

Arctic Specimens in the Zoological Collections at the Natural History Museum, University of Oslo, Norway (NHMO)

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Abstract

In the NHMO zoological collections, specimens from the Arctic include about 9,000 mammals and 7,100 birds, whereas the Insect Collection holds about 105,000 specimens plus more than hundred jars with unsorted material. The Fish Collection contains approximately 1,400 specimens, while the Herptile Collection (amphibians & reptiles) holds only thirty-one specimens of three taxa. Many of these specimens originate from expeditions to E Greenland, N Canada, Svalbard, Novaya Zemlya, Finnmark, and NE Siberia in the period 1898 to 1966. Furthermore, the DNA Bank has about 5,600 tissue and extracted DNA samples, mostly sampled from wild animals during the last decades but also from specimens in the voucher collections. Most of the Arctic specimens have been digitized and are available in online data portals like GBIF, except for the Insect Collection, where only the type material and about 30 percent of the total specimens are digitized.

Keywords

Arctic specimens, vertebrate collection, invertebrate collection, collection specimens, animal specimens, permanent collection, database, digital collections, digitization, natural history

Introduction

The Arctic region is a major focal area for many of the scientific collections at NHMO. This is also the case for several zoological collections. In the present publication, we

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provide a brief overview of the geographical, temporal, and taxonomic origin of Arctic specimens in some of these, viz. the “traditional” mammal, bird, fish, herptile, and insect voucher collections, plus the DNA Bank (tissue and DNA collection).

The Arctic can be defined in several ways, perhaps the most common being the region north of the Arctic Circle (66°30'N). This is also the basic definition adopted here, but lack of exact location (coordinates) for many collection specimens has made it necessary to employ a slightly more pragmatic approach to this region. We have therefore included specimens from the following regions in this presentation: Svalbard, Jan Mayen and the three northernmost counties of Norway, that is, Finnmark, Troms, and Nordland (even though parts of Nordland are south of the Arctic Circle); Sweden and Finland north of the Gulf of Bothnia; regions of Russia north of ca. 66°N; the state of Alaska, United States of America; the territories of Yukon, Northwest Territories and Nunavut in Canada; and Greenland.

While the vast majority of specimens are from Norway, including Svalbard, a considerable number also originate from several Norwegian expeditions to various Arctic regions (see Figure 1), predominantly from the 1890s until the 1930s, but some also as late as 1966 (to Pasvik, Norway). In the Bird Collection, for example, expedition material accounts for as much as 18 percent of the Arctic specimens. These expeditions usually brought back specimens from several organism groups, and thus for several collections. To provide some background for this group of specimens, brief descriptions of the relevant expeditions are presented below.

Distribution of the main collecting periods differ among the various collections. Samples in the DNA Bank were mostly collected in the wild during the last four decades, while most specimens of vertebrates were collected in the late nineteenth to early twentieth century or in the 1960s to 1990s. The Bird Collection has also seen a considerable addition of egg shells since about 2010, and a substantial part of the Arctic material in the Insect Collection, primarily that from Svalbard and northern Norway, was collected during the last three decades.

While the following sections present summaries of the Arctic specimens in the various collections, links to complete datasets are provided in the Datasets section for those collections where specimen data are readily available.

Expeditions

The following Arctic expeditions made significant contributions to almost all of the NHMO collections covered in the current presentation.

The Norwegian North-Atlantic Expedition 1876–1878 (Henrik Mohn,¹ Georg Ossian Sars²)

Oceanographic expedition aboard the steamship “Vøringen” to the Norwegian Sea between Norway, the Faroe Islands, Iceland, and Svalbard.³ In three consecutive

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1. “Henrik Mohn,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q2587502>.
 2. “Georg Ossian Sars,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q658307>.
 3. “The Norwegian North-Atlantic Expedition 1876–1878,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q17765610>.

