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From the late 1800s and until the protection of polar bears came into force in 1973, there were regular private hunting expeditions to the Arctic by boat, including several from Tromsø. In this article, I investigate how masculinity is manifested in specific empirical evidence: a trophy hunting expedition with the Sutton family that left from Tromsø in the summer of 1932. Using masculinity as a lens through which to see the historical trophy hunt shows, however, that this activity deals with more than obtaining trophies and potency. The Sutton family expedition undertook to hunt, kill and stuff wild animals to the benefit of science and the general information of the public. Sutton himself goes in and out of the role of conqueror; he puts his trust in the Norwegian crew and highlights his recommendations for safety on such trips. By looking at a specific example such as Sutton's expedition, it is obvious that this also deals with various forms of masculinity – or manliness: about the conquering and mastering of nature, but also about an interest in and care of nature. Masculinity is seen in terms of civic ideals with an emphasis on rationality and discipline – a hunt in which women may also be granted a place – as well as the role of fatherhood with a responsibility for the training of new generations and educating the public by contributing to the development of scientific collections and the municipal zoo.

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Aguirre de Cárcer, D., et al. (2015). "Biodiversity and distribution of polar freshwater DNA viruses." 1(5).

Viruses constitute the most abundant biological entities and a large reservoir of genetic diversity on Earth. Despite the recent surge in their study, our knowledge on their actual biodiversity and distribution remains sparse. We report the first metagenomic analysis of Arctic freshwater viral DNA communities and a comparative analysis with other freshwater environments. Arctic viromes are dominated by unknown and single-stranded DNA viruses with no close relatives in the database. These unique viral DNA communities mostly relate to each other and present some minor genetic overlap with other environments studied, including an Arctic Ocean virome. Despite common environmental conditions in polar ecosystems, the Arctic and Antarctic DNA viromes differ at the fine-grain genetic level while sharing a similar taxonomic composition. The study uncovers some viral lineages with a bipolar distribution, suggesting a global dispersal capacity for viruses, and seemingly indicates that viruses do not follow the latitudinal diversity gradient known for macroorganisms. Our study sheds light into the global biogeography and connectivity of viral communities.

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I dag udgør tabet af is fra gletsjere og iskapper i Arktis 35 % af den globale havniveaustigning, og denne afsmeltning af is forventes frem over at øge hastigheden af globale havniveaustigninger. Dette kan føre til oversvømmelser, erosion i klinter, ødelæggelse af bygninger og infrastruktur, ændringer i økosystemer og forurening af drikkevandskilder i kystnære samfund og lavtliggende øer over hele verden.

Tabet af is fra gletsjere og iskapper og den tilsvarende stigning i havniveau er vokset igennem de seneste årtier, og vi må forvente, at dette tab af is fortsætter med at stige efter midten af dette århundrede. SWIPA 2017 vurderer, at gletsjere og iskapper i Arktis som et minimum vil bidrage med 19-25 cm stigning i det globale havniveau i år 2100. De 19 cm er vurderingen ved et klimascenarie (RCP4.5), der forudsætter forholdsvis omfattende reduktion i udledningen af CO2 og resulterer i en stabiliseret global gennemsnitlig sluttemperatur på 2,4 +/- 0,7 grader C ved afslutningen af det 21. århundrede. Og de 25 cm er ved et klimascenarie med uændret udledning af CO2 i forhold til i dag (RCP8.5), der resulterer i en ikke stabiliseret global temperaturstigning på 4,3 +/- 1,1 grader C ved afslutningen af dette århundrede.

Når alle kilder til vandstandsstigninger tages i betragtning, fx varmeudvidelse af havvandet og smeltning af is uden for Arktis, vil den globale vandstandsstigning i 2100 være mindst 52 cm ved RCP4.5

klimascenariet, og 74 centimeter ved business as usual-scenariet RCP8.5, Disse minimumsvurderinger er næsten dobbelt så store som de tilsvarende minimumsvurderinger foretaget af Intergovernmental Panel of Climate Change IPCC i 2013.

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Rapporten er en del av kunnskapsgrunnlaget som ble innhentet i forbindelse med utarbeidelse av forvaltningsplanen for nasjonalparkene på Vest-Spitsbergen. Undersøkelsesområdet ligger innenfor Nordvest- Spitsbergen nasjonalpark. Rapporten inneholder resultatet av en totaltelling av fugl på øyer i Liefdefjorden i juli 2014. Dataene er sammenholdt med data fra tellinger fra samme område fra 1982, 1993, 1995 og 2007. Det er avslutningsvis gjort en vurdering av dyrelivets sårbarhet for forstyrrelser på disse øyene i hekkeperioden.

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Two global glaciations occurred during the Neoproterozoic. Snowball Earth theory posits that these were terminated after millions of years of frigidity when initial warming from rising atmospheric CO2 concentrations was amplified by the reduction of ice cover and hence a reduction in planetary albedo1, 2. This scenario implies that most of the geological record of ice cover was deposited in a brief period of melt-back3. However, deposits in low palaeo-latitudes show evidence of glacial–interglacial cycles4, 5, 6. Here we analyse the sedimentology and oxygen and sulphur isotopic signatures of Marinoan Snowball glaciation deposits from Svalbard, in the Norwegian High Arctic. The deposits preserve a record of oscillations in glacier extent and hydrologic conditions under uniformly high atmospheric CO2 concentrations. We use simulations from a coupled three-dimensional ice sheet and atmospheric general circulation model to show that such oscillations can be explained by orbital forcing in the late stages of a Snowball glaciation. The simulations suggest that while atmospheric CO2 concentrations were rising, but not yet at the threshold required for complete melt-back, the ice sheets would have been sensitive to orbital forcing. We conclude that a similar dynamic can potentially explain the complex successions observed at other localities.

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Bergmann, M. and M. Klages (2012). "Increase of litter at the Arctic deep-sea observatory HAUSGARTEN." Marine Pollution Bulletin 64(12): 2734–2741.

