

Review

A Review of Circumpolar Arctic Marine Mammal Health—A Call to Action in a Time of Rapid Environmental Change

Ashley Barratclough ^{1,*}, Steven H. Ferguson ² , Christian Lydersen ³, Peter O. Thomas ⁴ and Kit M. Kovacs ³

¹ National Marine Mammal Foundation, 2240 Shelter Island Drive, San Diego, CA 92106, USA

² Arctic Aquatic Research Division, Fisheries and Oceans Canada, Winnipeg, MB R3T 2N6, Canada; steve.ferguson@dfo-mpo.gc.ca

³ Norwegian Polar Institute, Fram Centre, 9296 Tromsø, Norway; christian.lydersen@npolar.no (C.L.); kit.kovacs@npolar.no (K.M.K.)

⁴ Marine Mammal Commission, 4340 East-West Highway, Room 700, Bethesda, MD 20814, USA; pthomas@mmc.gov

* Correspondence: ashley.barratclough@nmmf.org; Tel.: +1-813-938-9166

Abstract: The impacts of climate change on the health of marine mammals are increasingly being recognised. Given the rapid rate of environmental change in the Arctic, the potential ramifications on the health of marine mammals in this region are a particular concern. There are eleven endemic Arctic marine mammal species (AMMs) comprising three cetaceans, seven pinnipeds, and the polar bear (*Ursus maritimus*). All of these species are dependent on sea ice for survival, particularly those requiring ice for breeding. As air and water temperatures increase, additional species previously non-resident in Arctic waters are extending their ranges northward, leading to greater species overlaps and a concomitant increased risk of disease transmission. In this study, we review the literature documenting disease presence in Arctic marine mammals to understand the current causes of morbidity and mortality in these species and forecast future disease issues. Our review highlights potential pathogen occurrence in a changing Arctic environment, discussing surveillance methods for 35 specific pathogens, identifying risk factors associated with these diseases, as well as making recommendations for future monitoring for emerging pathogens. Several of the pathogens discussed have the potential to cause unusual mortality events in AMMs. *Brucella*, morbillivirus, influenza A virus, and *Toxoplasma gondii* are all of concern, particularly with the relative naivety of the immune systems of endemic Arctic species. There is a clear need for increased surveillance to understand baseline disease levels and address the gravity of the predicted impacts of climate change on marine mammal species.

Keywords: *Brucella*; cetaceans; emerging infectious diseases; influenza A virus; morbillivirus; pinnipeds; polar bear; seals; *Toxoplasma gondii*; whales



Citation: Barratclough, A.; Ferguson, S.H.; Lydersen, C.; Thomas, P.O.; Kovacs, K.M. A Review of Circumpolar Arctic Marine Mammal Health—A Call to Action in a Time of Rapid Environmental Change. *Pathogens* **2023**, *12*, 937. <https://doi.org/10.3390/pathogens12070937>

Academic Editor: Tung Phan

Received: 13 April 2023

Revised: 26 June 2023

Accepted: 12 July 2023

Published: 14 July 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Environmental change resulting from climate warming is well documented, particularly in the Arctic, where increases in air and water temperatures and concomitant reductions in sea ice have been dramatic over recent decades [1]. These physical changes to the environment have the potential to impact the health of Arctic marine mammals (AMM) [2–5]. Reductions in the extent, seasonal duration of coverage, and thickness of sea ice can have direct consequences on marine mammals by impacting mating, offspring rearing, and foraging, as well as habitat availability and ultimately species distributions and abundances [6–10]. Similar to other animals in the Arctic, AMMs are highly specialised to deal with both high levels of interannual variation and what are for many other species harsh environmental conditions [11]. These specialised adaptations to unique

Arctic environments have resulted in relatively low species diversity, which in turn leads to modestly simple food webs and also minimal interspecific competition [2]. As K-selected species, AAM reproductive rates are slow, limiting their rates of population growth or recovery [12,13]. Additionally, they have had limited exposure to diseases because of the harsh environment and little contact with broad-ranging species. Ecosystem disruptions such as the major habitat changes currently taking place in the Arctic can precipitate an increase in disease in wildlife through shifts in individual immunity and pathogen evolution and transmission [14–18]. Individual susceptibility to disease and the ability of species to adapt to the changing environmental conditions will ultimately influence their long-term survival [19–21].

Potential emerging health concerns in AMMs that could be driven by climate change are plentiful. One of the biggest risks to AMMs is the naiveté of these populations to pathogen exposure and their subsequent limited immunity. Emerging infectious diseases in naïve populations can result in rapid population declines [22]. The migration of temperate species into the Arctic could result in the arrival of novel pathogens, for example phocine distemper virus or cetacean morbillivirus, which could result in widespread morbidity and mortality. AMMs should be monitored for emerging health concerns, but the challenges are significant because of their remoteness, the extreme environmental conditions, and their dispersal over vast areas. Major mortality events could go undetected in many AMM populations. Baseline serologic data could provide documentation of the presence or absence of disease as well as allowing for the monitoring of increases or decreases in disease exposure or prevalence. Biological health assessment data such as serum biochemistry have been published for several AMMs, providing baseline data for “normal” values for these species [23–29]. Other biomarkers such as haptoglobin and cortisol have also been measured in ringed seals (*Pusa hispida*), narwhals (*Monodon monoceros*), and white whales (*Delphinapterus leucas*) [30–32]. Monitoring of current health and mortality trends in the 11 endemic Arctic species is essential to determine health status and to detect change [33]. An interdisciplinary approach combining longitudinal health data from citizen science observations (including indigenous hunters), governmental research programs, and international scientific collaborations could be employed to achieve a holistic approach to wildlife health monitoring and successful species conservation [34].

