situated on an island not far from Håbets Koloni, produced the hitherto largest sample of Great Auk bones in Greenland. Three excavated house ruins provided stratigraphically well defined faunal samples with in all 19 Great Auk bones, dated from the 17th and 18th centuries, and a midden gave 71 Great Auk bones, from the time period c. 1500 through to c. 1800 AD.

The Kangeq and Itivsalik sites are situated on two islands very close to Igdlorpait. The Kangeq midden produced 10 Auk bones dated from 1600 to 1800 AD, while 20 bones dating from the 18th century were excavated at Itivsalik.

Itivnera is situated in the inner parts of the Nuup kangerlua (Godthåbsfjord). The site, dating from c. 1500 BC was a Saqqaq (Predorset) caribou hunting camp. It was excavated in 1958 and 1960 (Meldgaard, 1961), and the faunal material from the 1958 excavation was subsequently identified by Møhl (1972). Six Great Auk bone fragments were recently recognized in the 1960 sample.

Between 1984 and 1987, excavations at the Saqqaq Culture site of Qeqertasussuk (2400–1600 BC) in Disko Bay have produced three wing bones of the Great Auk (Meldgaard and Grønnow, 1986; Meldgaard, 1986b, 1987) (Figs. 3 and 4). This find extended the known prehistoric range of the Great Auk c. 400 kilometres to the north.

Unartoq (1700–1800 AD) is the southernmost Greenland archaeological locality from which the Great Auk has been identified. The site, situated on an island at the mouth of the Unartoq Fjord, was excavated in 1934 (Mathiassen and Holtved, 1936) and has yielded a single Auk bone.

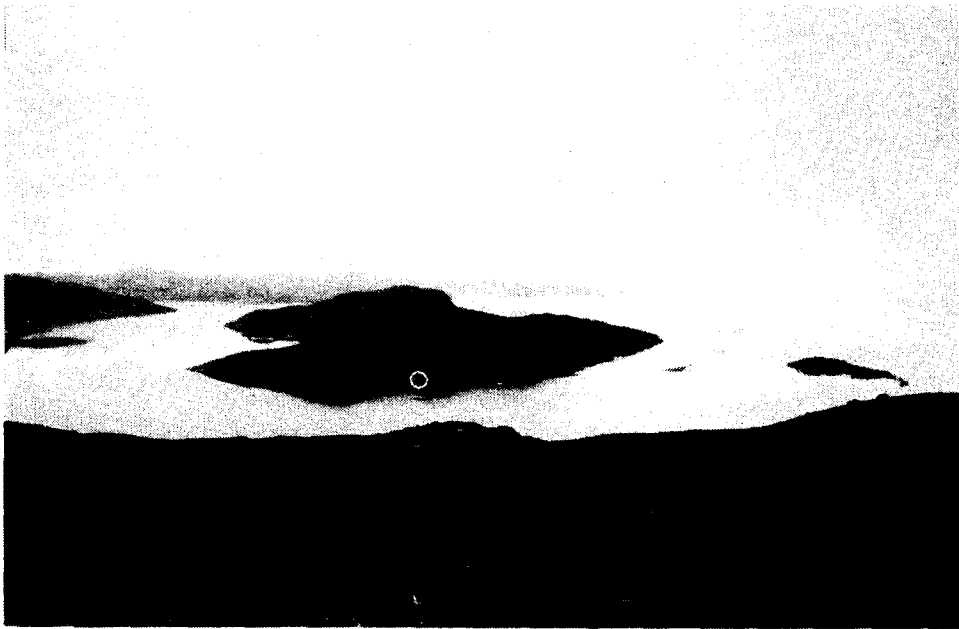


Figure 3 Qeqertasussuk Island situated in the southeastern corner of the Disko Bay, view to the west. The circle shows the position of the Qeqertasussuk site where three Great Auk bones were excavated in 1986. (Photo by the author).

A Great Auk humerus was found in 1982 in the eroding midden deposits of the Gammel Frederikshåb settlement (1400–1800 AD) close to Paamiut (Frederikshåb) (Grønnow and Meldgaard, 1982).

Finally, a remark should be made regarding a Great Auk tibiotarsus that was recently identified among the faunal remains procured from West Greenland by Japetus Steenstrup in the 1860s and 70s. There is no site indication attached to the bone, but reports in the files of the Zoological Museum, Copenhagen, suggest that it originated from a midden either in the Disko Bay or in the Nuuk area.



Figure 4 Three wing bones of *Pinguinus impennis*. From left to right: right radius, right ulna, left humerus. Found in 1986 at the Qeqertasussuk site, Disko Bay. They represent the hitherto oldest and northernmost find of Great Auk in Greenland. (Photo Geert Brovad).

Juvenile Great Auk Bones

Degerbøl *et al.* (1931: 138) stated that some of the Great Auk bones identified from the sites near Maniitsoq were from juvenile birds. They did not conclude, however, that the species bred in Greenland but implied that the young birds came to West Greenland from breeding grounds elsewhere. The two juvenile bones in question – part of a beak and a fragment of a sternal bone – are from Umanát (App. 1, 8: (1) and (2); Fig. 5, 3b).

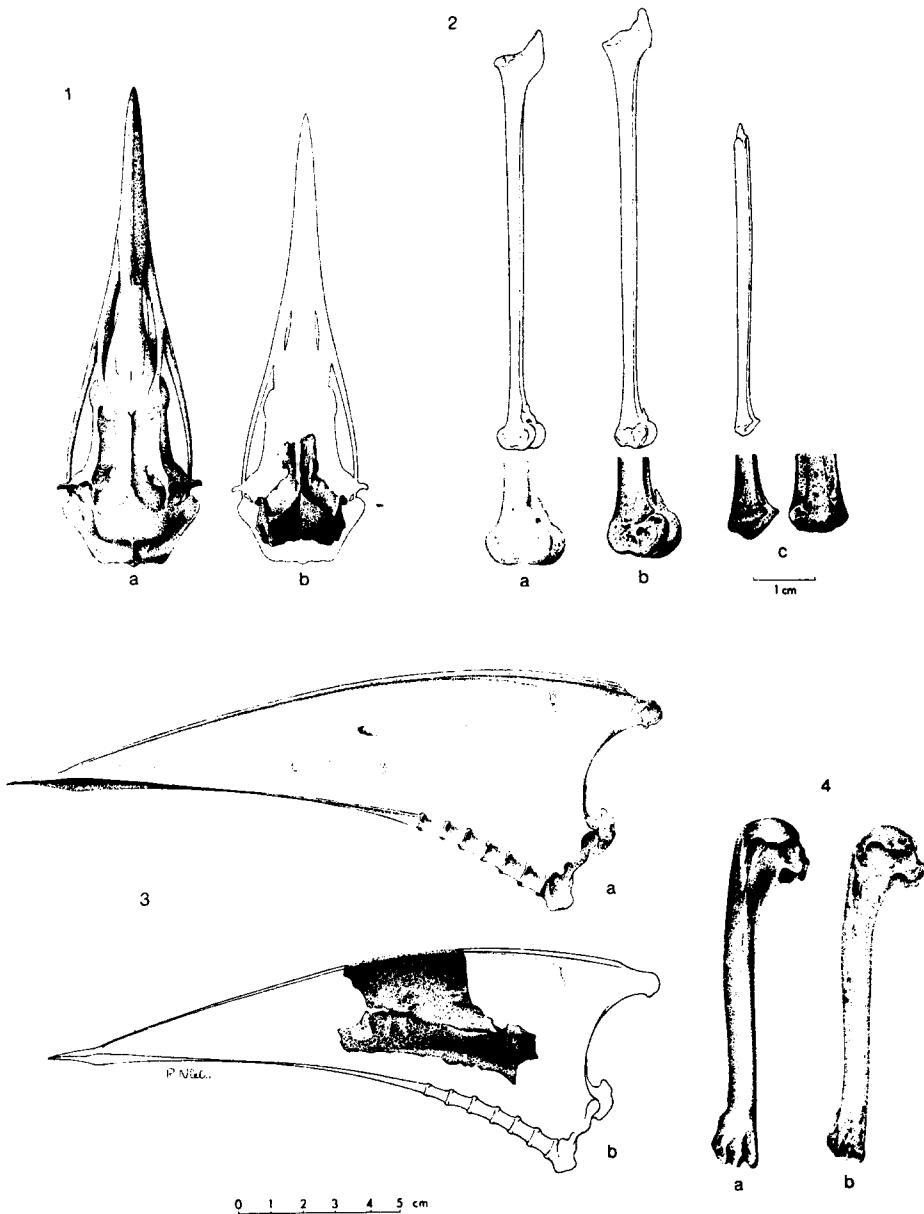


Figure 5 Bones of juvenile *Pinguinus impennis* from Greenland compared with bones of adult *P. impennis* from Greenland and Funk Island, Newfoundland. Note that the juvenile bones, with the exception of 2b, are smaller than their adult counterparts. 1) ^a Adult cranium from Funk Island, ^b juvenile cranial fragment from Igdlorpait; 2) ^a adult left tibiotarsus from Funk Island, ^b juvenile left tibiotarsus from Unartoq, ^c incomplete juvenile left tibiotarsus from Igdlorpait; 3) ^a adult sternum from Funk Island, ^b juvenile sternal fragment from Umanát; 4) ^a adult left humerus from Igdlorpait, ^b juvenile left humerus from Håbets Koloni. (Drawn by Robert Nielsen).