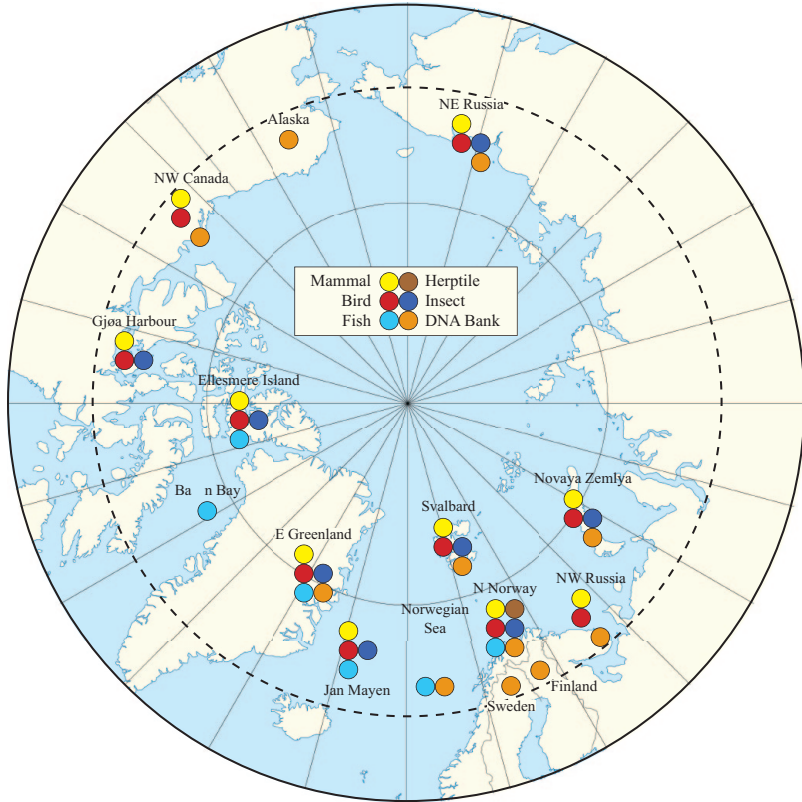


Figure 1. Main areas of origin for Arctic samples in the NHMO collections included in the current publication (Arctic Circle indicated by dotted line). For more details about abundances per collections and localities, please see datasets referred to in Table 3. Base map by Tentotwo, CC BY-SA 3.0, via Wikimedia Commons.

cruises in the summers of 1876, 1877, and 1878, the expedition explored bathymetry, ocean currents, and meteorology, but also returned many zoological specimens.⁴

“Fram” I 1893–1896 (Fridtjof Nansen⁵)

Fridtjof Nansen’s famous ice-locked drift over the Arctic Ocean.⁶ From Norway, the expedition led along the Siberian coast to the New Siberian Islands (ca. 135°E), then north into the sea ice. “Fram” drifted with the sea ice over the Arctic Ocean from

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4. Robert Collett, “Fishes,” in *The Norwegian North-Atlantic Expedition 1876–1878*, ed. H. Mohn and G.O. Sars (Christiania: Grøndahl & Søn, 1882).
 5. “Fridtjof Nansen,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q72292>.
 6. “Nansen’s Fram Expedition (1893–1896),” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q1964751>.

September 1893, reaching close to 86°N (Nansen and Johansen reached 86°13.6′N on foot), before emerging in open waters north of Svalbard in August 1896.⁷

“Fram” II 1898–1902 (Otto Sverdrup⁸)

Otto Sverdrup’s expedition to Arctic Canada.⁹ During four winterings on the east and south coast of Ellesmere Island they explored and mapped an enormous area, covering most of the previously unmapped Ellesmere Island and some of the islands further west.¹⁰

Aurora Polaris Expedition to Novaya Zemlya 1902–1903 (Kristian Birkeland¹¹)

Expedition arranged by Kristian Birkeland to study the aurora borealis and Earth magnetism,¹² led by the physicist Hans Riddervold.¹³ His two assistants were the zoologists Hans Thomas Lange Schaanning¹⁴ and Johan Koren,¹⁵ who collected a number of mammals and birds during their stay at Matochkin Shar from August 1902 to July 1903.¹⁶

“Gjøa” 1903–1906 (Roald Amundsen¹⁷)

Expedition that left from Oslo, Norway in June 1903, via Greenland to Gjøahavn on King William Island in the Canadian Arctic archipelago.¹⁸ “Gjøa” was stationed in

7. Fridtjof Nansen, *Farthest North: Being the Record of a Voyage of Exploration of the Ship Fram 1893–96 and of a Fifteen Months’ Sleigh Journey*, 2 Vols., Vol. 1–2 (Westminster: Archibald Constable and Company, 1897).

8. “Otto Sverdrup,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q321261>.

9. “Sverdrup’s Fram Expedition (1898-1902),” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q4327278>.

10. Otto Sverdrup, *New Land. Four Years in the Arctic Regions*, 2 Vols., Vol. 1–2 (London, New York and Bombay: Longmans, Green, and Co., 1904).

11. “Kristian Birkeland,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q461624>.

12. “The Norwegian Aurora Polaris Expedition 1902–1903,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q116452699>.

13. “Hans Riddervold,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q116452788>.

14. “Hans Thomas Lange Schaanning,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q11974137>.

15. “Johan Koren,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q4232856>.

16. Hans Thomas Lange Schaanning, “Bidrag til Novaja Semljas fauna,” *Dansk Ornithologisk Forenings Tidsskrift*, 10, no. 3 (1916): 145–90; Kristian Birkeland, *The Norwegian Aurora Polaris Expedition 1902–1903*, Vol. 1 (Christiania: H. Aschehoug & Co., 1908).

17. “Roald Amundsen,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q926>.

18. “The Gjøa Expedition (1903–1906),” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q3062320>.

Gjøahavn for two winters and explored the surrounding region, before they continued westward and arrived in Nome, Alaska in August 1906.¹⁹

Svalbard 1906–1938 (Adolf Hoel²⁰)

Adolf Hoel was involved in, and often in charge of many expeditions to the Svalbard archipelago during the period from 1906 to 1938. While geology and mapping often were the main focus of these expeditions, zoological specimens were also collected on many of them.²¹

“Maud” 1918–1925 (Roald Amundsen)

Roald Amundsen’s expedition from Norway via the Siberian coast, where they spent two winters, east of Cape Chelyuskin and near Ajon Island respectively, before arriving in Nome, Alaska in July 1920.²² Then from 1922 to 1925 “Maud” sailed, with several winterings in the ice, from the Bering Strait, north and west of the New Siberian Islands and back along the Siberian coast to return to the Bering Strait in August 1925.²³

Novaya Zemlya 1921 (Olaf Holtedahl²⁴)

In 1921, the geologist Olaf Holtedahl arranged a multidisciplinary excursion to Novaya Zemlya.²⁵ They spent the months of July and August mainly along the western coast of the islands, from ca. 72°N to 76°N, but did also reach the eastern coast via the Matochkin Shar strait.²⁶

19. Roald Amundsen, *The North West Passage. Being the Record of a Voyage of Exploration of the Ship “Gjøa” 1903–1907*, 2 Vols., Vol. 1–2 (London: Archibald Constable and Co., Ltd., 1908).