Although recent research has shown that marine litter has made it even to the remotest parts of our planet, little information is available about temporal trends on the deep ocean floor. To quantify litter on the deep seafloor over time, we analysed images from the HAUSGARTEN observatory (79°N) taken in 2002, 2004, 2007, 2008 and 2011 (2500m depth). Our results indicate that litter increased from 3635 to 7710itemskm−2 between 2002 and 2011 and reached densities similar to those reported from a canyon near the

Portuguese capital Lisboa. Plastic constituted the majority of litter (59%) followed by a black fabric (11%) and cardboard/paper (7%). Sixty-seven percent of the litter was entangled or colonised by invertebrates such as sponges (41%) or sea anemones (15%). The changes in litter could be an indirect consequence of the receding sea ice, which opens the Arctic Ocean to the impacts of man’s activities.

Bergmann, M., et al. (2017). "Citizen scientists reveal: Marine litter pollutes Arctic beaches and affects wild life." Marine Pollution Bulletin.

Recent data indicate accumulation areas of marine litter in Arctic waters and significant increases over time. Beaches on remote Arctic islands may be sinks for marine litter and reflect pollution levels of the surrounding waters particularly well. We provide the first quantitative data from surveys carried out by citizen scientists on six beaches of Svalbard. Litter quantities recorded by cruise tourists varied from 9–524gm−2 and were similar to those from densely populated areas. Plastics accounted for >80% of the overall litter, most of which originated from fisheries. Photographs provided by citizens show deleterious effects of beach litter on Arctic wildlife, which is already under strong pressure from global climate change. Our study highlights the potential of citizen scientists to provide scientifically valuable data on the pollution of sensitive remote ecosystems. The results stress once more that current legislative frameworks are insufficient to tackle the pollution of Arctic ecosystems.

Berry, C. M. and J. E. A. Marshall (2015). "Lycopsid forests in the early Late Devonian paleoequatorial zone of Svalbard." Geology 43(12): 1043-1046.

The Middle to early Late Devonian transition from diminutive plants to the first forests is a key episode in terrestrialization. The two major plant groups currently recognized in such “transitional forests” are pseudosporochnaleans (small to medium trees showing some morphological similarity to living tree ferns and palms) and archaeopteridaleans (trees with woody trunks and leafy branches probably related to living conifers). Here we report a new type of “transitional” in-situ Devonian forest based on lycopsid fossils from the Plantekløfta Formation, Munindalen, Svalbard. Previously regarded as very latest Devonian (latest Famennian, 360 Ma), their age, based on palynology, is early Frasnian (ca. 380 Ma). In-situ trees are represented by internal casts of arborescent lycopsids with cormose bases and small ribbon-like roots occurring in dense stands spaced ~15–20 cm apart, here identified as Protolepidodendropsis pulchra Høeg. This plant also occurs as compression fossils throughout most of the late Givetian–early Frasnian Mimerdalen Subgroup. The lycopsids grew in wet soils in a localized, rapidly subsiding, short-lived basin. Importantly, this new type of Middle to early Late Devonian forest is paleoequatorial and hence tropical. This high-tree-density tropical vegetation may have promoted rapid weathering of soils, and hence enhanced carbon dioxide drawdown, when compared with other contemporary and more high-latitude forests.

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De spektakulære foldene og skyveforkastningene på Svalbard er ikke bare et flott skue. De hjelper oss å forstå hvordan slike strukturer påvirker petroleums- og grunnvannsprovinser.

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Buhl-Mortensen, L. and P. Buhl-Mortensen (2017). "Marine litter in the Nordic Seas: Distribution composition and abundance." Mar Pollut Bull.
Litter has been found in all marine environments and is accumulating in seabirds and mammals in the Nordic Seas. These ecosystems are under pressure from climatic change and fisheries while the human population is small. The marine landscapes in the area range from shallow fishing banks to deep-sea canyons. We

present density, distribution and composition of litter from the first large-scale mapping of sea bed litter in arctic and subarctic waters. Litter was registered from 1778 video transects, of which 27% contained litter. The background density of litter in the Barents Sea and Norwegian Sea is 202 and 279 items/km2 respectively, and highest densities were found close to coast and in canyons. Most of the litter originated from the fishing industry and plastic was the second most common litter. Background levels were comparable to European records and areas with most littering had higher densities than in Europe.

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Polar bears (Ursus maritimus) are among those species most susceptible to the rapidly changing arctic climate, and their survival is of global concern. Despite this, little is known about

polar bear species history. Future conservation strategies would significantly benefit from an understanding of basic evolutionary information, such as the timing and conditions of their initial divergence from brown bears (U. arctos) or their response to previous environmental change. We used a spatially explicit phylogeographic model to estimate the dynamics of 242 brown bear and polar bear matrilines sampled throughout the last 120,000 years and across their present and past geographic ranges. Our results show that the present distribution of these matrilines was shaped by a combination of regional stability and rapid, long-distance dispersal from ice-age refugia. In addition, hybridization between polar bears and brown bears may have occurred multiple times throughout the Late Pleistocene. The reconstructed matrilineal history of brown and polar bears has two striking features. First, it is punctuated by dramatic and discrete climate-driven dispersal events. Second, opportunistic mating between these two species as their ranges overlapped has left a strong genetic imprint. In particular, a likely genetic exchange with extinct Irish brown bears forms the origin of the modern polar bear matriline. This suggests that interspecific hybridization not only may be more common than previously considered but may be a mechanism by which species deal with marginal habitats during periods of environmental deterioration.

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Drei Stücke mit eigenen Titelblättern, datiert 1761-1763: Die wunderbare Reise Jacob Hemskirchens, eines Holländers, nach Nova Zembla; Die wundervolle Errettung Claudii Angeli de Martelli aus der mit vielen Drangsalen verknüpften türkischen Gefangenschaft; Die

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On 11 July 1897, a Swedish expedition under Salomon August Andrée attempted to reach the North Pole from Spitsbergen by balloon. The flight was terminated after only three days, as the weight of the balloon increased above a critical limit, due to an ice load caused by freezing fog and drizzle. Here the meteorological context of this expedition is discussed, in particular concerning the planning of the flight and in-flight weather conditions. Based on recently released pressure fields for the Arctic region for July 1897, obtained from the twentieth century reanalysis project (20CR), it can be shown that the Andrée expedition would not have reached the North Pole even with a perfect balloon, due to unfavourable wind conditions in the central Arctic after their departure from Spitsbergen.