Unartoq, Igdlorpait, Håbets Koloni, and Itivsalik produced juvenile Great Auk bones. From Unartoq there is a tibiotarsus with the tarsal part incompletely fused to the shaft (App. 1, 1; Fig. 5, 2b); from Igdlorpait the bones in question are a cranial fragment with partly unfused sutures (App. 1, 5: midden (1); Fig. 5, 1b), a humerus (App. 1, 5: midden (29)), and a tibiotarsus lacking the proximal end and the tarsal part (App. 1, 5: midden (60); Fig. 5, 2c); from Håbets Koloni there is a humerus (App. 1, 6: (2); Fig. 5, 4b); and from Itivsalik a humerus (App. 1, 4: (13)).

The juvenile Auk bones are characterized by a number of features. The bone surface is generally porous and rough to the touch, especially at the ends of the long bones, while the porosity of the cranial and sternal elements is more widespread; the bones are mostly smaller than corresponding adult bones; the cranial sutures are incompletely fused, and the tarsal parts unfused or partly fused with the tibial parts of the tibiotarsi.

Since no Great Auk skeletal material of known ontogenetic age is available for comparison, an age estimate is undertaken on the basis of well-known related species. *Cephus grylle* (ZMUC A 563, 571, 583), *Alca torda* (ZMUC A 445), and *Uria lomvia* (ZMUC A 575, 992) are fully developed at an age of approximately 2 1/2 months. The marked size difference between *Pinguinus impennis* (c. 5 kg, Bengtson, 1984) and the largest among the extant North Atlantic Alcidae, *Alca torda* (max. 1 kg) suggests that the Great Auk took longer to complete skeletal development.

Among the Anatidae, the swan *Cygnus olor* is fully developed at approximately 6 months, having a weight of c. 10 kg, whereas the goose *Anser anser* is fully developed at approximately 2 months, weighing c. 3 kg. From this, simple arithmetics would allot about one year for the Great Auk to reach skeletal maturity, which may be correct for this large flightless bird. A minimum of 5 months, twice that of Razorbill developmental time, cannot be an over-estimate.

Juvenile Great Auk bones of apparently similar ontogenetic age have been recovered at Port au Choix on Newfoundland (c. 2000 BC) (Tuck, 1976).

In Denmark, from a kitchen midden at Klintesø in North Zealand (3700–3200 BC), three Great Auk bones were described as juvenile on the basis of their porosity and the missing tarsal parts (Winge, 1900; Hufthammer, 1982). From Havelse, a Great Auk bone with possible juvenile characteristics is recorded (Steenstrup, 1855b).

THE ETHNOHISTORICAL AND THE HISTORICAL SOURCES

The Legends

Among the recorded Greenlandic legends there are two in which the Great Auk plays a part. Both were collected by Dr. Heinrich Rink in the late 19th century.

"The legend of the hunters of Qilangait" was collected by Rink (1871) from Qeqertarsuaatsiaat (Fiskenæsset). A group of kayak hunters from Kilangait was caught in a storm far out at sea. Many drowned. One of the survivors saw a Great Auk when he was just about to reach shore. Hitting the bird with his bird dart he lost his paddle, but instantly he took hold of the Auk and used it to keep his balance. "It was following the drowning of the many kayak hunters that the inhabitants of the Kilangait islands moved away and dispersed" (Rink, 1871: 121).

"The legend of the hunters from Qilangait" was illustrated with a series of three water colours by the Inuit artist Aron of Kangeq (1822–1864) (Knuth, 1960; Meldgaard, 1982). Number two shows the incident with the Great Auk (Fig. 6). The

settlement. Kangeq is one of the sites which has produced Great Auk bones. Aron presumably knew about the Auk from older people and thus acquired a good idea of its size and general appearance.



Figure 6 Watercolour by Aron of Kangeq illustrating "The legend of the hunters from Qilangait". Painted in 1868. Original at the Greenland Landsmuseum, Nuuk.

In "The land of the Great Auks" three kayak hunters had gone hunting for Hooded Seals. They paddled for a long time, and on the third morning they encountered a steep cliff on which Great Auks were nesting. Before the hunters headed home they collected some Great Auks to eat on their journey back. "It is said that, earlier on, when the land of the Great Auks had not yet sunk, there were many Great Auks even as far north as the Nuuk region" (Rink, 1871: 39).

As is the case among other peoples, many Inuit legends are based on historical facts. The narrators of the two Great Auk legends refer to specific human population movements and to the former extent of the range of the Great Auk. The historical facts are decorated with invented details, and the imaginative mind was inspired from many different sources. In "The Land of the Great Auks" the narrator may have heard about the "Gejrfugleskær" (the Great Auk Skerries) south of Iceland which disappeared into the sea in 1830 or 1831 following an earthquake (Salomonsen, 1945). The legends also reflect traditional everyday life, and the Great Auk appears in situations in which the Greenlanders usually encountered it, such as during kayak hunting at sea.

Egede, Crantz, and Glahn

Inuit kayak hunters, always skilled observers of nature, contributed most of the information on the Greenlandic Great Auk written down by colonial administrators, ministers, and naturalists. The primary literary sources on the Great Auk in Greenland are Hans Egede (1741, 1925), David Crantz (1770), Heinrich C. Glahn (1771, 1921), and Otto Fabricius (1780, 1929). Of these, the works by Otto Fabricius are by far the most comprehensive.

Giving the earliest known reference to the Greenlandic Great Auk, the missionary and minister Hans Egede stated in 1741 that he had seen it, and that it was a very large bird with wings so small that it had lost its ability to fly (1925: 353). Egede also presented an etching by the Norwegian artist Johanne Fosie (Fig. 7). It is a vivid depiction of daily life in a Greenlandic settlement of the time, and among many other activities a kayak hunter is shown with his bladder dart ready, aiming at a large bird with clearly indicated small wings and a characteristic high and curved beak – the Great Auk. If this interpretation is correct, the etching represents the older of the two known depictions of the Greenlandic Great Auk, Aron's being the younger.

David Crantz, in his "History of Greenland" (1770; in German) leaned heavily on Egede's work, but did add a new observation of the Great Auk by stating that the people at the colonies called the week before Christmas "Great Auk week" (ibid.: 111).

With the main purpose of correcting Crantz's "Historie von Grönland", Heinrich Glahn in 1771 published his "Remarks to David Crantz's History of Greenland" (in Danish) including new information on the breeding biology of the Auk. Glahn stated that the Auk nested on very remote skerries and therefore was only rarely found at its nest. Glahn had not seen the Auk eggs himself, but they were said (probably by the Greenlanders) to be very large and spotted. Japetus Steenstrup (1855c), a Danish zoologist, doubted that Glahn had personally collected the information on the Great Auk and thought that his descriptions were based on notes by a minister in Sisimiut (Holsteinsborg). However, Steenstrup did not at the time know of Glahn's journals kept while in Sisimiut and Amerdlok near Sisimiut from 1763 to 1768 (Glahn, 1921). Only one of six original journals remains, two are known in transcription, and three are lost (Ostermann, 1921). The one of interest with regard to Great Auks was written between 1 July, 1766 and June, 1767, and copied by Thomas Steenholdt in Jakobshavn for the Reverend N.E. Balle. Unfortunately, large parts on natural history were left out, including a section on the Great Auk, referred to as: "On Iserokitsok (takes up 5 pages)". This shows that Glahn had indeed studied the Great Auk and that his information on breeding Auks in West Greenland (possibly in the Sisimiut area) is probably sound.

Otto Fabricius

The most important source of information on the Great Auk in Greenland is Otto Fabricius's unpublished manuscript "Zoologiske Samlinger. . ." (finished in 1814). Following his stay in the Paamiut (Frederikshåb) district from 1768 to 1773, Fabricius (Fig. 8) collected all his zoological observations, originally contained in a number of notebooks, into eight large handwritten volumes entitled, in translation from the Danish original; "Zoological notes or descriptions of animals, from time to time written down according to personal observations from the year 1768 and here presented in collection from the year 1808" (Fabricius, 1808).