Health cannot be defined purely from an absence of disease. Holistic assessments need to encompass behaviour, movement, and reproduction, as well as physical and psychological wellbeing [35]. Such assessments are challenging to perform on free-ranging marine mammals; post-mortem examinations are often the only available proxy to assess marine mammal health in many species [16,36,37]. Mortalities of marine mammals above expected rates or in abnormal circumstances are referred to as unusual mortality events (UMEs) [38]. While mass mortalities in terrestrial mammals can be observed relatively easily in most species, marine mammal carcasses often go undetected because of sinking. Additionally, in the case of AMMs, detections are challenging even if carcasses wash ashore, since human populations in Arctic areas are small and not widely distributed, and polar bears (*Ursus maritimus*) and other scavengers patrol coastal areas for carrion [39]. A lack of basic data on population size, reproduction, and mortality makes confirming UMEs challenging. Despite these challenges, several recent UMEs have been detected in the Pacific Arctic. A Pacific walrus (*Odobenus rosmarus*) UME was declared in 2011, predominantly consisting of calves with unusual ulcerated skin lesions leading to the case definition of “Pacific walrus ulcerative dermatitis syndrome”; however, environmental factors and underlying pathogens were not determined [40]. An ice-seal UME from 2011–2016 included ringed, bearded (*Erignathus barbatus*), ribbon (*Histriophoca fasciata*), and spotted seals (*Phoca largha*) predominantly in northwestern Alaska with at least 657 recorded deaths (<https://www.fisheries.noaa.gov/alaska/marine-life-distress/diseased-ice-seals-and-unusual-mortality-events>, accessed on 12 December 2022). The seals had skin lesions, and the histopathological findings included hepatic abnormalities including lymphoplasmacytic hepatitis and lobular necrosis, bronchopneumonia, *Otostrongylus circumlitus*, and mild myocardia necrosis [41]. Clinically,

in the ringed seal cases, where blood sampling was possible, bilirubin and alanine transaminase (ALT) were elevated in comparison to published baseline values, confirming hepatic pathology. However, despite extensive investigations, including ruling out pathogens such as poxvirus, herpesvirus, papillomavirus, morbillivirus, and calicivirus, the underlying cause of the UME was not determined [41]. Cases were documented from Alaska to Canada and Russia, indicating this was not an isolated incident within a small subpopulation [42]. Starting in June 2018, a second UME has been declared in Alaska involving stranded ice seals, with 368 seals found dead as of 07 January 2022 [43]. Similar to the first UME, the underlying cause has not yet been determined (<https://www.fisheries.noaa.gov/> accessed on 5 November 2022).

A recent UME involving cetaceans has also been documented, on a much smaller scale, involving bowhead whales (*Balaena mysticetus*) in the eastern Canada–west Greenland stock, with eleven whales found dead in a seven month period beginning October 2020 [44]. The causes of death are unknown, in part because of limited access to be able to perform necropsies. Although the number of carcasses found to date is relatively small, it is extremely unusual to find a cluster of dead bowhead whales. Another cetacean-related UME has also been declared for grey whales (*Eschrichtius robustus*). While grey whales are not a species endemic to the Arctic, their summer migration does extend into Conservation of Arctic Flora and Fauna (CAFF) Arctic boundaries. Since January 2019, 133 dead grey whales have been found in Alaska. The cause of the mortality is unknown, but many whales were in a poor body condition with a few considered to be emaciated (<https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2023-gray-whale-unusual-mortality-event-along-west-coast-and#gray-whale-strandings> (accessed on 14 March 2023)) [45].

The lack of baseline monitoring data on health and disease in AMMs limits our ability to predict or assess the outcome of a changing climate on their health status. However, we can extrapolate from the available literature on other species and from model predictions to make recommendations for sampling approaches in the future to fill data gaps [46]. The focus of this review is primarily on the 11 AMMs, as identified by Conservation of Arctic Flora and Fauna (CAFF), namely three cetaceans (narwhal, white whales, bowhead whale), seven pinnipeds (bearded, harp (*Pagophilus groenlandicus*), hooded (*Cystophora cristata*), ribbon, ringed, and spotted seals, and walruses, as well as the polar bear. In addition, the harbour seal (*Phoca vitulina*; [47]), grey seal (*Halichoerus grypus*; [48]) and harbour porpoise (*Phocoena phocoena*), which generally have more temperate distributions, are included because they have populations that reside within the CAFF boundaries. Additionally, some attention is devoted to migratory whales that are increasingly occurring in some Arctic areas [49–53] because of the risk they pose regarding disease transmission to AMMs [54]. The species include blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), grey, humpback (*Megaptera novaeangliae*), killer (*Orcinus orca*), sperm (*Physeter macrocephalus*), minke (*Balaenoptera actinoptera*), and northern bottlenose (*Hyperoodon ampullatus*) whales and white-beaked dolphins (*Lagenorhynchus albirostris*) [52,55–59].

This review highlights: (1) the presence of disease documented in AMMs; (2) the risk factors associated with these diseases and emerging infectious diseases; (3) trends in disease transmission (where possible); and (4) recommendations for future monitoring, taking into account the hotspots of marine mammal aggregation identified in Hamilton et al. (2022) [60].