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The alpine topography observed in many mountainous regions is thought to have formed during repeated glaciations of the Quaternary period1, 2. Before this time, landscapes had much less relief1, 2, 3. However, the spatial patterns and rates of Quaternary exhumation at high latitudes—where cold-based glaciers may protect rather than erode landscapes—are not fully quantified. Here we determine the exposure and burial histories of rock samples from

eight summits of steep alpine peaks in northwestern Svalbard (79.5° N) using analyses of 10Be and 26Al concentrations4, 5. We find that the summits have been preserved for at least the past one million years. The antiquity of Svalbard’s alpine landscape is supported by the preservation of sediments older than one million years along a fjord valley6, which suggests that both mountain summits and low-elevation landscapes experienced very low erosion rates over the past million years. Our findings support the establishment of northwestern Svalbard’s alpine topography during the early Quaternary. We suggest that, as the Quaternary ice age progressed, glacial erosion in the Arctic became inefficient and confined to ice streams, and high-relief alpine landscapes were preserved by minimally erosive glacier armour.

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        In this report, I review recent molecular studies dealing with the origin and evolution of polar bears (Ursus maritimus), with special emphasis on their relationships with brown bears (U. arctos). On the basis of mitochondrial and nuclear data, different hypotheses have been proposed, including rapid morphological differentiation of U. maritimus, genetic introgression from U. arctos into U. maritimus, or inversely from U. maritimus into U. arctos, involving either male- or female-mediated gene flow. In the light of available molecular and eco-ethological data, I suggest, firstly, that all divergences among major clades of large bears can be linked to glacial periods, secondly, that polar bears diverged from brown bears before 530thousand years ago (ka), during

one of the three glacial marine isotope stages (MIS) 14, 15.2 or 16, and, thirdly, that genetic introgression had occurred from female polar bears into brown bear populations during at least two glacial periods, at 340±10ka (MIS 10) in western Europe, and at 155±5ka (MIS 6) on the ABC islands of southeastern Alaska, and probably also in Beringia and Ireland based on ancient DNA sequences.

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We re-examine a Lower Cretaceous dinosaur tracksite at Boltodden in the Kvalvågen area, on the east coast of Spitsbergen, Svalbard. The tracks are preserved in the Helvetiafjellet Formation (Barremian). A sedimentological characterization of the site indicates that the tracks formed on a beach/margin of a lake or interdistributary bay, and were preserved by flooding. In addition to the two imprints already known from the site, we describe at least 34 additional, previously unrecognized pes and manus prints, including one trackway. Two pes morphotypes and one manus morphotype are recognized. Given the range of morphological variation and the presence of manus tracks, we reinterpret all the prints as being from an ornithopod rather than a theropod, as previously described. We assign the smaller (morphotype A, pes; morphotype B, manus) to Caririchnium billsarjeanti. The larger (morphotype C, pes) track is assigned to Caririchnium sp., differing in size and interdigital angle from the two described ichnospecies C. burreyi and C. billsarjeanti. The occurrence of a quadrupedal, small to medium-sized ornithopod in Svalbard is puzzling, considering the current palaeogeographical reconstructions and that such dinosaur tracks have mainly been described from Europe but not North America.

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A field survey to collect microplastics with sizes <5mm was conducted in the Southern Ocean in 2016. We performed five net-tows and collected 44 pieces of plastic. Total particle counts of the entire water column, which is free of vertical mixing, were computed using the surface concentration (particle count per unit seawater volume) of microplastics, wind speed, and significant wave height during the observation period. Total particle counts at two stations near Antarctica were estimated to be in the order of 100,000pieceskm-2.

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Radioisotopic dating of volcanic minerals is a powerful method for establishing absolute time constraints in sedimentary basins, which improves our understanding of the chronostratigraphy and evolution of basin processes. The relative plate motions of Greenland, North America, and Eurasia changed several times during the Palaeogene. However, the timing of a key part of this sequence, namely the initiation of compression between Greenland and Svalbard, is currently poorly constrained. The formation of the Central Basin in Spitsbergen is inherently linked to changes in regional plate motions, so an improved chronostratigraphy of the sedimentary sequence is warranted. Here we present U–Pb zircon dates from tephra layers close to the basal unconformity, which yield a weighted-mean 206Pb/238U age of 61.596 ± 0.028 Ma (2σ). We calculate that sustained sedimentation began at ~61.8 Ma in the eastern Central Basin based on a sediment accumulation rate of 71.6 ± 7.6 m/Myr. The timing of basin formation is broadly coeval with depositional changes at the Danian–Selandian boundary around the other margins of Greenland, including the North Sea, implying a common tectonic driving force. Furthermore, these stratigraphic tie points place age constraints on regional plate reorganization events, such as the onset of seafloor spreading in the Labrador Sea.

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The response of the Greenland Ice Sheet (GIS) to changes in temperature during the twentieth century remains contentious1, largely owing to difficulties in estimating the spatial and temporal distribution of ice mass changes before 1992, when Greenland-wide observations first became available2. The only previous estimates of change during the twentieth century are based on empirical modelling3, 4, 5 and energy balance modelling6, 7. Consequently, no observation-based estimates of the contribution from the GIS to the global-mean sea level budget before 1990 are included in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change8. Here we calculate spatial ice mass loss around the entire GIS from 1900 to the present using aerial imagery from the 1980s. This allows accurate high-resolution mapping of geomorphic features related to the maximum extent of the GIS during the Little Ice Age9 at the end of the nineteenth century. We estimate the total ice mass loss and its spatial distribution for three periods: 1900–1983 (75.1 ± 29.4 gigatonnes per year), 1983–2003 (73.8 ± 40.5 gigatonnes per year), and 2003–2010 (186.4 ± 18.9 gigatonnes per year). Furthermore, using two surface mass balance models10, 11 we partition the mass balance into a term for surface mass balance (that is, total precipitation minus total sublimation minus runoff) and a dynamic term. We find that many areas currently undergoing change are identical to those that experienced considerable thinning throughout the twentieth century. We also reveal that the surface mass balance term shows a considerable decrease since 2003, whereas the dynamic term is constant over the past 110 years. Overall, our observation-based findings show that during the twentieth century the GIS contributed at least 25.0 ± 9.4 millimetres of global-mean sea level rise. Our result will help to close the twentieth-century sea level budget, which remains crucial for evaluating the reliability of models used to predict global sea level rise.