20. “Adolf Hoel,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q362227>.

21. Adolf Hoel, *The Norwegian Svalbard Expeditions 1906–1926*, Spitsbergenkomitéen (Oslo, 1929); Adolf Hoel, Report on the Activities of Norges Svalbard- og Ishavsundersøkelser 1927–1936, Norges Svalbard- og Ishavsundersøkelser (Oslo, 1937).

22. “The Maud Expedition (1918–1925),” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q108887245>.

23. Roald Amundsen, *Nordostpassagen. Maudfærden langs Asiens Kyst 1918–1925. H.U. Sverdrups Ophold blandt tsjuksjerne. Godfred Hansens depotekspedition 1919–1920* (Kristiania: Gyldendalske Boghandel, 1921); Harald U. Sverdrup, *Tre Aar i Isen med “Maud”* (Oslo: Gyldendal, 1926).

24. “Olaf Holtedahl,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q3319845>.

25. “Holtedahl’s Novaya Zemlya Expedition 1921,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q116451851>.

26. Olaf Holtedahl, “A Crossing of Novaya Zemlya,” *The Geographical Journal*, 59, no. 5 (1922): 370–5; Hans Thomas Lange Schaanning, “Die Vögel,” in *Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya, 1921*, ed. O. Holtedahl (Kristiania: Videnskapselskapet i Kristiania, 1923).

East Greenland 1929–1937 (Adolf Hoel)

From 1929 to 1937, Hoel sent out expeditions to the east coast of Greenland, and these contributed quite a few specimens to the NHMO collections. Most of this collecting took place from 72°N to 75°N, with Myggbukta on the south-eastern shores of the Hudson Land peninsula as a base camp.²⁷

Franz Josef Land 1930 (Adolf Hoel, Gunnar Horn²⁸)

After a failed attempt in 1929, Hoel sent the ship “Bratvaag,” led by Gunnar Horn, toward Franz Josef Land in 1930.²⁹ They reached the archipelago on 11 August and spent two weeks collecting geological, botanical, and zoological material in the south-western parts of the islands.³⁰

Pasvik 1966 (Rolf Vik³¹/Zoological Museum)

In 1966 the Zoological Museum, which was the name of the zoological division of NHMO at the time, arranged a multidisciplinary excursion to the north-easternmost corner of Norway, on the border with Russia.³² Their main focus was on the Pasvik Valley, but they also visited the coastal region between Kirkenes and the Russian border.³³

Mammal Collection

The Arctic part of the Mammal Collection includes 8,944 specimens from seventy species, but the collection is characterized by several large series of specimens from a few species; ten species account for 85 percent of the specimens. The collection contains several valuable Arctic sub-collections, including Reindeer *Rangifer tarandus* ($n=3,597$), Polar Bear *Ursus maritimus* ($n=438$), Arctic Fox *Vulpes lagopus* ($n=743$), Walrus *Odobenus rosmarus* ($n=264$), European Otter *Lutra lutra* ($n=1,111$), Muskox *Ovibos moschatus* ($n=60$), Wolf *Canis lupus* ($n=41$), and lemmings (*Lemmus* spp., *Dicrostonyx* spp.; $n=253$). These were mostly collected by various Norwegian research institutes or personnel from the Zoological Museum during the last thirty to forty years, but also include for example, more than 150 polar bear skulls collected by trappers at Svalbard during the 1960s and 1970s, a similar number of rodents collected by Schaanning 1900 to 1911 mostly in the Pasvik valley in north-eastern Norway, and

27. Hoel, *Report on the Activities of Norges Svalbard- og Ishavsundersøkelser 1927–1936*.

28. “Gunnar Horn,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q5619038>.

29. “The Bratvaag Expedition 1930,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q1609682>.

30. Hoel, *Report on the Activities of Norges Svalbard- og Ishavsundersøkelser 1927–1936*.

31. “Rolf Vik,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q62649460>.

32. “Zoological Museum’s Pasvik Expedition 1966,” Wikidata, 2023, available at: <http://www.wikidata.org/entity/Q116451579>.

33. Per Pethon, “Avifaunistiske iakttagelser i Syd-Varanger sommeren 1966,” *Fauna*, 19, no. 4 (1966): 196–211.

Table 1. The most important sub-collections in the NHMO Mammal Collection.