2. Materials and Methods

Searches were conducted in the peer-reviewed published literature and in governmental reports for the 23 marine mammal species identified above for the following topics: climate change, AMM health and pathology. In addition, key words for 35 possible pathogens that might impact AMMs were searched for independently and in conjunction with each species. Finally, the literature cited in the articles and book chapters found through the above searches was examined. Where appropriate, the PRISMA guidelines (Preferred

Reporting Items for Systematic Reviews and Meta-Analyses) were followed for protocol, search strategy, and risk of bias assessment [61]. The influences of toxins or contaminants on AMM health were not included in this study. The St Lawrence Estuary white whale stock (which is found south of the CAFF Arctic boundaries) did not receive focussed attention because contaminants played such a major role in earlier health issues for this southern population [62,63]. Non-infectious causes of disease and direct anthropogenic effects on health such as Arctic industrial development, increased shipping traffic resulting in trauma, or increased fishing practices increasing entanglements are only briefly summarised herein as contributors to cumulative impacts, because other recent publications address these causes of mortality in relation to climate change [64–68].

3. Results

Pathogens were reviewed according to their classification as bacterial, fungal, parasitic, protozoal, and viral agents. The 35 pathogens that were assessed to be of particularly high relevance to the selected marine mammal species are listed in Supplementary Table S1. All these pathogens can infect all AMMs (unless specifically stated otherwise).

3.1. Bacteria

Improved and new diagnostic techniques such as PCR (polymerase chain reaction) are improving bacterial detection methods, and genomic sequencing is now enabling bacterial characterisation. The primary challenge in the assessment of the potential impacts of bacteria on AMMs is determining whether their presence is pathogenic or if they are normal commensals. Below, the most clinically relevant bacterial diseases for potential impacts for AMMs are reported.

3.1.1. *Brucella*

Brucella is a Gram-negative coccobacillus, which is known to cause abortion and infertility in livestock. *Brucella* has been reported in marine mammals, where it can cause sporadic late-term foetal-loss in cetaceans [69–73]. *Brucella ceti* and *B. pinnipedialis* are emerging concerns in marine mammal populations around the world, with the two different strains being observed in cetaceans and pinnipeds, respectively. *B. pinnipedialis* appears to be endemic within many seal populations with minimal pathological effects observed [74,75]. *Brucella* is of particular concern in already at-risk species due to its potential to cause reproductive failure [76]. *Brucella* can be transmitted through contact with an infected individual via respiratory exposure through damaged mucosa or via skin as well as through the ingestion of infected material or transmission through copulation or lactation [77]. Increased densities of animals, for example through a reduction in haul-out sites or the size of breeding areas, resulting in closer contact between individuals, could result in increased transmission of *Brucella*. Recent suggestions of lungworms carrying *Brucella* spp. could provide another route of transmission to AMMs through the consumption of intermediate host fish species [78–80]. Clinical signs in addition to abortion are primarily neurological symptoms with meningitis, meningoencephalitis, choroiditis, and abnormal cerebrospinal fluid (CSF) noted upon post-mortem examination [81,82].

The detection of *Brucella* is undertaken via isolation or PCR from tissue samples post-mortem or via blood sampling from live individuals and serum screening via competitive ELISA [83–85]. Isolation and characterization remain the gold standard. Extensive research has been conducted to identify the best methods to detect *Brucella* isolates, with an emphasis on sequence-base approaches, namely MLVA (multiple locus variable-number tandem repeats analysis), MLSA (multi-locus sequence analysis), SNP (single nucleotide polymorphisms)-typing, and whole-genome analysis [76].

In the Arctic, polar bears have been confirmed to be positive for *Brucella* spp. with a prevalence of 5.4% of anti-*Brucella* antibodies in a recent study screening 297 bears from Svalbard and the Barents Sea and in a study in the southern Beaufort Sea, showing a seroprevalence of 10% [86–88]. Evidence of reproductive disorders attributed to *Brucella*

in these populations has not been documented [86]. Polar bear blood samples from the southern Beaufort Sea ($N = 139$) were tested for exposure to *Brucella*, which increased with time through the data series and was 2.5 times less likely for more terrestrial bears in their sample compared to bears that spent more time on the sea ice [89]. Sera from several Arctic seals have also been found to be positive for *Brucella*, with the following prevalences: hooded seals (35%); harp seals (2%); and ringed seals (10%) [90–92]. Given that seals are an important food source for polar bears, this is the most likely route of transmission for polar bears [90]. In a longitudinal study sampling harbour seals in southeast Alaska from 1976–1999, 46% were found to have antibodies to *Brucella* with antibody prevalence increasing with age [93]. Similarly, *Brucella* was isolated from bearded seals in Svalbard and Alaska [83,94] and in Baltic ringed seals [95], and anti-*Brucella* antibodies have been detected in Atlantic walruses [75,96]. In cetaceans, antibodies for *Brucella* have been found in minke whales (8 %) and fin whales (11%) [90]. White whales in Svalbard and in the Russian Arctic have also been found to be positive for *Brucella* antibodies [97]. A serological screening of white whales from Bristol Bay and the Chukchi Sea confirmed the presence of *Brucella* antibodies, indicating widespread exposure to the bacteria. However, the low level of rtPCR and lack of positive culture results demonstrated that clinical Brucellosis was not prevalent in Alaska [98,99]. Blood samples from 339 narwhal samples between 1984 and 2003 confirmed antibody presence to *Brucella* [100]. However, currently there are no reports of mortality attributed to this bacterium.