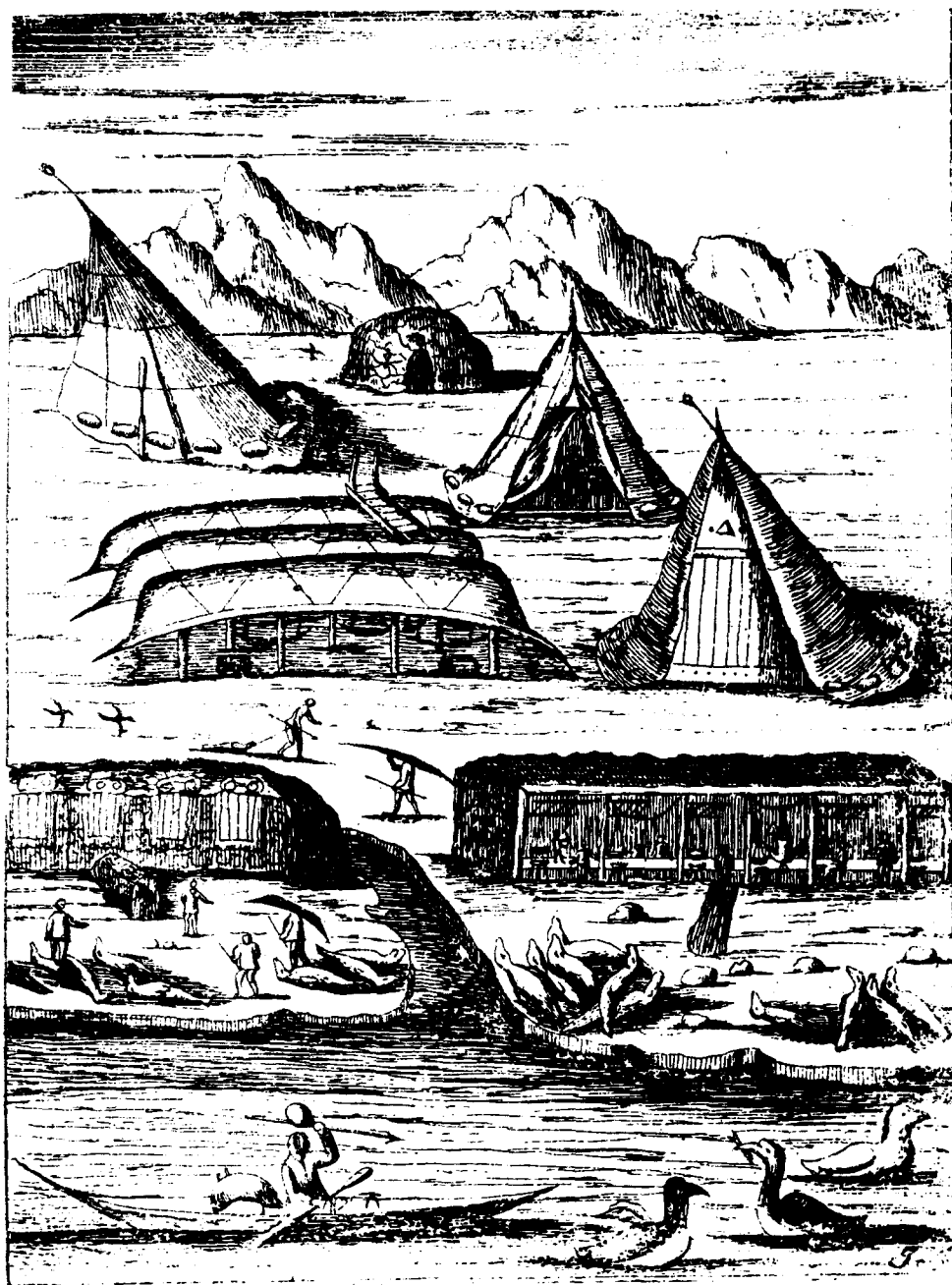


Figure 7 Everyday life in a West Greenlandic settlement in the mid-18th century. In the foreground is a large bird with small wings and a characteristic curved beak, probably a Great Auk. The etching was made by Johanne Fosie as an illustration to "The New Natural History of the Ancient Greenland" (in Danish) by Hans Egede (1741).



Figure 8 Otto Fabricius (1744–1822), clergyman, naturalist, ethnographer, and philologist, author of “*Fauna Groenlandica*” and the only scientist to make primary observations and perform dissections on the Great Auk. Around 1770 he worked as a minister in the Paamiut district, SW Greenland, and all his information on the biology of the Great Auk derives from this region (Fabricius, 1929: 27).

Much of the information compiled in the "Zoological Notes" had already been published by Fabricius. Among the unpublished sections, however, were valuable observations of the Great Auk. These have to some extent been cited by Steenstrup (1855c) and Winge (1898). Considering the importance of this primary source I have chosen to present a translated version of Fabricius's full account of the Great Auk in Greenland in Appendix 2.

Based on Fabricius's observations (1780, 1808, 1818, 1929), a fairly detailed description of Great Auk biology and zoogeography can be given.

In Southwest Greenland, Great Auks were seen early in the winter, from September to January. Usually they were quite rare, but in some winters they turned up in larger numbers. They were encountered only among the outer islands and skerries, never close to the mainland or on shore. Some Great Auks were "stupid and tame" and easy to catch, while others were difficult to approach. Fabricius suggested that the difference in behaviour was related to a difference in age, the tame ones being juveniles and the alert ones adults. In general he found that juvenile Great Auks were much more common than adult ones. His age estimate was based on the number of furrows on the beak, juveniles having few and poorly developed furrows while adults had several well defined furrows.

Fabricius claimed to have seen downy young in August. One such specimen "was grey and downy from which I deduct that it was only a few days old. Inside the bird I found rosewort (*Sedum rosea*) and other plant parts that usually grow on very steep coastal cliffs, but no fish. From this it can be deduced that it had recently left its nest and that it had not been far removed from it" (Fabricius, 1929: 124). In the Zoological notes . . . Fabricius took sporadic presence of downy young to indicate that the "breeding sites must not be so very far away" (Fabricius, 1808). Steenstrup (1855c) and Salomonsen (1950) rejected these observations of downy juvenile Great Auks. They both argued that the Greenlanders would have known if the bird bred on the Greenland coast. Steenstrup (1855c: 41-42) also believed that downy Great Auks could not be found as late as in August, and he therefore maintained that Fabricius had mistaken another species for a juvenile Great Auk.

It must, however, be remembered that not only was Otto Fabricius a gifted writer, he was also a very able observer who went hunting in kayak with the Greenlanders, and was familiar with their tools, their language, and their environment; he was quite familiar with the Great Auk, as well as with the Southwest Greenland fauna in general. From his description of the downy Great Auk and its stomach content it appears that he handled and carefully examined the specimen. So there is no reason why he should have misidentified the bird. In agreement with Winge (1898: 238) I find that Fabricius's observations of downy Great Auks should be accepted. Consequently, the Great Auk bred in the vicinity of Paamiut in the second half of the 18th century, probably on remote skerries and islands. The Great Auks on the nesting grounds near Iceland and Newfoundland seem to have been fully fledged by the middle of July (Bengtson, 1984). Considering the variation in the timing of egg laying both within and between populations of other alcids (Harrison, 1977; Bengtson, 1984), the observation of downy Great Auks in August seems plausible, as also maintained by Winge (1898: 238).

Other Historical and Ethnohistorical References

In 1867, the British zoologist Robert Brown visited Godhavn on Disko Island. Through the governor of Godhavn, Mr. Frederick Hansen, he was informed that two

Great Auks had been seen and one of them killed by a Greenlander in the winter of 1859 (Brown, 1868; Gurney, 1872; Hayes, 1872; Collin, 1875: 77). However, both Brown and Collin rejected the observation.

The story may have been instigated by a campaign from the Zoological Museum in Copenhagen in the first half of the 19th century. In letters to all governors in Greenland the museum offered rewards for the recovery of specimens of the Great Auk (Reinhardt, 1824; letters in the files of ZMUC). This incitement, combined with traditional knowledge of *isarukitsog*, may well have produced the story of the two Great Auks off Godhavn. Altogether the "record" should be disregarded.

During a visit in the Cape Farewell area in 1883, A.E. Nordenskiöld was told by a Greenlander acting as his pilot that old people remembered the Auk and that it used to occur in that area (Nordenskiöld, 1885: 411). But even though Nordenskiöld was particularly interested in the Great Auk in Greenland, he obtained only this one piece of information on the subject.

At the settlement of Itivdleq in the same geographical region, Oldendow (1935: 144–145) interviewed an old hunter who said that as a child he saw a Great Auk. On request, he was able to give a perfect description of the bird. Still, Oldendow felt that the old man's observations might be founded on the strong traditions of the area.

In the two latter instances the observations could very well have been made one or even several generations earlier than literally stated. The stories narrated by the pilot and the old man at Itivdleq are supported by the excavation of a Great Auk bone in the midden at Unartoq which is dated from 1700–1800 AD.

In 1972 Jeppe Møhl conducted an interview with Apollo Tobiassen (1907–1979) of Kangeq, Nuuk district (tape at ZMUC). Apollo Tobiassen knew the Great Auk from descriptions given by relatives and he recalled that it once occurred in the area, and that it was hunted from kayak.

In Ammassalik, East Greenland, in 1884, captain Gustav Holm met a Greenlander whose grandfather allegedly caught a Great Auk. The informant gave a precise description of the bird (Holm, 1887: 54, 1918: 297) which was probably a straggler from the Auk colonies off Iceland.

The Tale of Gunbjørnsøerne

According to accounts chronicled by Bjørn Johnsen in the first part of the 17th century, a man called Latra-Clemens visited Gunbjørnsøerne, "the Gunbjørn Islands", some time between 1580 and 1596. These islands have been identified as Leifs Ø and Erik den Rødes Ø which are situated close to Ammassalik (Anonymous, 1838: 124–125, 133; Holm, 1918). Bjørn Johnsen described how a boatload of Great Auks was taken on a skerry close to Gunbjørnsøerne.