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Polar bears are uniquely adapted to life in the High Arctic and have undergone drastic physiological changes in response to Arctic climates and a hyperlipid diet of primarily marine mammal prey. We analyzed 89 complete genomes of polar bear and brown bear using population genomic modeling and show that the species diverged only 479–343 thousand years BP. We find that genes on the polar bear lineage have been under stronger positive selection than in brown bears; nine of the top 16 genes under strong positive selection are associated with cardiomyopathy and vascular disease, implying important reorganization of the cardiovascular system. One of the genes showing the strongest evidence of selection, APOB, encodes the primary lipoprotein component of low-density lipoprotein (LDL); functional mutations in APOB may explain how polar bears are able to cope with life-long elevated LDL levels that are associated with high risk of heart disease in humans.

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Plastic, as a form of marine litter, is found in varying quantities and sizes around the globe from surface waters to deep-sea sediments. Identifying patterns of microplastic distribution will benefit an understanding of the scale of their potential effect on the environment and organisms. As sea ice extent is reducing in the Arctic, heightened shipping and fishing activity may increase marine pollution in the area. Microplastics may enter the region following ocean transport and local input, although baseline contamination measurements are still required. Here we present the first study of microplastics in Arctic waters, south and southwest of Svalbard, Norway. Microplastics were found in surface (top 16 cm) and sub-surface (6 m depth) samples using two independent techniques. Origins and pathways bringing microplastic to the Arctic remain unclear. Particle composition (95% fibres) suggests they may either result from the breakdown of larger items (transported over large distances by prevailing currents, or derived from local vessel activity), or input in sewage and wastewater from coastal areas. Concurrent observations of high zooplankton abundance suggest a high probability for marine biota to encounter microplastics and a potential for trophic interactions. Further research is required to understand the effects of microplastic-biota interaction within this productive environment.

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The high Arctic archipelagos around the globe are among the most strongly glacierized landscapes on Earth apart from the

Greenland and Antarctic ice sheets. Over the past decades, the mass losses from land ice in the high Arctic regions have contributed substantially to global sea level rise. Among these regions, the archipelago of Svalbard showed the smallest mass losses. However, this could change in the coming decades, as Svalbard is expected to be exposed to strong climate warming over the 21st century. Here we present extensive Monte Carlo simulations of the future ice-mass evolution of 29 individual land-terminating glaciers on the Svalbard archipelago under an RCP 8.5 climate forcing. An extrapolation of the 29 sample glaciers to all land-terminating glaciers of the archipelago suggests an almost complete deglaciation of the region by 2100. Under RCP 8.5, 98% of the land-terminating glaciers will have declined to less than one tenth of their initial size, resulting in a loss of 7392 ± 2481 km 2 of ice coverage.

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Det er ikke bare føttene til krykkja som er svart, men også framtida. På grunn av klimaendringene kjemper måkearten for å overleve, og den kan forsvinne helt i løpet av 50 år.

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ABSTRACT On 18 June 1928, Roald Amundsen and a team of five men (René Guilbaud, Leif Dietrichson, Albert Cavelier de Cuverville, Gilbert Brazy and Emile Valette) flew in a French Latham 47 prototype aeroplane from Tromsø, Norway, to aid in the rescue of survivors of the crashed airship Italia. The party disappeared nearly without trace into the Barents Sea. We shall examine Amundsen's last years, the decision to employ for an Arctic relief mission a prototype aeroplane which had not completed its flight tests, and the evidence that, in deciding to disregard warnings and fly this aeroplane unaccompanied over the Barents Sea, Amundsen took a significant risk that led to his death and those of his crew.

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The Svalbard archipelago in the High Arctic is influenced by cold Arctic water masses from the north-east and the warm West Spitsbergen Current flowing northwards along its western coast. The eastern waters and the fjords are normally frozen during the winter months, while the coastal waters west of the archipelago remain open. Norwegian fishers have been harvesting from Svalbard waters for decades and detailed records of catches exists from 1980 onwards. We analyze the catch records from the Svalbard zone (approximately ICES area IIb). The large fishery for capelin in summer yielding annual catches up to 737 000 tons was closed by a Norwegian fishery regulation in the mid nineteen nineties. Demersal

fisheries have been continuous, and the results clearly indicate a northward trend in landings of Northeast Arctic cod, haddock, ling and Atlantic halibut. Fisheries of Northern shrimp have been more variable and shown no clear geographic trends. A “gold rush” fishery for scallops north of Svalbard lasted for about 10 years (1986–1995) only, and ended due to low profitably. These results are discussed in relation to the possibility of further northward extension of fisheries subjected to climate change.

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Greenland's bed topography is a primary control on ice flow, grounding line migration, calving dynamics and subglacial drainage. Moreover, fjord bathymetry regulates the penetration of warm Atlantic Water (AW) that rapidly melts and undercuts Greenland's marine-terminating glaciers. Here, we present a new compilation of Greenland bed topography that assimilates seafloor bathymetry and ice thickness data through a mass conservation (MC) approach. A new 150-m horizontal resolution bed topography/ bathymetric map of Greenland is constructed with seamless transitions at the ice/ocean interface, yielding major improvements over previous datasets, particularly in the marine-terminating sectors of northwest and southeast Greenland. Our map reveals the total sea level potential of the Greenland Ice Sheet is 7.42±0.05 m, which is 7 cm greater than previous estimates. Furthermore, it explains recent calving front response of numerous outlet glaciers and reveals new pathways by which AW can access glaciers with marine-based basins, thereby highlighting sectors of Greenland that are most vulnerable to future oceanic forcing.