Brucella is more frequently reported from temperate climates; however, this could be due to higher levels of monitoring rather than higher prevalence [82,101–103]. Nevertheless, obtaining baseline *Brucella* levels in AMMs is important to determine if levels increase in the future, particularly if climate change is favourable to *Brucella* [74]. *Brucella* is a primary emerging pathogen of concern for bowhead whales as it has not been confirmed previously in this species despite being confirmed in other mysticetes [104]. Community monitoring of marine mammals has increased the reporting of *Brucella* in apparently healthy seals harvested for human consumption [100].

3.1.2. *Leptospira*

Leptospira are a group of zoonotic spirochaete bacteria that have over 200 serotypes described worldwide. Transmission likely occurs through compromised mucous membranes via cuts or wet skin with subsequent dissemination into the bloodstream. In marine mammals, *Leptospira pomona* has been documented in northern fur seals (*Callorhinus ursinus*) in the Bering Sea and in California sea lions (*Zalophus californianus*) as well as in northern elephant seals (*Mirounga angustirostris*) along the coast of California. [105–109]. Since 1970, *L. pomona* has caused both epizootic and enzootic disease in California sea lions [110]. Clinical signs include lethargy, anorexia, polydipsia, reproductive failure, and renal disease. Diagnosis can be via culture of kidney or urine post-mortem, PCR, or direct immunofluorescence on fresh kidneys and urine, or blood samples can be used to assess serum antibody titres. In the Arctic, serology of a small number of bowhead whales has demonstrated a lack of antibodies for *Leptospira interrogans* [111].

Currently, the temperate climate favoured by *Leptospira* appears to be limiting the spread of this parasite into the Arctic. In cattle, leptospirosis is most common in late summer, which is correlated with an increase in mean air temperatures [112]. A recent study of livestock in the Russian Arctic has documented 808 cases of this bacteria between 2000 and 2019 in subarctic and Arctic regions [113]. In sea lions, there appears to be a seasonal prevalence pattern, but it is unclear if this is associated with their migratory behaviour or the environmental temperature. However, this is a pathogen whose emergence should be monitored within AMMs [114]. A single bearded seal has been reported with a low titre of 100 to *L. interrogans* in Alaska, and walruses from Alaska have also been found to have *Leptospira* antibodies [115].

3.1.3. *Coxiella burnetii*

Coxiella burnetii is a small Gram-negative intracellular bacterium that is the causative agent of Q fever. This zoonotic bacterium can cause flu-like symptoms as well as gastrointestinal symptoms in humans [116]. Despite a wide host range, domestic livestock (sheep, cattle, and goats) are most commonly affected, with weak newborns and abortion or stillbirths being the most common clinical signs. Reports in marine mammals are rare but do exist, as shown by positive serology in sea otters (*Enhydra lutris*), harbour seals, and northern fur seals and the detection of *Coxiella* sp in placenta by PCR in harbour seals, northern fur seals, harbour porpoise, and Steller sea lions [117–121]. Cold Arctic air temperatures have likely limited the spread of Q fever, but it has been documented in cattle in Greenland and is therefore worth further investigation as temperatures in the Arctic continue to warm [122,123].

3.1.4. *Vibrio parahaemolyticus* (Vp)

Vp is a Gram-negative bacterium found in marine environments, which has predominantly been studied because of its association with the consumption of raw seafood and gastroenteritis in humans [124]. This organism only proliferates in water of temperatures >15 °C, so its presence in the Arctic has been considered to be an indicator of climate change [125]. It is also an emerging source of infection in the Baltic Sea associated with warming water temperatures [126,127]. The State of Alaska has been screening oysters for Vp since 1995. However, it has only been detected since the summer of 2004 when the first human outbreak of Vp gastroenteritis occurred in southeastern Alaska. Detection is carried out via culture in trypticase soy agar with 5% sheep blood at 35 °C for 24 h with identification via Vitek 32. Pulsed field gel electrophoresis can further characterise the isolates. While Vp has been detected in Alaskan sea otters, harbour porpoises, and white whales, these were an incidental findings and did not appear to have caused significant pathology in any of the infections reported [125]. Studies of the prevalence of *Vibrio* in free-ranging harbour seals off the California coast from 2007–2011 found 29% of animals to be infected [128]. Currently, there are no reports of Vp in the Arctic; the most northerly observations are reported from southern Alaska. However, this bacterium has been highlighted as a potential public health risk due to the likelihood of increased prevalence in association with a warmer climate [129].

3.1.5. *Streptococcus*

Beta-haemolytic streptococci are one of the most frequently isolated bacteria across all species of marine mammals [130]. Between 2007 and 2012, 1696 marine mammal carcasses (cetacean, pinniped, and sea otter) were screened for the presence of *Streptococcus phocae* in Arctic Canada and the northeastern Pacific [131]. Lung tissue was most frequently positive culture, with 47 of 186 positive cases cultured from the lung. Infection appeared to be opportunistic rather than the cause of death and might be primarily an indication of an underlying pathology. A single case report exists of a uterine infection (pyometra) in a spotted seal harvested by subsistence hunting in Alaska where *S. phocae* was isolated [132]. Streptococcal infections are unlikely to be linked directly to climate change, but the prevalence of infection should be monitored as an indication of overall health status across all AMMs.