This has been cited by many authors as evidence that at the time there existed a colony of Great Auks in the Ammassalik area (Preyer, 1862: 338, 340–341; Grieve, 1885: 4; Steenstrup in Grieve, 1885: 37; Winge, 1898: 4; Salomonsen, 1950: 359–60, 1967). Recently, however, the identity and geographical position of the said islands have been questioned (Nettleship and Evans, 1985: 62–63). It appears that the islands' number, nature and geographical position have been "... the subject of speculation rather than geographical knowledge" (Jones, 1986: 73). I agree with Nettleship and Evans that the historical event took place probably at one of the Great Auk colonies off South or Southwest Iceland and is no proof of Great Auk breeding along the east coast of Greenland.

THE LAST GREAT AUK FROM GREENLAND

The Zoological Museum, Copenhagen, possesses a mounted specimen of the Great Auk killed in 1815 near Qeqertarsuatsiaat (Fiskenæsset). It is the only known specimen of the Greenlandic Great Auk and it is one of two adult birds in winter plumage that exist today (Ree, 1984).

Much has been written on the origin and history of this particular specimen (Boie, 1822; Benicken, 1824; Holbøll, 1843: 457; Steenstrup, 1855a; 1855c: 42; Newton, 1861; Reinhardt, 1861: 15; Preyer, 1862: 339; Winge, 1898; Salomonsen, 1950; 1967). A review of the literature and of letters and receipts in the ZMUC files supports the following account.

In the winter of 1814/15 or 1815/16 a Great Auk was killed in the vicinity of Qeqertarsuatsiaat, probably by a Greenlandic kayak hunter. It was delivered to Mr. Heilmann, director of the Royal Greenlandic Trading Company in Qeqertarsuatsiaat. Five years later the skin turned up in Schleswig (then Slesvig, southern Denmark) in the possession of the ornithologist F. Benicken. He had probably received it through one of the trading company directors. Between 1830 and 1842 the ornithologist Emil Hage from Stege, Denmark, purchased the skin from Benicken, and 20 December, 1842, Hage sold it to the director of the Zoological Museum in Copenhagen, J. Reinhardt-sen. Before 1855 the skin was mounted and placed on a wooden tablet labelled: "Geirfugl, *Alca impennis* L., Sydgrønland, 1842, E. Hage" (Fig. 9).

The Great Auk killed near Qeqertarsuatsiaat in 1815 was the last live Great Auk documented from Greenland.

ZOOGEOGRAPHY

The Oldest Finds (2500–1500 BC)

The oldest recorded Great Auk find in Greenland is from Qeqertasussuk in the Disko Bay and it dates from the Saqqaq Culture period around 2000 BC (Table 1). This is also the northernmost known occurrence.

Around 1500 BC the Great Auk was also known to the Saqqaq people at Itivnera in Nuup kangerlua (Godthåbsfjord). Itivnera is situated almost 100 kilometres by boat from the sea (Fig. 1). Qeqertasussuk island in the extreme southeastern part of Disko Bay is somewhat tucked away from the open sea. Both sites seem to be located some distance from typical Great Auk habitats as we know them historically.

Were the Itivnera Great Auk bones carried from the coast to this interior site? We know that the Inuit in West Greenland, both in prehistoric and historic times, had an annual hunting cycle that included summer inland Caribou hunting and char fishing, and winter coastal sealing and fishing. Caribou bones and antlers that could be made into tools were brought to the coastal sites from the interior, and dried seal meat would be brought into the interior as temporary provisions until the first Caribou was shot (Grønnow *et al.*, 1983). However, unnecessary extra weight would not be transported. Ethnoarchaeological and archaeozoological studies show that bones in anatomical parts of low food value and bones of low tool value (such as avian wing bones) are not liable to be carried far (Binford, 1978; Meldgaard, 1986a). On the Caribou hunting site Aasivissuit 30 kilometres NW of Søndre Strømfjord Air Base not one seabird bone was found, while seal bones from imported provisions were quite common (Grønnow *et al.*,



Figure 9 Great Auk killed in the winter of 1815 off Qeqertarsuatsiaat (Fiskenæsset). It was the last Great Auk ever to be observed in Greenlandic waters. (Kept at the Zoological Museum, Copenhagen) (photo Geert Brovad).

1983). This suggests that the six fragments of Great Auk humeri excavated at the fjord site of Itivnera represent birds killed in the fjord rather than at sea more than 100 kilometres to the west, and it suggests that the Auk once occurred even in extensive branched fjords such as Nuup kangerlua.

The two earliest finds indicate that the Great Auk may have been more widely distributed in West Greenland prior to 4–3000 BC than in historical times. This may in part be attributed to warmer climatic conditions. The record coincides with the terminal part of the climatic optimum (c. 7000–3500 BC) during which the sea temperature off West Greenland was higher than today and during which a more boreal marine fauna flourished (Weidick, 1976; Funder, 1978; Kelly, 1980). This situation could have favoured the existence of the Great Auk, perhaps even in areas north of the Disko Bay.

The Itivnera site in Nuup kangerlua, judging from Caribou tooth eruption patterns, was a typical summer camp used during the months of July and August (Møhl, 1972), and the Auk remains found here were presumably taken during the summer. The Qeqertasussuk site in the Disko Bay was inhabited during summer and perhaps also during winter (Meldgaard and Grønnow, 1986), so the Auk remains from this site could also have been taken in the summer period. The occurrence of Great Auks in the summer could indicate a breeding population that may have nested on skerries in Nuup kangerlua and in the southeastern part of the Disko Bay. Or they could be non-breeding subadult birds that summered in the protected West Greenland fjords and bays.

Apparently the distributional range of the Great Auk shrank after c. 1500 BC. This could be due to climatically induced changes in abundance of the prey organisms (cf. Bengtson, 1984). It may also be significant that the first Inuit had only recently (c. 2400 BC) penetrated into West Greenland. The Auks would at this time have been unadjusted to human predation and it could be expected that especially the more accessible breeding colonies would have been depleted through overexploitation by the rapidly expanding Saqqaq people. The hunting activities of the Saqqaq people could thus have helped to reduce the range of the Great Auk.

Younger Finds and Historical Information (1350–1815 AD)

More than 90% of the excavated Great Auk bones date from c. 1350 to c. 1800 AD.

The sites occur within a north-south range of approximately 1000 kilometres, the majority of them being located on archipelagic islands in the transitional zone between the Southwest Greenland mainland and Davis Strait.

Great Auks occurred at sea off Paamiut from September to February and the colonists in Nuuk observed them around Christmas. Bones from juvenile Auks presumed to be c. half a year old have been found near Nanortalik, Nuuk, and Maniitsoq. As the Great Auks probably hatched in early July (Bengtson, 1984), the juvenile birds could well have been killed in early winter.

Fabricius noted that the Auks were common within reach of the hunters only in certain years. Probably the intermittent occurrence of larger numbers of Auks close to the coast resulted from extended periods of stormy weather driving the birds shorewards. Other species of alcids are known to become "shore-wrecked" during heavy storms (Hudson, 1985).

It seems that Great Auks wintering off West Greenland only unwillingly came close to the coast. Off Newfoundland, where Great Auks wintered far out at sea, they were closely bound to the banks. They never seemed to occur outside the shelf, and it

appears that the Auks were foraging at depths of less than 75 metres (Bradstreet and Brown, 1985; Brown, 1985). It would seem reasonable to assume, as did Bradstreet and Brown (1985), that the West Greenlandic Great Auks were tied to the banks off West Greenland: Frederikshåbs Bank, Danas Bank, Fiskenæs Bank, Fyllas Bank, and Lille Hellefiske Bank (Fig. 10).



Figure 10 Map showing archaeological sites (1500–1800 AD) with Great Auk remains, historical observations of Great Auks, the assumed breeding area, the wintering area of the Greenlandic Great Auks between 1500 and 1815 AD, and major West Greenland towns.

There is evidence of nesting Great Auks near Paamiut and possibly near Sisimiut in the 18th century. The breeding population at this time must, however, have been small and unstable.

The Great Auks that wintered off Southwest Greenland probably consisted of a small contingent from a local breeding population and of a large contingent of migrating birds from breeding colonies off Newfoundland and/or Iceland.

Salomonsen (1950) and Greenway (1958) believed that the Great Auks that wintered off West Greenland came from breeding colonies on Funk Island, Newfoundland (Fig. 11). However, Brown (1985: 409) pointed out that no northward migrating Great Auks had been observed by fishermen fishing off Labrador in the last half of the 18th century. He suggested that the Greenlandic Great Auks represented a post-breeding dispersal from colonies off Southwest Iceland. Brown (1985) calculated that if the Auks left the colonies in early July they would have to swim c. 22 km/day in order to cover the 1400 kilometres and reach West Greenland by September. With the help of the East Greenland Current flowing at c. 18 km/day, this would be possible. The same type of southwestward post-breeding dispersal is undertaken by other alcids breeding in Iceland, e.g. Dovekies, Thick-billed Murres, and Black Guillemots (Brown, 1985).