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A reconstruction of Holocene sea ice conditions in the Fram Strait provides insight into the palaeoenvironmental and palaeoceanographic development of this climate sensitive area during the past 8500 years BP. Organic geochemical analyses of sediment cores from eastern and western Fram Strait enable the identification of variations in the ice coverage that can be linked to changes in the oceanic (and atmospheric) circulation system. By means of the sea ice proxy IP25, phytoplankton-derived biomarkers and ice rafted detritus (IRD) increasing sea ice occurrences are traced along the western continental margin of Spitsbergen throughout the Holocene, which supports previous palaeoenvironmental reconstructions that document a general cooling. A further significant ice advance during

the Neoglacial is accompanied by distinct sea ice fluctuations, which point to short-term perturbations in either the Atlantic Water advection or Arctic Water outflow at this site. At the continental shelf of East Greenland, the general Holocene cooling, however, seems to be less pronounced and sea ice conditions remained rather stable. Here, a major Neoglacial increase in sea ice coverage did not occur before 1000 years BP. Phytoplankton-IP25 indices ("PIP25-Index") are used for more explicit sea ice estimates and display a Mid Holocene shift from a minor sea ice coverage to stable ice margin conditions in eastern Fram Strait, while the inner East Greenland shelf experienced less severe to marginal sea ice occurrences throughout the entire Holocene.

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Fridtjovbreen, Svalbard, is a partially tidewater-terminating glacier that started a 7-year surge during the 1990s. Flow peaked during 1996 and no surge front was apparent. We use two pre-surge (1969 and 1990) and a post-surge (2005) digital elevation models (DEMs) together with a bed DEM to quantify volume changes and iceberg calving during the surge, calculate the changes in glacier hypsometry, and investigate the surge trigger. Between 1969 and 1990, the glacier lost 5% of its volume, retreated 530 m and thinned by up to 60 m in the lower elevations while thickening by up to 20 m in its higher elevations. During the surge, the reservoir zone thinned by up to 118 m and the receiving zone thickened by ~140 m. Fridtjovbreen's ice divide moved ~500 m, incorporating extra ice into its catchment. Despite this volume gain, during 1990– 2005 the glacier lost ~ 10% of its volume through iceberg calving and 7% through surface melt. The surge occurred in a climate of decreasing overall ice volume, so we need to revise the notion that surging is triggered by a return to an original geometry, and we suggest Fridtjovbreen's surge was triggered by increasing shear stresses primarily caused by increases in surface slope.

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I årene 1838?1840, altså nu for 100 år siden, blev naturforholdene på Svalbard. i Nordishavet, i Finnmarken, til dels også i Nordland, i det nordligste Sverige og i Finnland samt på Fær? yene og Island gjort til gjenstand for omfattende unders?kelser av en stort anlagt fransk ekspedisjon.

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We compare satellite altimetry from the Ice, Cloud, and Land Elevation Satellite (ICESat, 2003–2007) to older topographic maps and digital elevation models (1965–1990) to calculate long-term elevation changes of glaciers on the Svalbard Archipelago. Results indicate significant thinning at most glacier fronts with either slight thinning or thickening in the accumulation areas, except for glaciers that surged which show thickening in the ablation area and thinning in the accumulation areas. The most negative geodetic balances occur in the south and on glaciers that have surged, while the least negative balances occur in the northeast and on glaciers in the quiescent phase of a surge cycle. Geodetic balances are related to latitude and to the dynamical behavior of the glacier. The average volume change rate over the past 40 years for Svalbard, excluding Austfonna and Kvitøya is estimated to be −9.71 ± 0.55 km3 yr−1 or −0.36 ± 0.02 m yr−1 w. equivalent, for an annual contribution to global sea level rise of 0.026 mm yr−1 sea level equivalent.

Nweeia, M. T., et al. (2014). "Sensory ability in the narwhal tooth organ system." The Anatomical Record 297(4): 599–617.
The erupted tusk of the narwhal exhibits sensory ability. The hypothesized sensory pathway begins with ocean water entering through cementum channels to a network of patent dentinal tubules extending from the dentinocementum junction to the inner pulpal wall. Circumpulpal sensory structures then signal pulpal nerves terminating near the base of the tusk. The maxillary division of the fifth cranial nerve then transmits this sensory information to the brain. This sensory pathway was first described in published results of patent dentinal tubules, and evidence from dissection of tusk nerve connection via the maxillary division of the fifth cranial nerve to the brain. New evidence presented here indicates that the patent dentinal tubules communicate with open channels through a porous cementum from the ocean environment. The ability of pulpal tissue to react to external stimuli is supported by immunohistochemical detection of neuronal markers in the pulp and gene expression of pulpal sensory nerve tissue. Final confirmation of sensory ability is demonstrated by significant changes in heart rate when alternating solutions of high-salt and fresh water are exposed to the external tusk surface. Additional supporting information for function includes new observations of dentinal tubule networks evident in unerupted tusks, female erupted tusks, and vestigial teeth. New findings of sexual foraging divergence documented by stable isotope and fatty acid results add to the discussion of the functional significance of the narwhal tusk. The combined evidence suggests multiple tusk functions may have driven the tooth organ system's evolutionary development and persistence. Anat Rec, 297:599–617, 2014. © 2014 Wiley Periodicals, Inc.

Obbard, R. W. (2018). "Microplastics in Polar Regions: The role of long range transport." Current Opinion in Environmental Science & Health 1: 24-29.
Microplastics (particles <5 mm) pose a threat to the marine ecosystem that is disproportionate to their tiny size. They have been found in high numbers in sea water and sediments, and are interacting with organisms and the environment in a variety of ways. Recently their presence has been confirmed in Polar water, sediment, and sea ice. We review the recent literature on microplastic distribution and transport in marine environments, primarily in the Northern Hemisphere, summarize current understanding, identify gaps in understanding, and suggest future research priorities.

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Microplastics (MP) are recognized as a growing environmental hazard and have been identified as far as the remote Polar Regions, with particularly high concentrations of microplastics in sea ice. Little is known regarding the horizontal variability of MP within sea ice and how the underlying water body affects MP composition during sea ice growth. Here we show that sea ice MP has no uniform polymer composition and that, depending on the growth region and drift paths of the sea ice, unique MP patterns can be observed in different sea ice horizons. Thus even in remote regions such as the Arctic Ocean, certain MP indicate the presence

of localized sources. Increasing exploitation of Arctic resources will likely lead to a higher MP load in the Arctic sea ice and will enhance the release of MP in the areas of strong seasonal sea ice melt and the outflow gateways.