Recently, *Streptococcus lutetiensis* (of the *Streptococcus bovis/equinus* complex) and *Streptococcus phocae*, known as “Strep syndrome”, have been the cause of significant morbidity and mortality in sea otters in Alaska [133]. Additional research is needed, but initial findings demonstrate it is possible that sea otter susceptibility to “Strep syndrome” could be associated with previous *Phocine distemper virus* infection and subsequent possible immunosuppression [134,135].

3.1.6. *Erysipelothrix rhusiopathiae*

Erysipelothrix rhusiopathiae is a Gram-positive bacterium that can present in two forms in cetaceans; a classic dermatological presentation or acute septicaemia, which is often fatal [136,137]. Diagnosis can be via tissue, direct PCR, culture, or via serology. While the disease has been found worldwide and can exist in soil for weeks, it has not been reported commonly in the Arctic, suggesting that cold temperatures may be a limiting factor. However, recently (August 2012), an unusual mortality event in muskoxen (*Ovibos moschatus wardi*) in the Canadian Arctic occurred with *E. rhusiopathiae* [138], demonstrating that this bacteria now occurs in the Arctic and might make its way into the marine environment in the north. Recent reports have documented low levels of prevalence of *Erysipelothrix rhusiopathiae* around the UK in bottlenose dolphins, harbour porpoises, and common dolphins ($n = 7/1127$) [139], and there was a large scale mortality event in 2021 involving the deaths of 190 harbour porpoises in the Netherlands [140]. To determine any potential increase in incidence, particularly in relation to climate change, it is necessary to continue screening, as routine bacteriology detects most cases even in the absence of gross lesions.

3.1.7. *Pasteurella*

Pasteurella multocida and *Mannheimia hemolytica* from the Gammaproteobacteria family are important pathogens in domestic livestock due to their contribution to Bovine respiratory disease, which can cause high morbidity and mortality in cattle [141,142]. Both pathogens have been isolated in cases of septicaemia and mortality in marine mammals [143]. Most members of this family are opportunistic pathogens residing on the mucosal surfaces of healthy individuals. Colonization in compromised individuals occurs primarily within the respiratory tract [144,145]. Diagnosis is possible using multiple methods including bacterial isolation and identification, PCR, and serological tests [146]. As it is primarily an opportunistic pathogen in debilitated individuals rather than highly infectious and transmissible, it is unlikely to cause mass mortality events in AMMs. However, if warming temperatures allow the extension of domestic livestock into the Arctic, then *Pasteurella* would be an example of a pathogen that could be transmitted to wildlife.

3.1.8. Mycobacteria

Mycobacteria are acid-fast, Gram-positive bacteria in the genus *Mycobacterium*, which are well known because they cause tuberculosis in humans and in other animals. The bacteria are aerobic, rod-shaped, and red in colour when stained with Ziehl–Neelsen, which enables their detection and diagnosis [147]. In marine mammals, *M. pinnipedii* causes tuberculosis in pinnipeds in other parts of the world such as the New Zealand sea lion (*Phocartos hookeri*) and can be detected and characterised by culture or PCR [148]. *M. abscessus* has been found to cause pneumonia in cetaceans [149]. Mycobacterial infections in seals are not uncommon in temperate climates [150]. Environmental exposure to non-tuberculosis-forming mycobacteria has been confirmed in free-ranging cetaceans with measurable titres reported, although widespread disease as a result of mycobacteria in marine mammals is rare [151]. *M. avium* of the subspecies *paratuberculosis*, which is the cause of Johne’s disease, has been detected in several herds of caribou (*Rangifer tarandus* spp.) in the Arctic. This demonstrates that the bacteria can survive within the Arctic, although it is infrequently reported in AMMs [145].

3.1.9. *Nocardia*

Nocardia species are Gram-positive facultative intracellular aerobic bacteria that are found ubiquitously in soil and water [152]. The most common presentations are systemic, with pyogranulomatous lesions in multiple organs, most commonly in the lungs. Detection is via culture and via haematoxylin and eosin and acid-fast staining of bacteria. With a 100% mortality rate in marine mammals, this pathogen is of concern [152–156]. However, to date, it has not been observed in the Arctic [154,157–160]. Ante-mortem diagnosis via sero-diagnostic testing remains challenging [161].

3.2. Fungi

More than 320 fungal organisms have been isolated in the Arctic, creating significant potential for fungal disease. However due to their temperate climate preference and the shortage of potential vectors, there are currently no reports of fungal disease as primary pathogens in AMMs [154,162]. Most fungal species that are known to affect marine mammals occur in human care situations, where *Candida albicans*, *Cryptococcus*, *Fusarium*, *Blastomyces*, *Zygomycetes*, and *Coccidioides* have been documented [145,163]. For fungal organisms inhabiting Polar Regions, the main vector of transmission is air [164]. *Aspergillus* is the primary fungal agent of concern because it can cause respiratory infections in cetaceans, and it is an indicator of systemic immunosuppression [154]. It has been diagnosed in both captive and free-ranging cetaceans as far north as Scotland [165,166]. *A. fumigatus* produces a mycotoxin that causes immunosuppression, which in turn increases host susceptibility to other pathogens. Marine strains of *A. fumigatus* have been found in free-ranging cetaceans along with morbilliviruses [165,167,168]. Clinical presentation is frequently abnormal neurological signs and respiratory infection. Accurate serological tests are still being developed. Diagnosis can be via culture but caution should be taken because this organism is present in the environment [163]. No reports currently exist for *A. fumigatus* in AMMs. As fungal diseases in marine mammals can present as opportunistic infections or as indicators of underlying health concerns, an increase in the prevalence of fungal disease could indicate declining health within a population.