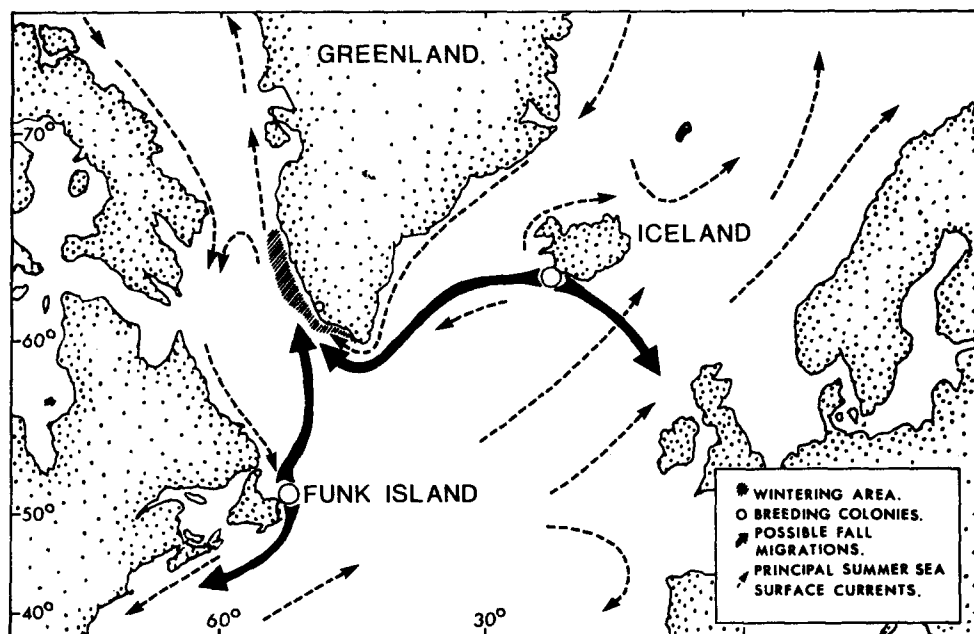


Figure 11 Map showing the wintering area of the Greenlandic Great Auk, assumed fall migration routes, and breeding localities as far as present evidence goes. The principal sea surface currents in summer are based on Brown (1985).

Considering that the population of Great Auks on Funk Island was severely reduced in the second half of the 18th century (Brown, 1985), and that the birds still occurred off West Greenland and Iceland in the early 19th century, there does seem to be some support of Brown's hypothesis of Auk migrations between Iceland and Greenland.

Hufthammer (1982) has shown that the Great Auk in prehistoric times in Scandinavia exhibited some geographical variation with respect to the size of skeletal elements, and this could theoretically be the case with historic Auk populations from other parts of the range. Table 2 presents measurements of bones from contemporary populations at Funk Island and West Greenland. The size difference between male and female Auks seems to have been negligible (Lucas, 1890), so a possible difference in sex composition of the bone samples should not influence the results. As can be seen, there is no significant difference in size between the Funk Island and the West Greenland specimens. Only three Icelandic bones have been measured and they fall within the size range of the Funk Island and West Greenland Great Auk bones. On the basis of bone size, none of the suggested hypotheses regarding the origin of the wintering Greenland Great Auks can be excluded.

Table 2 Lengths in millimetres of Great Auk bones from Funk Island, (Newfoundland); West Greenland; and Iceland.

Humerus, radius, and femur were measured according to Driesch (1976). Coracoid length was taken as the minimum distance from the acrocoracoid to facies articularis sternalis, and ulna length was taken as the maximum distance from facies articularis ventralis to trochlea articularis.

		<i>Coracoid</i>	<i>Humerus</i>	<i>Radius</i>	<i>Ulna</i>	<i>Femur</i>
<hr/>						
Funk Island ¹						
(1500–1800 AD)	n	50	58	50	50	50
	max	63	111	60	60	79
	min	54	99	52	52	68
	\bar{x}	58.9	104.0	55.4	55.4	73
<hr/>						
West Greenland ²						
(1350–1800 AD)	n	5	14	4	7	2
	max	60	109	57	59	71
	min	53	100	52	54	67
	\bar{x}	58.0	104.4	54.0	55.9	69.0
<hr/>						
Iceland ³						
(historical)	n		1	1	1	
	\bar{x}		102.0	58.0	57.0	
<hr/>						

¹ Material stored at the National Museum of Natural History, Washington.

² Material from localities nos 2, 3, 4, 5, 6, and 10 (Table 1), all stored at the Zoological Museum, Copenhagen.

³ Material from the site of Tjernagata 4, Reykjavik, stored at the Zoological Museum, Copenhagen.

GREAT AUK HUNTING

Methods and Implements

The only known detailed descriptions of Great Auk hunting in Greenland are given by Fabricius (1780, 1814, 1818, 1929). The Great Auk was an excellent diver, and it was said that it could stay submerged as long as a harp seal (Holm, 1887, 1918). The bird was pursued by several kayak hunters at a time. When a Great Auk was sighted, the hunters would start yelling to scare the bird and make it dive. The idea was, not to give the bird time to breathe sufficient air, and after a while it became so exhausted that it could be secured with a bird dart. Fabricius stated that when caught, the Great Auk could be quite aggressive and defend itself by biting. This observation is in contrast to

the defenceless and docile impression given by the Great Auk when pursued on land at the breeding colonies (Steenstrup, 1855c).

The only implement for hunting Great Auks mentioned by Fabricius was the bird dart, a rather light dart thrown from the kayak with the help of a throwing board. The long thin point was supposed to pierce the bird. If it missed, the three or four barbed side prongs made from Caribou antler were supposed to catch a wing, a leg, or the neck of the bird.

Aron of Kangeq confirmed the use of the bird dart for Great Auk hunting in his narration of the story about the hunters from Qilangait.

Johanne Fosie's illustration (Fig. 7) suggests the use of a bladder dart. This is known to have been used for hunting small seals and larger birds.

Products

Fabricius (1780, 1814, 1929) is the primary source. The Great Auk was quite valuable to the Greenlanders and it was used in a variety of ways. The meat and intestines were eaten, and the bird provided a lot of fat which was used both for food and as oil in the lamps.

The Great Auk skins were used for warm and insulating inner garments. One other source, which unfortunately cannot be verified, speaks of the Inuit's use of Great Auk skins. In a copy of Pennant's "Arctic Zoology", which belonged to the German zoologist Friederich Faber, there was a small note added under the section on the Great Auk: "The eskimaux which frequent Newfoundland cloath themselves with the skins of these birds" (Faber, 1827: 684). Archaeologically, however, there may be an indication that the natives of Newfoundland once used Great Auks for clothing. In a c. 4000 years old cemetery excavated at Port au Choix, seven graves containing Great Auk beaks were found (Tuck, 1976). In one of them, 200 beaks covering all of the human skeleton were uncovered. They may have decorated a dress made from Great Auk skins, or have been attached on other clothing, of e.g. seal skin, for ornamental purposes or as amulets. Skin garments formerly used on the Alaskan coast sometimes carried "tufts" or beaks of different species of alcids for decorative purposes (anorak on exhibit at the University of Alaska Museum). Tuck (1976: 68) mentions the possible symbolic or ceremonial significance which the Great Auk may have had for the people at Port au Choix. He found support for this viewpoint both in the occurrence of beaks and in a bone hairpin surmounted by an effigy of the head of a Great Auk.

A Great Auk mandible, excavated in the midden of Igdlorpait (App. 1, 5: midden (2)), was found with a string of baleen tied through the mandibular foramen (Gulløv, pers. comm.). The baleen loop may have fixed the mandible onto something. Could it be a parallel to the apparent symbolic use of Great Auk beaks at Port au Choix?

The black skin from the feet of the Great Auk was sometimes sewn together with pieces of seal skin to make small bags in which different items could be stored (Fabricius, 1808). The feet of other birds were used for the same purpose and they were all regarded as being very decorative.

A special use was made of the windpipe of the Great Auk. It was inflated and mounted as a bladder on the bladder dart (Fabricius, 1929).

The early Danish colonists also made use of the Great Auk. Several Great Auk bones have been found in Hans Egede's house and midden (Møhl, 1979) (Table 1), and Fabricius stated that the Danes used the skin both as lining in clothes and for bed-clothes.

Butchering Great Auks

In total, 13.5% of the excavated Great Auk bones from Greenland have cut marks (Table 3). These are traces of skinning and butchering procedures and may give an idea of how the dead bird was treated and for what purpose before the bones were dumped.

The distribution of cut marks is shown in Table 3. The cut marks are most common on humeri, tibiotarsi and femora. Most of them are groups of parallel, c. 3 mm long grooves, arranged transversely on the long bones, resulting from a back and forth movement of a knife in the process of cutting through skin, meat and sinew. Two cut marks, on a humerus and a tibiotarsus, are different. Each occurs at one level all around the bone, as if the knife had been traced 360° to cut the skin. Such a procedure was probably followed as a preparation for separating the body skin from that of the wing and feet before skinning the bird. The cut marks then testify to initial skinning and subsequent dismemberment of the carcass, perhaps with the aim of boiling it, boiling being a common Inuit cooking technique.