Species	Scientific name	Count	Main region(s)	Main collection period	Main specimen type(s)
Reindeer	<i>Rangifer tarandus</i>	2,911	Svalbard	1984–2007	Mandibles
		686	N Norway, Russia	1909–1911; 2003–2008	Skulls, (partial) skeletons, skins
European otter	<i>Lutra lutra</i>	1,111	N Norway	1990–2004	Skulls
Rodents	Mainly <i>Microtus agrestis</i> , <i>M. oeconomus</i> , <i>Myodes glareolus</i>	787	N Norway	1966; 1972–1976	Whole specimen in ethanol; 75 w/skull stored dry separately
Arctic fox	<i>Vulpes lagopus</i>	690	Svalbard	1972–2001	Skulls, (partial) skeletons
Polar bear	<i>Ursus maritimus</i>	271	Svalbard	1964–67; 1979	Skulls
		32	Russia (N Siberia)	Ca. 1920	Skulls
Walrus	<i>Odobenus rosmarus</i>	239	Svalbard	1991	Mandibles, teeth
Muskox	<i>Ovibos moschatus</i>	60	East Greenland, Canada (Ellesmere Land)	1889–1976	Skulls, skins
Lemmings	<i>Lemmus</i> spp., <i>Dicrostonyx</i> spp.	79	Russia (Novaya Zemlya)	1871–1921; mainly 1903	Skins, skulls
Arctic Wolf	<i>Canis lupus occidentalis</i>	8 (3 ind.)	Canada (Ellesmere Land)	1900–1901	Skulls

about twenty-five specimens of rodents (Rodentia) and mustelids (Mustelidae) from eastern Siberia, collected by Koren ca. 1915.³⁴ The more important sub-collections of various species are highlighted in Table 1.

Less than 4 percent of the Arctic specimens in the Mammal Collection were provided by the expeditions mentioned above. Still, several of these provided valuable additions to the collection, including a large, mounted Polar Bear collected toward the end of the “Fram” I expedition.

While additions to the Mammal Collection in general, including the Arctic sub-collection, were quite substantial around the turn of both of the last two centuries, the current situation is quite different. Yearly growth of the collection is very limited, and comes nearly exclusively from salvage, which, owing to the location of the museum well outside the Arctic Circle, very rarely includes specimens from the Arctic.

34. Fridtjof Mehlum and Eugene Potapov, “Small Mammals from the Koren Arctic Expedition to the Kolyma River, Northeast Siberia 1914–1918,” *Polar Research*, 14, no. 1 (1995): 1–14.

Bird Collection

In contrast to the Mammal Collection, the Bird Collection contains fewer specimens per species, but from a larger number of species. A total of 247 species are represented among the 7,094 specimens, and with a maximum of just over 300 specimens per species (Common Eider *Somateria mollissima* $n=331$, Black-legged Kittiwake *Rissa tridactyla* $n=321$). The collection consists of two main types of specimens; study skins and mounted specimens constitute ca. 52 percent, while eggshells account for 44 percent. In the last couple of decades, a considerable number of sperm samples have also been added to the collection, currently making up about 3 percent of the Arctic part of the collection.

Several of the expeditions mentioned above provided important samples to the skin and mount sub-collection, accounting for 18 percent of the 3,743 specimens. Hoel's expeditions to Svalbard and especially East Greenland provided 276 specimens, ca. 200 originate from the Pasvik expedition, hundred from "Gjøa,"³⁵ forty from "Maud,"³⁶ and twenty-four from Høltedahl's Novaya Zemlya expedition.³⁷ The material from these expeditions includes from ten to fifty species each. There are even fewer specimens from Nansen's "Fram" expedition,³⁸ but these include three specimens of the enigmatic Ross's Gull *Rhodostethia rosea*. At that time very little was known about this species, and the specimens caught were the youngest that had so far been secured for science, providing important cues to where their so far unknown breeding grounds might be located. Other important collectors include Hans T.L. Schaanning and Robert Collett³⁹ (mostly from Norway), Herman L. Løvenskiold⁴⁰ (Norway, mostly Svalbard), Johan Koren (mostly eastern Siberia, Russia), and Ørjan Olsen⁴¹ (mostly Norway). Overall, 65 percent of the specimens in this sub-collection are from northern Norway, 13 percent from Svalbard (including Bear Island) and Jan Mayen, and 10 percent from Russia.

The majority of the egg sub-collection originates from three main sources; two private collections bought by the museum in 1939 (Anthon Landmark,⁴² $n=646$; Johan A. Thome,⁴³ $n=342$), and the Environmental Specimen Bank (ESB) in Trondheim,

35. Hans Thomas Lange Schaanning, "Birds from Arctic North-America. Ornithological Results of the Fram-Expedition 1898-1902 and the Gjøa-Expedition 1903-1907," *Nyt Magazin for Naturvidenskaberne*, 73 (1933), 137–65.
36. Hans Thomas Lange Schaanning, ed., *Birds from the North-Eastern Siberian Arctic Ocean*, 5 Vols., Vol. Vol. 5, No. 6, The Norwegian North Polar Expedition with the "Maud" 1918-1925. Scientific Results (Bergen: A. S. John Griegs Boktrykkeri, 1928).
37. Schaanning, "Die Vögel."
38. Robert Collett and Fridtjof Nansen, "An Account of the Birds," in *The Norwegian North Polar Expedition, 1893-1896. Scientific Results*, ed. F. Nansen (Christiania: Jacob Dybwad, 1900), 1–53.
39. "Robert Collett," Wikidata, 2021, available at: <http://www.wikidata.org/entity/Q1111078>.
40. "Herman L. Løvenskiold," Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q11975180>.
41. "Ørjan Olsen," Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q59241114>.
42. "Even Anthon Thomas Landmark," Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q62649558>.
43. "Johan Andreas Thome," Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q109269713>.