3.3. Parasites

Most AMM parasites live within their hosts, although some few ectoparasites do manage to survive on marine mammals. The most common endoparasites in AMMs are helminth parasites, which are commensals to their host and usually do not cause health issues. However, large burdens of parasites can have negative effects either directly or indirectly [169]. Previously benign parasites can become pathogenic in a susceptible host, affecting health and immune status. Studies in the Arctic to date suggest that the influence of climate change on Arctic host–parasite systems will likely favour the parasites rather than the hosts [170,171]. Here, the parasites of primary concern to AMMs and those of potential emerging disease importance are reviewed.

3.3.1. *Trichinella*

Trichinella is a genus of roundworms that can cause zoonotic disease, particularly in the Arctic where transmission to humans can occur from the consumption of raw meat, resulting in serious gastrointestinal symptoms [172–176]. *Trichinella* has been diagnosed in several Arctic species dating back to the 1940s, including walruses in Greenland [177–179] and killer whales in Pond Inlet, Canada [180]. Historically, microscopic examination of polar bear diaphragm and masseter muscles has found infection rates of *Trichinella* as high as 58% (n = 364) [181]. More recently, low levels have been reported in polar bears assayed for antibodies against *Trichinella* spp. [182,183]. Interestingly, surveys of bearded seals (n = 84) and ringed seals (n = 252) have shown only negative results [181]. Broader screening should be conducted to identifying which AMMs carry high levels of *Trichinella* from a subsistence-hunting zoonotic perspective [180,184].

3.3.2. Trematodes

Trematodes are parasitic flatworms known as flukes within the subclass Digenea and can cause pathology in marine mammals, primarily affecting the liver and lungs of the host species. The hepatic fluke *Orthosplanchinus arcticus* has been described in ringed seals in Greenland [185] and in bearded seals in the Chukchi Sea [186]. In other species such as sea lions or common dolphins in California, trematode eggs from *Zalophotrema hepaticum* and *Campula rochebruni* have been found in the brain at necropsy with associated meningoencephalitis [187,188]. The lifecycle is not fully understood, but molluscs or fish are likely intermediate hosts. Diagnosis is predominantly post-mortem as an incidental

finding. Recently, faecal analysis has also confirmed the presence of eggs and larvae of trematodes in polar bears [183,189].

3.3.3. Cestodes

Tapeworms are extremely common in the intestinal tracts of AMMs, including those of bearded, harp, hooded, ringed, and harbour seals as well as walruses [186,190,191]; some few have larvae that migrate through the abdominal cavity (*Phyllobothrium*, *Monorygma*, *Polypocephalus*) [192]. Although they are common in seal intestines, they rarely cause pathology unless they occur at high enough burdens to block the intestinal lumen [193]. Clinical signs of heavy infestations are gastro-intestinally related and can include diarrhoea, anorexia, emaciation, and anaemia.

3.3.4. Acanthocephalans

Thorny-headed worms within the genus *Bolbosoma* have been found in cetacean intestines [194], and members of the genus *Corynosoma* have been found in northern fur seals and harbour seals in Alaska [195] as well as in other pinnipeds. As with other helminths parasites, a small load can occur in a commensal relationship, whereas a heavy load can be pathogenic. Heavy burdens of these species cause severe ulceration of the intestinal wall [196]. Cases have been reported in stranded cetaceans with obstructive loads of acanthocephalans; this seems to be secondary to malnutrition or poor overall health [194,197]. No acanthocephalans have been reported in polar bears. However, the recent increase in observed helminths in general in polar bears warrants continued monitoring [183,198,199].

3.3.5. Nematodes

Roundworms are the most diverse and numerous of the helminth parasites found in marine mammals with a wide range of adaptations resulting in more deleterious effects. Numerous roundworms have been documented in AMMs in the lungs of ringed seals [200], the stomachs of bearded seals [201], and in multiple organs in ribbon and spotted seals [202]. Common nematodes in AMMs include *Ascaroids* such as *Anisakis*, *Spirurids* such as *Crassicauda*, *Filaroids* such as *Acanthocheilonema*, hookworms such as *Uncinaria*, and *Metastrongyloids* (lungworms) such as *Otostrongylus circumlitus* [203–207]. Zoonotic *Anisakis* is well documented in both people and AMMs [208]. Lungworm has been reported in all AMM seals [200,202,209,210]. A report also exists of *Metastrongyloidea* found upon necropsy in narwhal, which were captured for public display in 1970 in northwest Canada [211]. With nematodes already prevalent within AMMs, there is the potential for numbers to increase if host susceptibility shifts because of climate change. Therefore, documentation of the presence (or absence) and quantity at necropsy is important.

3.3.6. Parasitic Arthropods

Few parasitic arthropods have been documented in AMMs due to the fact that most are intolerant of both cold environments and marine environments [212]. However, some parasitic arthropods do specialise on marine mammals, and a high burden of parasites can be indicative of underlying health concerns and lower immunity, which leaves the individual susceptible to parasitic infection. Thus, these organisms should be assessed in AMMs where possible. The seal louse (*Echinophthirius horridus*), for example, is one of the few insects that has successfully adapted to the marine environment [213]. The seal louse is itself not dangerous, but it is an intermediate host of seal heartworm *Dipetalonema spirocauda* and *Acanthocheilonema*, which are more likely to have deleterious effects on seal health [214]. Lice have been reported in harbour, grey, harp, and ringed seals and walruses; transmission likely occurs through physical contact among animals [212,215,216]. A nasal mite, *Halarachne halichoeri*, has been documented in spotted seals [217] as well as in walrus [218]. While Arctic seals have been exposed minimally to date, warming

temperatures could give rise to increased vector distribution, resulting in increased disease prevalence [219].