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Pohlman, J. W., et al. (2017). "Enhanced CO2 uptake at a shallow Arctic Ocean seep field overwhelms the positive warming potential of emitted methane." Proceedings of the National Academy of Sciences.
Continued warming of the Arctic Ocean in coming decades is projected to trigger the release of teragrams (1 Tg = 106 tons) of methane from thawing subsea permafrost on shallow continental shelves and dissociation of methane hydrate on upper continental slopes. On the shallow shelves (<100 m water depth), methane released from the seafloor may reach the atmosphere and potentially amplify global warming. On the other hand, biological uptake of carbon dioxide (CO2) has the potential to offset the positive warming potential of emitted methane, a process that has not received detailed consideration for these settings. Continuous sea-air gas flux data collected over a shallow ebullitive methane seep field on the Svalbard margin reveal atmospheric CO2 uptake rates (−33,300 ± 7,900 μmol m−2·d−1) twice that of surrounding waters and ~1,900 times greater than the diffusive sea-air methane efflux (17.3 ± 4.8 μmol m−2·d−1). The negative radiative forcing expected from this CO2 uptake is up to 231 times greater than the positive radiative forcing from the methane emissions. Surface water characteristics (e.g., high dissolved oxygen, high pH, and enrichment of 13C in CO2) indicate that upwelling of cold, nutrient-rich water from near the seafloor accompanies methane emissions and stimulates CO2 consumption by photosynthesizing phytoplankton. These findings challenge the widely held perception that areas characterized by shallow-water methane seeps and/or strongly elevated sea-air methane flux always increase the global atmospheric greenhouse gas burden.

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The Arctic is becoming warmer at a high rate, and contractions in the extent of sea ice are currently changing the habitats of marine top-predators dependent on ice. Polar bears (Ursus maritimus) depend on sea ice for hunting seals. For these top-predators, longer ice-free seasons are hypothesized to force the bears to hunt for alternative terrestrial food, such as eggs from colonial breeding birds. We analyzed time-series of polar bear observations at four locations on Spitsbergen (Svalbard) and one in east Greenland. Summer occurrence of polar bears, measured as the probability of encountering bears and the number of days with bear presence, has increased significantly from the 1970/80s to the present. The shifts in polar bear occurrence coincided with trends for shorter sea ice seasons and less sea ice during the spring in the study area. This resulted in a strong inverse relationship between the probability of bear encounters on land and the length of the sea ice season. Within, 10 years after their first appearance on land, polar bears had advanced their arrival dates by almost 30 days. Direct observations of nest predation showed that polar bears may severely affect reproductive success of the barnacle goose (Branta leucopsis), common eider (Somateria mollissima) and glaucous gull (Larus hyperboreus). Nest predation was strongest in years when the polar bears arrived well before hatch, with more than 90% of all nests being predated. The results are similar to findings from Canada, and large-scale processes, such as climate and subsequent habitat changes, are pinpointed as the most likely drivers in various parts of the Arctic. We suggest that the increasing, earlier appearance of bears on land in summer reflects behavioral adaptations by a small segment of the population to cope with a reduced hunting range on sea ice. This exemplifies how behavioral adaptations may contribute to the cascading effects of climate change.

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The development of tourism is a significant aspect of the processes of modernity in the High Arctic. This article discusses

the British art historian and mountaineer Sir William Martin Conway's two travelogues, The First Crossing of Spitsbergen (1897) and With Ski and Sledge over Arctic Glaciers (1898), in terms of a pioneering tourist approach to the archipelago of Svalbard. Unlike earlier yachting tourists, Conway described a journey into the uncharted interior of the main island, Spitsbergen. His books are therefore narrated as exploration accounts and following many of the demands of that genre, such as an emphasis on mapping, natural science and being the first. However, they may also be read as guidebooks for other discerning and undaunted British gentleman travellers. Inspired by the art critic John Ruskin's "science of aspects", which combined accurate scientific observations and practical knowledge with an imaginative and aesthetic response to the landscape, Conway attempts to give his readers a positive sense of the qualities of the Arctic. At the same time, he promotes Svalbard as an Arctic "Playground of Europe", where adventurous Alpinists in addition to climbing unknown mountains and glaciers could find fraternal domesticity far away from home around the hearth of the campfire. In this way Conway locates natural beauty, life and recreational opportunities where travellers before him had only described desolation and death.

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The black-legged kittiwake (Rissa tridactyla) is a pelagic seabird whose population has recently declined in most parts of the North Atlantic, and which is red-listed in most bordering countries. In order to investigate a possible cause for this decline, we analysed the population dynamics of five kittiwake colonies along the Norwegian coast, ranging from 62° to 71° N, over the last 20–35 years. By quantifying the importance of sea surface temperatures (SST) in relevant areas of the North Atlantic, we tested the importance of climatic conditions throughout the populations' annual cycles. We found no synchrony among colonies; however, SSTs affected population dynamics, explaining between 6% and 37% (average 18%) of the variation in annual population growth rate. While dynamics of the southerly colonies were mainly affected by winter conditions in the Grand Banks area, dynamics of the northernmost colonies were dominated by autumn conditions off Svalbard. Negative slopes indicated stronger population decline under warmer ocean conditions. Population dynamics were affected both via adult survival and offspring recruitment, as evidenced by the presence of unlagged effects as well as effects lagged by the age at recruitment. Finally, we performed population viability analyses taking into account the projected warming trends for the future. The median time to extinction of the Norwegian colonies was 52–181 years without

considering covariates; 45–94 years when considering the effects of SST but ignoring future warming; and 10–48 years when ocean warming, based on a "business as usual" scenario, was taken into account.

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Plastic debris is ingested by hundreds of species of organisms, from zooplankton to baleen whales, but how such a diversity of consumers can mistake plastic for their natural prey is largely unknown. The sensory mechanisms underlying plastic detection and consumption have rarely been examined within the context of sensory signals driving marine food web dynamics. We demonstrate experimentally that marine-seasoned microplastics produce a dimethyl sulfide (DMS) signature that is also a keystone odorant for natural trophic interactions. We further demonstrate a positive relationship between DMS responsiveness and plastic ingestion frequency using procellariiform seabirds as a model taxonomic group. Together, these results suggest that plastic debris emits the scent of a marine infochemical, creating an olfactory trap for susceptible marine wildlife.%U http://advances.sciencemag.org/content/advances/2/11/e1600395.full.pdf

Schaefer, J. M., et al. (2016). "Greenland was nearly ice-free for extended periods during the Pleistocene." Nature 540(7632): 252–255.