dating from 2012 until present. The latter is by far the largest, consisting of 1,115 eggs from the Arctic, mainly from four species: Common Eider ($n=280$), European Shag *Gulosus aristotelis* ($n=230$), Black-legged Kittiwake ($n=209$), and European Herring Gull *Larus argentatus* ($n=208$). These are only a subset of the eggs collected as part of an ongoing seabird-monitoring program along all of the coast of Norway. Further, Collett and Schaanning provided nearly 200 eggs each from Norway, while ca. 70 eggs originate from the “Gjøa” expedition and Johan Koren’s work, in Arctic Canada and eastern Siberia, respectively.

The Common Eider is the overall best represented species with 291 eggs and forty-eight other specimens. There are also more than 200 eggs from the European Shag, Black-legged Kittiwake, and European Herring Gull, mostly from the ESB, and in total there are eggs of 188 species. In the skin and mount collection 227 species are represented, and the Atlantic Puffin *Fratercula arctica* tops the list with 208 specimens (mainly from the island of Røst in Nordland, Norway). Further, there are 107 Black Guillemot *Cephus grylle* and ninety-nine Rock Ptarmigan *Lagopus muta* specimens (including the Svalbard subspecies, *L. m. hyperborea*), and ca. 80–90 Willow Grouse *L. lagopus*, Thick-billed Murre *Uria lomvia*, Black-legged Kittiwake, and Arctic Tern *Sterna paradisaea*. These are predominantly from northern Norway, but for example, 54 percent of the Rock Ptarmigans are from Greenland, 20 percent of the Willow Grouse from Canada and 10 percent from Russia, and 10 percent of the Arctic Terns from Russia.

The avian sperm collection⁴⁴ mainly holds samples from more southern latitudes, but also includes 211 Arctic sperm samples in formalin from twenty-five passerine species, predominantly Willow Warbler *Phylloscopus trochilus* ($n=107$), Arctic Warbler *P. borealis* ($n=13$), and Sedge Warbler *Acrocephalus schoenobaenus* ($n=13$).

The oldest specimen is from 1847, but there are only a few specimens from before the mid-1870s. Most specimens and species originate from two main periods, 1875 to 1918 and 1962 to 1987. In the former, collectors like Schaanning, Collett, Koren, Olsen, and Amundsen were central, while the latter was mostly accounted for by collections made by the Norwegian Polar Institute and field trips and expeditions (Pasvik) originating from the Zoological Museum. In the last decade, the contributions from the ESB have resulted in a third peak in the numbers of specimens.

Fish Collection

Of the ca. 1,400 Arctic specimens in the Fish Collection, a substantial proportion was added by the above-listed ship-based expeditions between 1876 and 1937. The Norwegian North-Atlantic Expedition led by Henrik Mohn and Georg Ossian Sars brought in fifty-five specimens that were analyzed and cataloged by Robert Collett, the then Director of the Zoological Museum. His analyses led to the description of four species of eelpouts (Zoarcidae; Glacial Eelpout *Lycodes frigidus*, Lütken’s Eelpout *L. luetkenii*, Pale Eelpout *L. pallidus*, and *Lycodonus flagellicauda*), two species and a new genus of snailfishes (Threadfin Seasnail *Rhodichthys regina* and Black Seasnail

44. Jan T. Lifjeld, “The Avian Sperm Collection in the Natural History Museum, University of Oslo,” *Alauda*, 87, no. 3 (2019): 93–101.

Paraliparis bathybius), and one species of skates (Arctic Skate *Amblyraja hyperborea*).⁴⁵ Types for these species remain at the NHMO.

As old as the specimens contributed by the North Atlantic expedition are the sculpins (Cottoidea), codfishes (Gadiformes), and salmonids (Salmonidae) that were collected as bycatch by whalers at Baffin Bay, Canada, between 1875 and 1878, and presented to the NHMO. The East Greenland expeditions led by Adolf Hoel contributed 118 specimens to the Fish Collection, the “Fram” II expedition added forty-nine specimens, and an expedition with the “Michael Sars” in 1900 and 1901⁴⁶ yielded another eighty-six specimens. All of these acquisitions were dominated again by sculpins, codfishes, eelpouts, and snailfishes (Liparidae). Land-based excursions to the coast of northern Norway, by G.O. Sars between 1864 and 1888 and by Collett between 1876 and 1898, added a further 155 specimens with a similar species composition, but also including flatfishes (Pleuronectiformes), lumpsuckers (Cyclopteridae), sticklebacks (Gasterosteidae), and hagfishes (Myxini).

More recently, 121 specimens were collected in annual surveys of the Norwegian Sea by Per Pethon (previous curator of the Fish Collection) onboard RV “Johan Ruud,” between 1980 and 1983; 299 specimens were added by Knut Erling Semb between 1970 and 1983; and 110 specimens were brought back from a cruise with RV “G.O. Sars” to the Barents Sea in 1998. A diverse set of forty-nine specimens also resulted from fieldwork on the island of Røst between 1979 and 1985, including sandlances (Ammodytidae), lanternfishes (Myctophidae), dragonets (Callionymidae), hatchetfishes (Gasteropelecidae), gunnels (Pholidae), and bullheads (*Ameiurus*) in addition to the more common Arctic taxa.