Whale lice, or cyamids (amphipods that are ectoparasites living on the skin of many whale species), are harmless to the host animal at normal levels, but large numbers can indicate underlying health concerns and low immunity [220]. From 1973 to 2015, 673 bowhead whales were examined for cyamids (*Cyamus ceti*) in Alaska, and they were found to be present at low abundances on 20% of the whales with fewer than 10 cyamids present on 95% of the whales [221]. Cyamid presence was found to be higher in the spring and autumn and in older or physically impaired individuals. In general, the number of cyamids counted has decreased over the last 35 years in Alaska. Unlike right whales (*Eubalaena* spp.) that have callosities that provide a mooring place for cyamids, the absence of callosities on bowhead whales means that cyamids are most often present only when damaged skin provides a place to attach [221]. Whale lice are also common on the other endemic Arctic whales; narwhal and white whale share the same two cyamids, *C. monodontis* and *C. nodosus* [220,222].

Another factor to consider with parasitic arthropods is their ability to transmit disease. For example, *Bartonella henselae* is an intravascular bacterium that is transmitted by arthropods. This organism has been diagnosed as contributing to the cause of death in a captive white whale, as well as being present in two of three tested hunter-harvested white whales [223].

Mange in black bears and other mammals is caused by the mite *Sarcoptes scabiei* [224]. It has not been reported in polar bears, most likely due to normal cold temperatures in this species range [225]. However, a recent study has confirmed *Francisella tularensis*—a bacterial infection—in polar bears in Alaska, which is transmitted through the bite of an arthropod vector [226]; the 13% positive seroprevalence in polar bears (n = 83) in this study demonstrates that there is a level of exposure to an unknown arthropod that was previously unrecognised. Expanding host ranges could result in the further expansion of parasites and potential spill-over into novel hosts.

3.4. Protozoan Parasites

Numerous protozoans infect marine mammals; these can range from normal biota, to host organisms, to pathogens. The primary concern regarding protozoal infections in marine mammals is mortality due to encephalitis, but in theory there is also a potential risk of reproductive failure. This review will focus on those protozoans deemed most important to AMMs.

3.4.1. *Toxoplasma gondii*

It is currently unknown how AMMs become infected with *Toxoplasma gondii* in the absence of direct contact with oocysts from infected felids (the definitive host). There is no known definitive host in the marine environment [227], though, theoretically, any marine mammal could be an intermediate host. Several studies have demonstrated seropositivity in Arctic species (narwhal, polar bear, ringed seals, and bearded seals) and PCR positive tissues [228–231]. The most likely route of infection is through the consumption of viable cysts in prey tissue, with differences in prey selection accounting for differences in prevalence between species and between the sexes within species [228,232]. The seroprevalence of 828 Arctic seals in Canada screened for *T. gondii* antibodies was 10.4% between 1999 and 2006 [233]. Terrestrial species are more likely to be infected; a recent serosurvey in Svalbard explored the prevalence in multiple species, finding a 43% positivity in Arctic foxes (*Vulpes lagopus*) followed by 7% in barnacle geese (*Branta leucopsis*) and 6% in walrus (*Odobenus rosmarus*) [234]. This study in Svalbard also demonstrated the potential for migratory birds to be a source of infection for *T. gondii* in AMMs and other species. Another recent publication hypothesised an alternative route of transmission through hydrological modelling [235]. Snowmelt runoff could be a new source of *T. gondii* infection for marine mammals and subsequently increase the risk of human infection via the consumption of uncooked meat.

The seroprevalence of *T. gondii* infection in polar bears in the western Hudson Bay has increased from 43.8% in the 1980s to 69.6% in 2015–2017 [236]. In this same study in Hudson Bay, it was also noted that there was a higher *T. gondii* seroprevalence following wetter summers. Polar bear blood samples from the southern Beaufort Sea (N = 139) tested for exposure to *T. gondii* showed that the seroprevalence increased with time through the data series [89]. The probability of polar bears being positive for *T. gondii* was seven times higher in individuals that spent more time on land compared to those that resided most of their time on sea ice.

Warmer water temperatures might play a role in the prolonged survival of oocysts of *T. gondii* in the future, increasing the risk of transport into the Arctic via north-flowing currents such as the North Atlantic Current or through marine invertebrate filter feeders [228]. White whales (n = 27) from Svalbard, Norway, were tested for *T. gondii* but were found to be negative [237], although antibodies have been detected in white whales in the Sea of Okhotsk [238]. Whilst *T. gondii* is currently a low mortality risk in the Arctic, an increased incidence could occur if the overall health of populations deteriorates. A recent study in harbour porpoise in Greenland demonstrated false-positive *T. gondii* results via a direct agglutination test, which was confirmed to be negative via ELISA and PCR. This indicates the need for caution when testing in AMMs, which are often rich in lipids, as this can lead to false-positive results from non-specific adherence to tachyzoites in the direct agglutination test [239,240]. From a human health perspective, there have been outbreaks documented in pregnant women in northern Quebec as well as high levels in wildlife harvested by Inuit communities in this region [241–243].