The Greenland Ice Sheet (GIS) contains the equivalent of 7.4 metres of global sea-level rise1. Its stability in our warming climate is therefore a pressing concern. However, the sparse proxy evidence of the palaeo-stability of the GIS means that its history is controversial (compare refs 2 and 3 to ref. 4). Here we show that Greenland was deglaciated for extended periods during the Pleistocene epoch (from 2.6 million years ago to 11,700 years ago), based on new measurements of cosmic-ray-produced beryllium and aluminium isotopes (10Be and 26Al) in a bedrock core from beneath an ice core near the GIS summit. Models indicate that when this bedrock site is ice-free, any remaining ice is concentrated in the eastern Greenland highlands and the GIS is reduced to less than ten per cent of its current volume. Our results narrow the spectrum of possible GIS histories: the longest period of stability of the present ice sheet that is consistent with the measurements is 1.1 million years, assuming that this was preceded by more than 280,000 years of ice-free conditions. Other scenarios, in which Greenland was ice-free during any or all Pleistocene interglacials, may be more realistic. Our observations are incompatible with most existing model simulations that present a continuously existing Pleistocene GIS. Future simulations of the GIS should take into account that Greenland was nearly ice-free for extended periods under Pleistocene climate forcing.

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Senger, K., et al. (2014). "Late Mesozoic magmatism in Svalbard: A review." Earth-Science Reviews 139(Supplement C): 123–144.

Late Mesozoic mafic igneous rocks are widespread across the Arctic region, and are collectively referred to as the High Arctic Large Igneous Province (HALIP). In Svalbard the HALIP is represented by the Diabasodden Suite, an extensive system of predominantly basic intrusive doleritic rocks. Associated lava flows are exposed on the far east of the archipelago. Two main igneous centres have been proposed: (1) Central Spitsbergen and (2) the eastern Svalbard dolerite belt, spanning Hinlopenstretet and the islands of Edgeøya and Barentsøya. Offshore seismic and magnetic data suggest a link between the Svalbard and Franz Joseph Land igneous exposures. Intrusions occur predominantly as sills, up to 100m thick and laterally continuous for up to 30km. Dykes are present locally, and range in thickness from <10m up to 100m. A compilation of published geochemical data reveals that the vast majority of samples have a basaltic geochemical signature. Comparison to HALIP rocks elsewhere in the Arctic, including paleotectonic reconstructions, suggests that the Diabasodden Suite formed as part of an intra-plate basaltic complex originating from a source near the Alpha Ridge. Apart from Late Mesozoic magmatism, Svalbard has also experienced magmatic activity both before and after the intrusion of the Diabasodden Suite dolerites. These are distinguished on the basis of their geochemical signature and timing. Timing of the Diabasodden Suite magmatism is currently poorly constrained. More than 130 radiometric (Ar–Ar and K–Ar) ages have been published, with a wide range of ages (ca. 75–145Ma). Modern radiometric dating (U–Pb) on three samples suggests a shorter-lived intrusion pulse at ca. 124.5Ma (i.e. early Aptian). While much work has been conducted on the Diabasodden Suite in the past, a detailed synthesis of this widespread unit is presently missing. In this contribution we discuss the current knowledge on the Diabasodden Suite, synthesizing and reviewing the past studies as well as pointing out possible future research directions.

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Hundrevis av kratre på havbunnen i Barentshavet forteller om store utblåsninger i fortiden. Forskerne tror de gjenværende gassfylte haugene kan lide samme skjebne innen rimelig tid.

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Stempniewicz, L., et al. (2014). "Unusual hunting and feeding behaviour of polar bears on Spitsbergen." Polar Record 50(02): 216-219.
ABSTRACT Prolonged chasing of an adult reindeer (Rangifer tarandus) by a polar bear (Ursus maritimus) was observed both on land and in the sea, in Magdalenefjorden, northwest Spitsbergen. Polar bears were also observed catching black guillemot (Cepphus grylle) in the sea in northwest Spitsbergen and feeding on chicks in the arctic tern (Sterna paradisea) colony in Hornsund, southwest Spitsbergen. While feeding on seabird species is unsurprising, the prolonged chasing of adult reindeer is unusual for polar bear hunting behaviour. The few documented cases of polar bear hunting reindeer consist of either surprising and killing resting/sleeping prey or stalking and a short rapid chase of the reindeer. Our observations describe new feeding habits of polar bears that may be in response to decreasing seal availability due to shrinking sea-ice cover in the Arctic.

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Die Hydrodynamik des Föhns und die "lokalen Winde" in Spitzbergen. Veröffentlichungen des Deutschen Obsevatoriums Ebeltofthafen-Spitzbergen. H. Hergesell. Lindenberg. Siebentes Heft: 15+12.

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van Sebille, E., et al. (2012). "Origin, dynamics and evolution of ocean garbage patches from observed surface drifters." Environmental Research Letters 7(4): 1-6.
Much of the debris in the near-surface ocean collects in so-called garbage patches where, due to convergence of the surface flow, the debris is trapped for decades to millennia. Until now, studies modelling the pathways of surface marine debris have not included release from coasts or factored in the possibilities that release concentrations vary with region or that pathways may include seasonal cycles. Here, we use observational data from the Global Drifter Program in a particle-trajectory tracer approach that includes the seasonal cycle to study the fate of marine debris in the open ocean from coastal regions around the world on interannual to centennial timescales. We find that six major garbage patches emerge, one in each of the five subtropical basins and one previously unreported patch in the Barents Sea. The evolution of each of the six patches is markedly different. With the exception of the North Pacific, all patches are much more dispersive than expected from linear ocean circulation theory, suggesting that on centennial timescales the different basins are much better connected than previously thought and that inter-ocean exchanges play a large role in the spreading of marine debris. This study suggests that, over multi-millennial timescales, a significant amount of the debris released outside of the North Atlantic will eventually end up in the North Pacific patch, the main attractor of global marine debris.