Herptile Collection

The Herptile Collection includes amphibian and reptile specimens. Only two anurans (Common Frog *Rana temporaria* and Moor Frog *R. arvalis*), a single lizard (Viviparous Lizard *Zootoca vivipara*) and one snake species (Common European Adder *Vipera berus*) can be found in the Scandinavian Arctic region north of the Arctic Circle.

The Herptile Collection of the NHMO holds twenty-six specimens of *R. temporaria* and four specimens of *Z. vivipara* from Norway’s northernmost district Finnmark. This material includes some of the oldest specimens of the entire Herptile Collection, for instance two individuals of *R. temporaria* (NHMO K 11 and NHMO K 69) collected near Mortensnes, Nesseby by Andreas Nordvi⁴⁷ in 1871, an individual of *Z. vivipara* (NHMO K 1001) collected in Bosekop, Alta by Schøyen on 25 July 1873, and another one of the latter species (NHMO K 1011) collected in southern Varanger by Robert Collett on 16 July 1885. In addition, a single specimen of *V. berus* (NHMO K 961), collected from just south of the Arctic Circle (Avadal, at ca. 66.4°N), represents the northernmost record of this species that is deposited in the collection of NHMO.

45. Collett, “Fishes.”

46. J. Hjort, “Michael Sars’ første Togt i Nordhavet Aar 1900,” *Aarsberetning vedkommende Norges Fiskerier*, 1900, no. 4 (1901): 231–68.

47. “Andreas Nordvi,” Wikidata, 2022, available at: <http://www.wikidata.org/entity/Q11957999>.

Insect Collection

In the Insect Collection, the majority of Arctic specimens originate from various collecting trips in Norway's three northernmost counties, Nordland, Troms, and Finnmark. Most specimens originate from more occasional collecting using among other techniques, Malaise traps and sweep netting. Roughly one third of the specimens have been digitized and constitute about 35,000 records in our database. Among the thirteen orders represented, Coleoptera (46 percent), Lepidoptera (24.5 percent), Diptera (15.1 percent), and Hymenoptera (9.3 percent) are the most common. More material is stored as bulk samples in alcohol, mostly from Malaise traps catches.

The collection also holds material from numerous localities at Svalbard (Spitsbergen and Bear Island). The digitized part of this material constitutes nearly 2,000 specimens, strongly biased toward Diptera (88 percent), with additional material of Hymenoptera (6 percent) and a few other orders. By numbers, the most dominant families of Diptera in the material are Mycetophilidae, Sciaridae, Chironomidae, Scathophagidae, and Muscidae. More restricted material also exists from Jan Mayen: eighty-five specimens, all Diptera, collected in 2011.

Outside Svalbard, Jan Mayen and the Norwegian mainland, most Arctic insects in our collection originate from expeditions carried out in the period from 1890 to 1930; the most important being "Fram" II (1898–1902), Hoel's expeditions to East Greenland (1929 and 1930), Høltedahl's expedition to Novaya Zemlya (1921), "Gjøa" (1903–1906), and "Maud" (1918–1925). The most valuable material is kept in the dry collection, and constitutes about 2,200 specimens held separately in seventeen drawers, that is, not incorporated into the systematic collection. The majority of specimens from these expeditions were identified by contemporary international experts, from both Norway and abroad. Based on the material, type specimens were designated for sixty-nine species, mostly midges (Diptera, Chironomidae). In addition, our wet collection holds about hundred jars of various sizes containing both identified and unsorted material. Except for the type specimens, this material is still not digitized.

DNA Bank

The DNA Bank is a comparatively new collection at the NHMO, originally established in the early 1990s to take care of samples collected for genetic analyses by researchers in both botany and zoology at the museum. This is still by far the biggest source of new additions to the collection, but samples from external sources are also accepted.

There are samples from 6,555 specimens from the Arctic in the zoological sub-collections of the DNA Bank. Most samples are blood and tissue samples collected from wild individuals during the last three decades, but some have also been sampled from preserved specimens in the voucher collections and may therefore stem from older specimens. For many of the tissue samples there is also extracted DNA stored in the DNA Bank; for the purpose of this summary, one or several blood or tissue sample(s) and any associated DNA extract(s) originating from one individual and sampling event are counted as one specimen.

Taxonomic, geographic, and temporal coverage varies among the Arctic sub-collections (i.e., organism groups) of the DNA Bank and will be dealt with separately for each of these.

The majority of the 429 Arctic mammal samples, from thirty-four species, have been sampled from specimens in the NHMO Mammal Collection, and the collecting dates are spread out in time from 1875 to 2018, but with a marked peak in 1964 to 1967. This is due to more than half of the samples being from Polar Bear teeth ($n=275$) from skulls collected at Svalbard in that period. Apart from the Polar Bear no species are represented by numerous samples; Wolf ($n=16$), Brown Bear *Ursus arctos* ($n=13$), Reindeer ($n=11$), and Hooded Seal *Cystophora cristata* ($n=10$) are the next four species on the list, while the rest of the thirty-four species are represented by from one to six samples. Marine mammals dominate the species list ($n=16$), followed by rodents ($n=9$) and terrestrial carnivores ($n=6$). Most samples are from Svalbard ($n=274$), but northern Norway ($n=60$), Russia ($n=31$), and Greenland ($n=18$) are also represented, as are the Greenland Sea ($n=16$) and Norwegian Sea ($n=13$).