Table 3 Great Auk bones from Greenland. Representation of skeletal elements and number of bones with cut-marks

	Loc. 1 ¹	Loc. 2	Loc. 3	Loc. 4	Loc. 5	Loc. 6	Loc. 7	Loc. 8	Loc. 9	Loc. 10	Loc. 11	No loc.	Total
	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut	n cut
Cranium					1 0			1 0	1 0	1 0			4 0
Mandibula				2 0	4 1								6 1
Vertebra				1 0	1 0								2 0
Sacrum			1 0		3 0					1 0			5 0
Sternum				2 0	4 0			1		1 0			8 0
Scapula			1 0		2 0			1 1					4 1
Pelvis			2 0	1 0									3 0
Furcula					7 0								7 0
Coracoid				5 0	14 1								19 1
Humerus		1 0	2 1	5 0	28 8	3 1	6 0			1 0	1 1		47 11
Radius					6 0						1 0		7 0
Ulna			1 0	1 0	10 0	1 0					1 0		14 0
Metacarpale I + II					2 0								2 0
Femur				3 0	3 1					2 1			8 2
Tibiotarsus	1 1		3 2		5 1				1 0			1 0	11 4
Tarsometatarsus									1 0				1 0
Sum	1 1	1 0	10 3	20 0	90 12	4 1	6 0	3 1	3 0	6 1	3 1	1 0	148 20

¹ Localities are described in Table 1.

Interarticulated Great Auk bones were excavated from the midden deposits at Igdlorpait (App 1, 5): (a) a furcula part attached to the sternum; (b) a set of sternum, furcula, right coracoid, and right humerus; and (c) most of a left wing skeleton including the humerus, radius, ulna, and metacarpals II + III. These bones are among the very few existing articulated skeletal elements of *Pinguinus impennis*.

Two Great Auk humeri from Igdlorpait have fine bite marks with a diameter of perforation of 1.5 mm (App. 1, 5: house 9 (2), and midden (30)), and four fragments of humeri from Itivnera have more or less widespread pitting (App. 1, 7: (2), (3), (5), and (6)). Judging from the character of the marks, they were probably made by foxes or dog puppies.

Great Auk Hunters

A number of features characterize the Greenlandic faunal assemblages in which Great Auk bones have been found. Bones of marine mammals and seabirds dominate the samples. Seals, especially Harp Seals and Ringed Seals, have been the mainstay in these Inuit economies, but alcids and gulls are also well represented. Only the Caribou hunting at Itivnera forms an exception to this pattern. Quantitatively the Great Auk bones constitute only a small fraction of the faunal samples, usually far less than 1%. It seems that the Great Auk had little economic significance to the Inuit in Greenland. This presumably had to do with the seagoing nature of the bird and with the fact that only in certain years did larger numbers of Auks occur within reach of the kayak hunters.

The same type of faunal assemblage has been excavated in eastern Canada at the Dorset Culture site Avayalik-1 dated from 400–450 AD (Jordan, 1980; Jordan and Olson, 1982). Avayalik-1 is an island site situated 25 kilometres south of the northernmost tip of Labrador. No more than three Great Auk bones were found among thousands of bones from marine mammals and seabirds. Such relative scarcity of Great Auk bones also characterizes faunal assemblages from archaeological sites in all other parts of the Great Auk's former range (Grieve, 1885; Winge, 1900; Möhl, 1970; and others).

CONCLUSIONS

Great Auk bones excavated in the Disko Bay area and dated from c. 2000 BC suggest that the Auk was distributed farther north in this period than in the period 1350–1800 AD. The find coincides with the close of the climatic optimum during which the sea temperature off West Greenland was higher and a more boreal fauna flourished. The more boreal conditions may have favoured the existence of the Great Auk in areas north of its historic range. The Great Auk appears to have frequented the inner branches of the large fjord system of Nuup kangerlua (Godthåbsfjord) c. 1500 BC. The fact that the Auks seem to have been caught during the summer could indicate that the Great Auk had breeding colonies on small islands and skerries in this area, but they could also represent a contingent of summering non-breeding subadult birds.

The general cooling that followed the climatic optimum may have forced the Great Auk farther south along the West Greenland coast.

Around 2400 BC, man, the hunter, entered into West Greenland, and soon these people of the Saqqaq Culture had occupied most parts of the West Greenland coastline. Initially the game species were unadjusted to human predation, and if the Auk did breed in West Greenland at the time, this species would have been particularly vulnerable, and many of the accessible colonies could possibly have been over-exploited.

Our knowledge of the Great Auk becomes much more detailed in late prehistoric and historic times. Archaeozoological and historical evidence from this period (c. 1350–1815 AD) shows that the Auk was distributed along the outer coast and at sea from Greenland's most southerly point, Cape Farewell, northwards along the west coast to Søndre Strømfjord c. 400 kilometres south of the Disko Bay. The Auks arrived on the banks off the West Greenland coast in September. Here adults and subadults spent the first part of the winter foraging on pelagic fishes. An analysis of subadult Auk bones from Inuit kitchen middens indicates that these birds were approximately half a

year old when killed. In certain years large numbers of Great Auks turned up in the vicinity of the outer islands off Southwest Greenland. The birds may have been driven towards the coast by extended periods of stormy weather, as is known for other alcids. After close to five months on the banks most of the Auks left in January.

The presence of downy Great Auks in August in the coastal waters near Paamiut indicates that some Auks were breeding in the area as late as in the 1770s, and they may have bred in the Sisimiut area in the same time period. They probably bred in small numbers on remote skerries towards the open sea.

The persistent "rumours" of a breeding colony on Gunbjørnsøerne allegedly near Ammassalik (East Greenland) should be rejected. No doubt the islands referred to are the Great Auk Skerries off Southwest Iceland. However, there is one plausible observation of an Auk in the Ammassalik area, probably a straggler from the Icelandic population.

Apart from the few locally breeding Great Auks, most of the birds appear to have been absent from Greenland waters between February and August.

The origin of the Auks wintering off West Greenland has been investigated through morphometric studies of bones from Funk Island, West Greenland, and Iceland. The results show that the Great Auks from Funk Island and West Greenland were very similar in size, and that three Icelandic Great Auk bones fall within the size range of the Funk Island/West Greenland sample. Based on this material, no conclusions can be drawn as to the breeding provenience of the wintering Great Auks in West Greenland. However, the fact that the Auk population on Funk Island was probably exterminated in the late 18th century, and the fact that Great Auks were observed in winter off West Greenland and breeding on Icelandic skerries in the early 19th century, suggest that the Greenlandic birds might well have had an Icelandic origin.

The last living Great Auk in Greenland to be observed and recorded was killed in the winter of 1815 near Qeqertarsuatsiaat (Fiskenæsset) by a Greenlandic kayak hunter. It was an adult bird in winter plumage. After 27 years in various private collections, the skin was purchased in 1842 by the Zoological Museum in Copenhagen where it was stuffed and mounted. It is the only known specimen from Greenland, and one of the two existing adult specimens in winter plumage.

The disappearance of the Great Auk from Greenland was not due to exploitation by the Inuit hunters. Archaeozoological finds show that the West Greenland Inuit have hunted the Auk through 4500 years, but although the Auk was a desired and welcome prey of many uses, it was actually of minor importance to the Inuit economy in general. The proportion of Auk bones in the Inuit kitchen middens amounts to less than 1% of total bone numbers.

Only 29 years after the killing of the last observed Greenlandic Great Auk, the last two Auks were reportedly seen alive on the 5th of June, 1844, on Eldey southwest of Iceland (Steenstrup, 1855c; Grieve, 1885; Bengtson, 1984). No doubt the Auk was driven quickly towards extinction by over exploitation on the main breeding grounds near Newfoundland and Iceland. In the 16th, 17th, and early 18th centuries European fishermen and local people collected enormous numbers of adult birds and eggs on Funk Island off Newfoundland, and the Auk had disappeared from the island before the end of the 18th century (Steenstrup, 1855c). The population decline in the eastern Atlantic seems to have been more gradual, but also in this region the final extermination was caused by man.

It has recently been suggested that the decline and extinction could not solely be blamed on man. It is likely that the changing climatic conditions during the "Little Ice Age" (c. 1500–1700 AD) influenced the distribution and abundance of the prey

organisms of the Auks. Apparently the Great Auk had a very tight energy budget in the breeding season, and the breeding performance is likely to be affected by periodic changes in distribution and abundance of fish populations. Thus Bengtson (1984) suggests that hungry fishermen could cause the final extinction of the Great Auk only because the population had already declined as a result of natural causes.

Still, to my mind, the fate of the Great Auk is one of the most clearcut examples of how vulnerable large and specialized species are to man's persecution and exploitation.

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APPENDIX 1

List of 148 *Pinguinus impennis* bones from archaeological sites in Greenland (Fig. 12) (for geographical position and dating see Table 1 and Fig. 1). D = dextra, S = sinistra, prox. = proximal end of bone, dist. = distal end of bone, shaft = bone shaft, cran. = cranial end, caud. = caudal end. All material is kept at the Zoological Museum, Copenhagen.