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Viering, K. (2017). Wie geht es den Eisbären wirklich? Spektrum - Die Woche. Heidelberg. 31: 6.

Eisbären gelten als Symboltiere für die negativen Folgen des Klimawandels. Während einige Bestände tatsächlich schon schrumpfen, können sich andere aber noch behaupten – wahrscheinlich, weil sie ihre Ernährung umgestellt haben.

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Walker, T. R., et al. (1997). "Marine debris surveys at Bird Island, South Georgia 1990–1995." Marine Pollution Bulletin 34(1): 61-65.

The Antarctic marine environment has relatively few direct sources of man-made marine debris; however, there is concern over the dangers posed to wildlife by increasing amounts of such debris. Between 1990 and 1995 beached debris was monitored at Bird Island, South Georgia. This was part of a programme developed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to monitor compliance with waste disposal under MARPOL and the effectiveness of additional regulations to reduce entanglement of marine mammals and birds. Overall, and in all but one year, the highest incidence of debris occurred during the winter months when 75% of all items were collected. The most numerous category overall (76%), and in all samples since 1991, was pieces of synthetic line as used in the long-line fishery for the Patagonian toothfish Dissostichus eleginoides around South Georgia. Packaging bands (6%) and polythene bags (6%) were the next commonest items. There was a substantial increase in the number of items found ashore in 1995 which coincided with an apparent increase in the long-line fishing effort in the area. The increase in the incidence of synthetic line found ashore corresponds to the increase in the proportion of Antarctic fur seal Arctocephalus gazella entangled in this material at South Georgia in a parallel study. An increasing use of environmentally-aware scientific observers on all fishing vessels, leading to an increased awareness of existing legislation, should result in less man-made debris entering the marine environment in the area around South Georgia.

Wang, Q.-L., et al. (2015). "Fractal analysis of polar bear hairs." Thermal Science 19(suppl. 1): 143-144.

Hairs of a polar bear (Ursus maritimus) are of superior properties such as the excellent thermal protection. Why do polar bears can resist such cold environ- ment? The paper concludes that its fractal porosity plays an important role, and its fractal dimensions are very close to the golden mean, 1.618, revealing the possible optimal structure of polar bear hair.

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Weyprecht, K. (1879). Die Metamorphosen des Polareises. Die österreichisch-ungarische Arktische Expedition 1872-1874. Wien, Moritz Perles.

Whiteman, J. P., et al. (2015). "Summer declines in activity and body temperature offer polar bears limited energy savings." Science 349(6245): 295-298.
Polar bears (Ursus maritimus) summer on the sea ice or, where it melts, on shore. Although the physiology of “ice” bears in summer is unknown, “shore” bears purportedly minimize energy losses by entering a hibernation-like state when deprived of food. Such a strategy could partially compensate for the loss of on-ice foraging opportunities caused by climate change. However, here we report gradual, moderate declines in activity and body temperature of both shore and ice bears in summer, resembling energy expenditures typical of fasting, nonhibernating mammals. Also, we found that to avoid unsustainable heat loss while swimming, bears employed unusual heterothermy of the body core. Thus, although well adapted to seasonal ice melt, polar bears appear susceptible to deleterious declines in body condition during the lengthening period of summer food deprivation.

Wilder, J. M., et al. "Polar bear attacks on humans: Implications of a changing climate." Wildlife Society Bulletin: .
Understanding causes of polar bear (Ursus maritimus) attacks on humans is critical to ensuring both human safety and polar bear conservation. Although considerable attention has been focused on understanding black (U. americanus) and grizzly (U.

arctos) bear conflicts with humans, there have been few attempts to systematically collect, analyze, and interpret available information on human–polar bear conflicts across their range. To help fill this knowledge gap, a database was developed (Polar Bear–Human Information Management System [PBHIMS]) to facilitate the range-wide collection and analysis of human–polar bear conflict data. We populated the PBHIMS with data collected throughout the polar bear range, analyzed polar bear attacks on people, and found that reported attacks have been extremely rare. From 1870–2014, we documented 73 attacks by wild polar bears, distributed among the 5 polar bear Range States (Canada, Greenland, Norway, Russia, and United States), which resulted in 20 human fatalities and 63 human injuries. We found that nutritionally stressed adult male polar bears were the most likely to pose threats to human safety. Attacks by adult females were rare, and most were attributed to defense of cubs. We judged that bears acted as a predator in most attacks, and that nearly all attacks involved ≤2 people. Increased concern for both human and bear safety is warranted in light of predictions of increased numbers of nutritionally stressed bears spending longer amounts of time on land near people because of the loss of their sea ice habitat. Improved conflict investigation is needed to collect accurate and relevant data and communicate accurate bear safety messages and mitigation strategies to the public. With better information, people can take proactive measures in polar bear habitat to ensure their safety and prevent conflicts with polar bears. This work represents an important first step towards improving our understanding of factors influencing human–polar bear conflicts. Continued collection and analysis of range-wide data on interactions and conflicts will help increase human safety and ensure the conservation of polar bears for future generations. © 2017 The Wildlife Society.

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Ziaja, W. and K. Ostafin (2015). "Landscape–seascape dynamics in the isthmus between Sørkapp Land and the rest of Spitsbergen: Will a new big Arctic island form?" AMBIO 44(4): 332–342.
Transformation of the glaciated isthmus between Sørkapp Land and the rest of Spitsbergen since 1900 is described. The landscape–seascape dynamics depends on the glacial recession determined by climate warming after the Little Ice Age (i.e., since

the beginning of the twentieth century, and especially since the 1980s). The isthmus has been narrowed from 28 km in 1899–1900 to 6.2 km in 2013, and lowered by 60–200 m from 1936 to 2005. Two isthmus' glaciers will have melted, given the current thermic conditions, by 2030–2035. It cannot be ruled out that Sørkapp Land will become an island after that period, because the altitude of the glaciers' bedrock is close to the sea level. The disappearance of this huge ice mass, even without origin of a sound and island, will lead to a great transformation of the landscape and the ecosystem.