In the bird sub-collection, a total of 131 species are represented among the 3,566 specimens. It is dominated numerically by seabirds (e.g., Little Auk *Alle alle* $n=529$, Lesser Black-backed Gull *Larus fuscus* $n=450$, Atlantic Puffin $n=408$, and Black-legged Kittiwake $n=233$), but there are also a reasonable number of samples of several passerine species (Passeriformes; e.g., Willow Warbler $n=124$, Bluethroat *Luscinia svecica* $n=120$) and other groups. The majority of samples (76 percent) are from northern Norway, 20 percent from Svalbard, 2 percent each from Russia and Sweden, and just some very few samples are from the remaining Arctic countries. Ninety-seven percent of the samples have been collected since 1990, with a marked peak in the period 2006 to 2008.

Fifteen fish species are represented among the total of 826 samples, mostly as otoliths ($n=714$) or fish scales ($n=99$). Three species constitute more than 97 percent of the samples: Atlantic Salmon *Salmo salar* ($n=556$), Brown Trout *Salmo trutta* ($n=239$) and Arctic Char *Salvelinus alpinus* ($n=28$). The samples are predominantly from northern Norway, but also some ($n=79$) from Russia, and were collected mainly in the period 1998 to 2006.

The only (nearly) Arctic herpetological sample in the DNA Bank is a tissue sample taken from an old Common European Adder *Vipera berus* specimen in the voucher collection. It was collected in Avadal, Nordland county, just south of the Arctic Circle (66.4 °N) in 1909.

The arthropod sub-collection ($n=1,733$) is dominated by Diptera ($n=624$) and Plecoptera ($n=585$), followed by Lepidoptera ($n=298$) and Hymenoptera ($n=145$). It contains samples from a total of 384 species, plus a number of samples that have not been determined to species level. About one third of these samples are associated with voucher specimens in the NHMO Insect Collection. Norway is the dominating country

of origin (94 percent), but there are also some samples ($n=11-49$) from most of the other Arctic countries. Most samples are from the last two decades, predominantly 2010 ($n=738$) and 2015 to 2016 ($n=450$).

Research Based on the Collections

For most of the collections, with the exception of the recently established DNA Bank, there are quite a few publications from as early as the 1880s and well into the 1900s, describing various contributions to the collections. While no in-depth literature survey has been performed specifically for the current publication, a considerable number of publications have been based on specimens in the collections covered over the years. In Table 2, we present a selection of both older and more recent publications. While it is hard to see any clear trends in the how usage of the collections might have changed over time, it is evident that most current studies relies, at least in part, on genetic data. The advances of genetic methods, unlocking most of the old specimens for genetic analyses, and establishment of the DNA Bank, in combination with the long time series represented, render collections like those covered in the current publication ever more relevant for researchers in various disciplines.

Table 2. Selected publications based on the collections covered in the current publication..

Collection	Author	Year	Title
Mammal	Wollebæk, A.	1926	The Spitsbergen reindeer (<i>Rangifer tarandus spetsbergensis</i>)
Mammal	Mehlum, F., and E. Potapov	1995	Small mammals from the Koren Arctic Expedition to the Kolyma River, northeast Siberia 1914–1918
Mammal	Ameen et al.	2019	Specialized sledge dogs accompanied Inuit dispersal across the North American Arctic
Mammal	Bachmann et al.	2021	Mitogenomics and the genetic differentiation of contemporary <i>Balaena mysticetus</i> (Cetacea) from Svalbard
Mammal	Lan et al.	2022	Insights into bear evolution from a Pleistocene polar bear genome
Bird	Collett, R., and F. Nansen	1900	An account of the birds ^a
Bird	Schaanning, H.T.L.	1916	Bidrag til Novaja Semljas fauna ^b [<i>Contributions to the fauna of Novaya Zemlya</i>]
Bird	Schaanning, H.T.L.	1923	Die Vögel ^c
Bird	Schaanning, H.T.L.	1928	Birds from the north-eastern Siberian Arctic Ocean ^d
Bird	Schaanning, H.T.L.	1933	Birds from Arctic North-America. Ornithological results of the Fram-Expedition 1898-1902 and the Gjøa-Expedition 1903-1907

(continued)

Table 2. (continued)