Locality No. Name		Number of bones	
1	Unartoq	1	(1) tibiotarsus, S.
2	Gammel Frederikshåb	1	(1) humerus, D.
3	Kangeq	10	(1) synsacrum, fragm.; (2) scapula, S.; (3) pelvis, S.; (4) pelvis, D. mid-piece; (5) humerus, D.; (6) humerus, S. no dist.; (7) ulna, D. no prox.; (8-9) tibiotarsi, D. shaft; (10) tibiotarsus, S. dist.
4	Itivsalik	20	(1) mandibula, S. prox.; (2) mandibula, D. fragm.; (3) vertebra thoracalis; (4) sternum, cran.; (5) sternum, fragm.; (6-7) coracoidea, D.; (8) coracoid, D. no prox.; (9) coracoid, D. no dist.; (10) coracoid, D. dist.; (11) pelvis, S. fragm.; (12) humerus, D.; (13) humerus, S.; (14-15) humeri, D. prox.; (16) humerus, S. shaft; (17) ulna, S.; (18) femur, D.; (19-20) femora, D. shaft
5	Igdlorpait, house 3	7	(1-2) humeri, D.; (3-4) humeri, S.; (5) humerus, D. shaft; (6) humerus, S. shaft; (7) ulna, S.
	house 9	5	(1) coracoid, S.; (2) humerus, S.; (3) humerus, S. diaph.; (4) radius, S. no dist.; (5) ulna, S.
	house 13	7	(1) furcula, mid-piece; (2-3) coracoids, D. mid-pieces; (4) coracoid, S. mid-piece; (5) humerus, D. no prox.; (6) femur, D. diaph.; (7) tibiotarsus, D. dist.
	midden	71	(1) cranium, frag.; (2) mandibula, D. and S. dist.; (3) mandibula, D. caud.; (4) mandibula, S. caud.; (5) mandibula D. and S., no prox.; (6) vertebra thoracalis; (7) synsacrum; (8) synsacrum, mid-piece; (9) synsacrum, fragm.; (10-11) sterna, cran.; (12) scapula, S. Prox.; (13-16) furculae, mid-piece; (17-19) coracoidea, D.; (20-23) coracoidea, S.; (24-25) coracoidea, S. no cran.; (26-29) humeri, D.; (30-31) humeri, S.; (32) humeri, D. no dist.; (33-35) humeri, S. no dist.; (36-38) humeri, D. no prox.; (39) humerus, S. no prox.; (40) humerus, D. shaft; (41) humerus, S. shaft; (42) humerus, fragm.; (43-45) radius, D.; (46) radius, D. no prox.; (47-48) ulnae, D.; (49-53) ulnae, S.; (54) metacarpals II + III, S.; (55) femur, S.; (56) femur, S. shaft; (57) tibiotarsus, D. shaft; (58-60) tibiotarsus, S. shaft
			Articulated bones: I. (61-A) sternum, cran.; (62-B) furcula, mid-piece. II. (63-A) sternum, no caud.; (64-B) scapula, D. no dist.; (65-C) furcula, mid-piece; (66-D) coracoid, D.; (67-D) coracoid, D.; (67-E) humerus, D. III. (68-A) humerus, S.; (69-B) radius, S.; (70-C) ulna, S.; (71-D) metacarpals II + III, S.
6	Håbets Koloni	4	(1) humerus, D.; (2) humerus, S.; (3) humerus, S. shaft (4) ulna, S.
7	Itivnera	6	(1) humerus, D. fragm.; (2-5) humeri, S. shaft; (6) humeri, S. fragm.
8	Umanåt	3	(1) upperbeak, fragm.; (2) sternum, fragm.; (3) scapula, S.
9	Igdlutalik	3	(1) quadratum, D.; (2) tibiotarsus, D. no prox.; (3) tibiotarsus, S.
10	Utorqait	6	(1) quadratum, S.; (2) sacrum; (3) sternum, cran.; (4) humerus, S.; (5) femur, D.; (6) femur, D. no dist.
11	Qeqertasussuk	3	(1) humerus, S. shaft; (2) radius, D.; (3) ulna, D.
?	No locality	1	(1) tibiotarsus, D. shaft

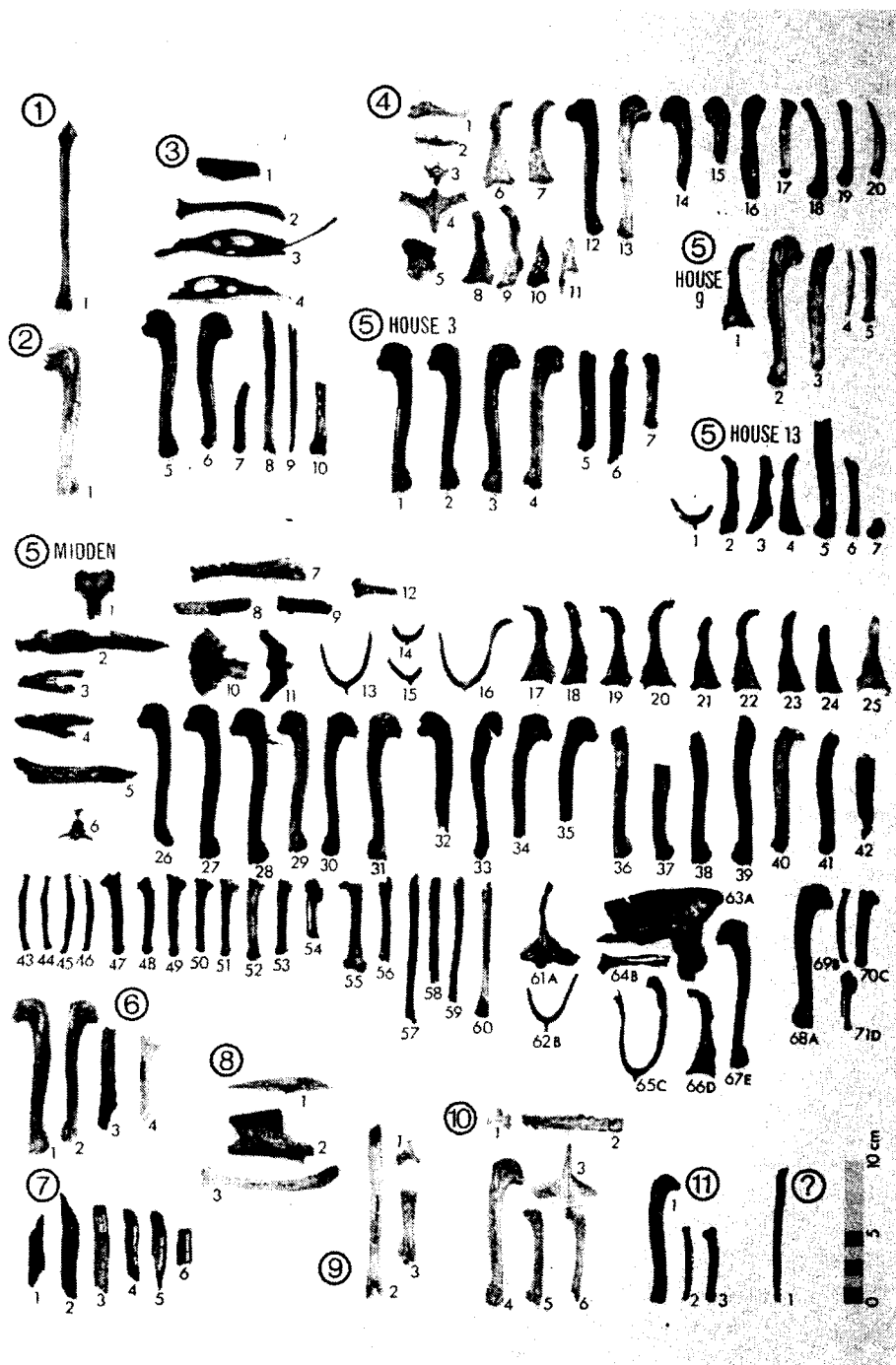


Figure 12 The complete collection of Great Auk bones from Greenland. Numbers refer to locality numbers and bone numbers in App. 1.

APPENDIX 2

The following description of the Great Auk in Greenland is the first complete translation from Danish of the description given by Otto Fabricius in his unpublished manuscript "Zoologiske Samlinger . . .", i.e., "Zoological notes or descriptions of animals, from time to time written down according to personal observations from the year 1768 and here presented in collection from the year 1808" (Fabricius, 1808).

The eight volumes of manuscript, now in the Royal Library, Copenhagen, are in Gothic handwriting. The section on the Great Auk (Vol. I, pp. 264–269) has been transcribed by Tammes Menne (ZMUC) and translated into English with the assistance of Mary E. Petersen (ZMUC). We have attempted to stay as close as possible to Fabricius's original text and style of writing, including the original punctuation, unless this would be confusing; however, originally capitalized nouns are not capitalized in the English text except where demanded by English usage. Underlinings in the manuscript are given in italics. Page numbers in parentheses are those of the manuscript. Bracketed comments [] are added to clarify the text. (?) preceding a word in the text indicates doubt about its meaning; (?) added to a word means that the word (or part of it) could not be deciphered.



Figure 13 Portrait of the Great Auk killed off Qeqertarsuatsiaat (Fiskenæsset) in 1815 (Figure 9) illustrating some of the anatomical features that Otto Fabricius mentions in his text (App. 2). (Photo Geert Brovad).

No. 83 (p. 264)

Gejrfuglen [the Garefowl, the Great Auk].

Anglemageren [the Angler].

Hav-Emmeren [the Sea Emmer].

Brillefuglen [the Spectacled Bird].

Alca impennis.

[The following literature references are written as a marginal notation at the beginning of the section on the Great Auk]: *Alca Impennis*. Gndl. j.n. 550, 3. Den grosse Papagoy(?). Pennant Brit. Zool. 2, 471. Lath. (?)vog: 3, 277.

I have described this bird in my Fauna Groenlandica p. 82 sp. 52 and will add here only that which was omitted, as far as my notes permit.