Collection	Author	Year	Title
Bird	Schaanning, H.T.L.	1954	A contribution to the ornithology of Eastern Siberia
Fish	Collett, R.	1882	Fishes ^e
Fish	Hjort, J.	1901	“Michael Sars” første togt i Nordhavet Aar 1900 [The first cruise of «Michael Sars» in the Norwegian Sea]
Fish	Wienerroither et al.	2011	The marine fishes of Jan Mayen Island, NE Atlantic – past and present
Fish	Mecklenburg et al.	2018	Marine fishes of the Arctic Region. Vol 1 & 2
Fish; Herptile	Pethon, P.	1969	List of type specimens of fishes, amphibians and reptiles in the Zoological Museum, University of Oslo.
Herptile	Koppetsch, T.	2021	The Herpetological Collection of the Naturhistorisk Museum in Oslo
Insect	Schei, P.E., and N. Wille	1907–1919	Report of the Second Norwegian Arctic expedition in the “Fram” 1898–1902
Insect	Holtedah, O.	1924–1928	Report of the scientific results of the Norwegian expedition to Novaya Zemlya 1921
Insect	Norges Svalbard- og Ishavsundersøkelser	1933–1937	Zoological results of the Norwegian Scientific Expeditions to East-Greenland
Insect	Linnaniemi, W.M.	1935	Collembolen aus Spitsbergen, Insel Hopen, Kong Karls Land und Jan Mayen, eingesammelt von norwegischen arktischen Expeditionen
Insect	Arnesen et al.	2012	Naturinventering/grunnlagsundersøkelser i virksomhetsområdene på Jan Mayen – Åpningsprosess for petroleumsvirksomhet i havområdene utenfor Jan Mayen [Nature inventory/baseline surveys in the business areas on Jan Mayen – Opening process for petroleum activities in the sea areas outside Jan Mayen]
DNA Bank	Lifjeld et al.	2005	No evidence of extra-pair paternity in the little auk <i>Alle alle</i>
DNA Bank	Pierce, E.P., and J.T. Lifjeld	1998	High paternity without paternity assurance behavior in the Purple Sandpiper, a species with large paternal investment
DNA Bank	Johnsen et al.	2010	DNA barcoding of Scandinavian birds reveals divergent lineages in trans-Atlantic species
DNA Bank	Wojczulanis-Jakubas et al.	2010	No evidence of blood parasites in Little Auks (<i>Alle alle</i>) breeding on Svalbard
DNA Bank	Wojczulanis-Jakubas et al.	2014	Weak population genetic differentiation in the most numerous Arctic seabird, the Little Auk

^aFrom the “Fram” I expedition.^bFrom the Aurora Polaris Expedition to Novaya Zemlya 1902–1903.^cFrom the Novaya Zemlya 1921 expedition.^dFrom the “Maud” expedition.^eFrom the The Norwegian North-Atlantic Expedition.

Datasets

Table 3 provides links to two types of datasets for those (parts of) collections for which specimen data are readily available:

Table 3. Digital Object Identifiers (DOI) of static and dynamic datasets for those (parts of) collections where specimen data have been digitized.

Collection	Static dataset	Dynamic dataset
Mammal	10.5281/zenodo.7429827	10.15468/dl.73x4a6
Bird	10.5281/zenodo.7467062	10.15468/dl.5zkuzq
Fish	10.5281/zenodo.7033043	10.15468/dl.gqja8q
Herptile	10.5281/zenodo.7030048	10.15468/dl.k46ae8
Insect: Jan Mayen	10.5281/zenodo.7036061	10.15468/dl.kgs3ma
Insect: Svalbard	10.5281/zenodo.7036071	10.15468/dl.u2g32s
DNA Bank Mammal	10.5281/zenodo.7472467	10.15468/dl.reanha
DNA Bank Bird	10.5281/zenodo.7455413	10.15468/dl.cg hun3
DNA Bank Fish & herptile	10.5281/zenodo.7429853	10.15468/dl.8e96ut
DNA Bank Arthropod	10.5281/zenodo.7429843	10.15468/dl.4gk2uk

- Static datasets contain data recorded for the records included at the time of publication of the dataset (December 2022)
- Dynamic datasets are linked to the GBIF datasets published for the complete collections to which the Arctic specimens belong. Includes the possibility to rerun the queries against the GBIF database to retrieve updated datasets, including any changes made to the records after the publication of the dataset (December 2022)

Conclusion

While the format of the present publication does not allow for any in-depth analyses of the presented datasets, we would still like to provide some concluding remarks. The collections for which electronic data are available fall into two major groups with respect to number of both specimens and taxa versus collecting year; the traditional specimen collections exhibit a main peak around 1900, and a secondary peak around the 1970s, while the DNA Bank collections originate from the last three decades. It is, however, crucial to keep in mind that this predominantly reflects changes in collecting priorities and activities, rather than in the natural occurrence of the species being collected. Annual number of new accessions has generally decreased, for some collections dramatically, and at the same time, the strategies and purpose of collecting have changed over the last 175 years. We can therefore not conclude that a species has

become less or more common based on the number of specimens found in our collections. The traditional collections may, however, provide data on historic presence, and to some extent also abundance, to which data on current distributions of species can be compared. Specifically, these collections can serve as evidence of a species' existence in areas where it may no longer be located.

The DNA Bank collections may serve a similar purpose, although from a much more recent period. More importantly, the DNA Bank provides easy access to resources for molecular analyses, reducing or sometimes even eliminating the need for costly field excursions and depletion of often small and vulnerable Arctic populations. Due to recent advances in molecular methods, DNA of sufficient quality for molecular analyses can now be extracted also from many specimens in the traditional collections, significantly increasing the time frame of this genetic repository. We therefore encourage the scientific community to explore the vast resources represented by these and similar collections around the Arctic fringe, and to exploit their potential by including specimens from them in future projects and analyses.

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