Its Greenlandic name *Isarokitsoq*, meaning *stump-winged* (:from *Iserok*, a *wing*), is well suited for this bird which has such short wings that it cannot use them for flight. The colonists call it "*Hesteprangeren*" ["*the horse dealer*"].

It is one of the big seabirds, nearly the size of a wild goose in length, though not quite in girth.

The beak [Fig. 13] is not very long, from the corner of the mouth to the tip about $3\frac{1}{2}$ inches ($3\frac{1}{2}$ Danish inches = c. 9 cm), is compressed, furrowed transversely, with a curved tip, both beaks [both halves of the beak] fitting well to each other so that it is tightly sealed, otherwise black, arched, double-edged, without teeth, a little blunt at the end but flat on the sides; the *upper jaw* is only very slightly longer than the lower jaw and curves downwards towards this, it has a rounded ridge but close to the tip a small (?)bump like the (?) [word appears to be "Gippet" or "Tippet"] on a chicken's beak, the tip [of the beak] is quite blunt but its edges are sharp; interiorly the upper jaw is divided lengthwise into three parts besides the (?) of the beak; the two parts that are situated closest to (?) are only narrow (?) edges that jut out to the sides at the corners of the mouth (p. 265) where they end in a soft serrated flap; the innermost [mid] part also starts farthest out [at the tip of the beak] with a low ridge, but further in, approximately at the midpoint of the beak, it turns into a large protuberance that becomes broader and higher the farther in it goes and is a thick flesh overgrown with many gland teeth ["Kjertletænder", probably glandular papillae] which are oriented inwards and here in addition along the midline [is] a deep furrow above [for] the tongue; behind this [furrow] is a deep cavity which also on the sides is overgrown with gland teeth; still further in two oval lumps similarly overgrown; the inside of *the mouth* is entirely yellow, but the outer surface of the beak is black all over, the tip alone a bit paler; *the lower jaw* should project more directly or straight out, but approximately midway it has a rounded prominence from where it towards the head seems to be separated into two parts by a narrow furrow, (?)a feather-covered groove, but towards the tip it curves upwards towards the upper jaw, it is quite deep inwards [proximally], but outwards [distally] it is also very compressed. If one is to identify 8–10 *furrows* on the beak, as Linné says, then one must look very carefully and add those of the upper jaw and those

of the lower jaw which, however, unite and can only be considered as really four or five and, however, not on the young birds (at least this is how it was with all the specimens I have seen), and these [furrows] must therefore be accounted for as follows: closest to the feathers of the head, which grow quite far out on the beak, is the 1st furrow which goes towards the ridge of the upper jaw where it with the uppermost ends from both sides of the beak forms a pointed projection, like a halter for the head-feathers, [and] against the lower ends it runs down from both sides to join on the lower jaw's underpart, directed towards the tip; after a narrow wrinkled space is the 2nd furrow which runs parallel to the 1st. Over the nostrils is the 3rd furrow which is small and round, forming an oval (?) [word appears to be "Bestikling"], whose point turns upwards; there is no corresponding furrow on the lower jaw; after a broad wrinkled space follows the 4th furrow which runs more lengthwise along the beak on the upper jaw, but more across it on the lower jaw. The remainder [of the beak] to the tip is smooth and (?)hard, only slightly compressed on the sides, which then should be the 5th furrow*. (*There is otherwise a large difference between the furrows as the young birds have none and they develop with age, but the beak is always black.) [marginal note by Fabricius]. *The corner of the mouth* is large, nearly reaching the eyes; *the tongue* is not as long as the lower jaw, but small, pointed, flat, shaped like the blade of a sword and with its tip ending exactly in the blunt protuberance of the lower jaw, it is narrow, with a scaly tip at the end, otherwise thick and fleshy (p. 266) ["Knude"], above tumorlike and smooth, but at the root [divided] in two wings overgrown with inwardly directed small gland teeth, about 22 in number; far behind these follows, after a smooth depression, an oval, large prominence which is bisected by a deep furrow along the length, whose hindmost sides are overgrown with downwards overlapping small glands inwards.

The nostrils are situated at the opening of the beak, [and] are elongate; above them can be seen the above-mentioned furrow as a narrow elongate black halter that makes a projection into the small feathers of the cheek as *the cheeks* are half overgrown with feathers[,] on the upper half black, on the lower towards the throat white, but black toward the beak.

The eyes are situated low on the sides of the head, are large and black, have just above them a white elongate feathered spot in the black head, but only on the old birds, as the spot is not found on the young ones.

The earholes are very small and covered with feathers, and in line with the beak's opening, immediately towards the end of the cheek.

The head is elongate, posteriorly black except for the white spot above the eye, below white.

The neck short, above black, on the sides and below white.

The back is muddy black all over.

The breast and abdomen are white all over with grey down; the abdominal feathers are long and densely packed, so they could hardly be plucked.

The wings are very small and insufficient and of use only for diving and for splashing through the water, but not for flying. The large wing feathers of the 1st size are not much larger than a starling's, and all black. Those of the 2nd size [are] black with white tips; the smallest are, as regards the uppermost part of the wing, black, but on the innermost part, white.

The rear short, black above, white below.

The legs short, set close to the rear, with webbed feet; the thighs short, covered with feathers, above white, below black; the tarsals and the feet black, only three inches with short claws, the in- (p. 267) -nermost shortest, the outermost somewhat longer, and the middle one the longest.

This bird is only seen in Greenland in early winter from September until January, sometimes in quite large numbers, but most winters only few and very rarely adult birds. Always far out at sea, very rarely between the lands [islands] and never on land (unless other observations should be had at the northern colonies than at the southern ones, where I was). It is not seen during the summer as it stays at its breeding grounds. The true residence cannot really be considered Greenland when it actually does not breed in the country (as far as I know) [the parenthetical remark was crossed out by Fabricius] but only comes inshore for a short time and then far at sea.

Where it breeds is not known as the Greenlanders never have seen its nest, but that its breeding sites must not be so very far away, but [that] some must breed on one or other uninhabited offshore island far to the west, can be concluded from the fact that in the month of August one once in a while finds between the lands [islands] young which still have down, thus cannot have come far over the wild sea; such by me (?) [perhaps "examined"] had only the earth's products in them, namely: sugar root [*Sedum rosea*] (in Greenland called *Tuglerunæt*) [in modern Greenlandic spelling "tungdlerúnak"], shrubbery [probably fragments of dwarf shrubs] which grow on bare steep cliffs facing the sea, on the other hand, they did not yet contain any of the water's products in them, as the old birds; from this I conclude that they must recently have taken to the water, and as the Greenlanders at the place I was [living] used to travel about on all islands, even those lying rather far away, and never saw these birds in the summer or have been able to find their nests, only a large island called Umanak, its western side towards the sea, and what to the west (?) [perhaps "komme" = come] might lie further west out in the sea, one does not come to, I think therefore that they thereabout, far from people and on other similar places far to the west, must have their breeding grounds much like the Guillemot (:No. 66:) [the number refers to a description of *Cephus grylle* in the manuscript] on steep cliffs facing the sea with no real preparations.

(p. 268) For food it takes the sculpin (:No. 52) [*Myxocephalus scorpius*] and the lump sucker (no. 49:) [*Cyclopterus lumpus*] which it brings up from the depths, tears into pieces with its sharp beak, and eats. Probably also other fish of this size.

If it cannot fly it is so much more a diver in the water. It must also be able to walk to come ashore and breed, but with difficulty as with all alcids whose feet are set so far back. Its cry is sometimes loudly scolding and raucous, sometimes cheeping. It bites furiously when it finds itself caught. When these birds have just arrived at the coast, some of them (perhaps the young ones) are very stupid and tame while others (perhaps the adults) are difficult to catch.

It is caught by the Greenlanders with the bird dart (see p. 200) as they pursue them in groups, and, as it can only dive, and not fly, they take care to yell as soon as it comes up for air so that it will become frightened, remain longer under water and thus sooner become exhausted, when they finally get so close to it they can hit it with the bird dart, but it can be quite enduring.

The use of it for the Greenlanders is:

1. *The skin* is flayed off the bird and used for a kind of garment called a birdskin parka which all[,] both men and women, especially during the winter, have under their other garments closest to the body with the feathers inward. The colonists also use them sometimes, both for lining under clothes and as bedclothes, for which use they are dried, the fat on the flesh side is pulled off, they are then rubbed pliant with the hands, and sometimes the feathers are plucked so that the only down remains attached to the

skin, as they are both warm, strong, and soft. Those Greenlanders who would be fashionable use only the necks of the skin which are thinner and whiter on the flesh side.

(p. 269)

2. *The meat* as well as all its intestines (except the gall), after it is cleaned, is eaten by them, boiled in water.

3. *The fat* on it, which is not a small quantity, is used either for eating, or in want of other blubber it is burnt in their lamps.

4. *The black skin on the feet* is used by the southern Greenlanders for ornament to sew onto their white sealskin bags which they have in the tents to keep this and that in, which [the bags] are thought to be more beautiful, the more colours they consist of, as they embroider them with black and red lines, diamonds, squares, circles, etc.

5. The wonderful firm and soft down could well be of good use in bedclothes if many of these birds were available.

Of enemies I know it has none except for the eagle (:No. 34:) [*Haliaëtus albicilla*].