3.4.2. *Neospora caninum*

The presence of *N. caninum* antibodies was first reported in marine mammals in 2003 in sea otters, walruses, Californian sea lions, harbour seals, ringed seals, bearded seals, and bottlenose dolphins (*Tursiops truncatus*) [232]. In all of the tested species, the levels indicated exposure rather than active clinical infection. Dogs are the definitive hosts of *N. caninum*, making areas of the Arctic that are more populated at greater risk for transmission [244]. Clinically, *Neospora* is known to cause abortion in cattle and neurological disease in dogs [245,246]. No clinical reports of death due to *Neospora* have been confirmed in studies of this parasite in polar bears, but confirmation would require histopathology of the foetus to confirm the underlying cause of abortion. Such samples would be almost impossible to obtain [236]. Seropositivity for *N. caninum* has been confirmed in polar bears in human care and in the wild [247].

3.4.3. *Sarcocystis*

Sarcocystis neurona is an important cause of protozoal encephalitis in marine mammals. A wide range of marine mammal species have been confirmed to be affected along the west coast of the USA in addition to some marine mammals in human care [248,249]. Opossums (*Didelphis virginiana*) are the only known definitive host for *S. neurona* in the USA, although alternative hosts may exist in the Arctic [250–252]. Positive diagnosis is achieved via PCR assay with no clinical signs apparent in the majority of intermediate hosts. *S. neurona* can cause encephalomyelitis if the parasite migrates from the encysted muscle to the brain [253,254].

In polar bears, *Sarcocystis canis* is of primary concern [255]. *Fatal sarcocystosis* has been reported in captive polar bears in Anchorage [256], but currently it has not been documented in the wild. Temperature and a lack of intermediate hosts has likely prevented its spread in the Arctic. The life cycle of this parasite in bears is not fully understood [257]. Increased interaction between intermediate hosts such as domestic species and polar bears could increase the prevalence of *S. canis* in polar bears [257].

3.4.4. *Giardia*

Giardia is a widespread pathogen that is easily transmitted in water. *Giardia* infections in AMMs are well documented, with reports being obtained from both Alaska and the Canadian Arctic [258,259]. Of 31 ringed seals tested for *Giardia*, 64.5% were positive, and in 39 bowhead whales, 33% were positive [258]. Despite its widespread detection, clinical disease has not been associated with this pathogen. The zoonotic significance of *Giardia* warrants further monitoring, particularly in populated areas [260]. Recently, in beavers (*Castor canadensis*), climate change has facilitated a northern range expansion, which in turn has also shifted the range of *Giardia lamblia*, which is carried by beavers and has also been found in a wider range, increasing the risk of exposure to this parasite in previously unexposed Arctic species [129].

3.4.5. *Cryptosporidium*

Cryptosporidium is another ubiquitous protozoan parasite that is detected widely in marine mammals, but it does not appear to cause clinical disease. It has been isolated from the gastrointestinal tracts of ringed seals in Canada [261,262]. A potential pathway for infection is through environmental pollution with human and domestic animal faecal material [263].

3.4.6. *Eimeria*

Eimeria causes symptoms of bloody diarrhoea and emaciation in domestic livestock, but infections in marine mammals appear to be primarily incidental and of minimal clinical significance. The exception is in phocids, with harbour seals susceptible as definitive hosts to *E. phocae*; transmission most likely occurs at haul-out sites [264,265]. There is potential for an outbreak in the Arctic given that this protozoa can withstand cold conditions, and reduced habitats could induce higher densities of animals than the norm for species such as ringed and bearded seals and even terrestrial concentrations of some of the ice seals (see [266,267]).

3.5. Viruses

3.5.1. *Paramyxoviruses* (including Morbillivirus)

The emerging infectious disease risk of viruses is arguably of greatest concern to AMMs. Morbilliviruses are of primary concern, with phocine distemper virus (PDV) in pinnipeds and cetacean morbillivirus (CeMV) in cetaceans [268,269]. Both have been encountered in AMM species [270]. The monitoring of serum antibody titre levels is of primary importance to assess exposure levels, immunity, and significance as a possible cause of mortality.

Epizootics resulting in extensive mortality in pinniped species have been documented repeatedly and appear to play a role in regulation of population size in some species of marine mammals, with outbreaks occurring when populations approach carrying capacity [271,272]. Relatively, recent harbour seal (and some grey seal) epidemics in the North Sea in 1988 and 2004 were confirmed to be PDV [273]. The 16-year interval between outbreaks gave the North Sea population sufficient time to recover and reach carrying capacity again. In these outbreaks of PDV, the close proximity of grey and harbour seals was determined to be a primary factor in the disease transmission [273]. As the populations reach carrying capacity and are physically competing for haul-out space, the disease transmission rate is likely to increase [266,274].

The mass mortality of polar phocids due to viruses has been suspected as far back as the 1950s [275]. Sea ice declines could lead to increased crowding in haul-out areas, increasing the risk of both intra-specific and potentially even inter-specific transmission [266]. The population levels of Arctic pinnipeds in many regions are high enough to sustain PDV within populations [276]. Although it is unknown exactly what paradigm shifts could initiate the next PDV outbreak, warm temperatures and high population densities are hypothesised to be key factors [277]. The more solitary behaviour of spotted seals, their

avoidance of crowded haul-out sites, and close contact with conspecifics may reduce their disease susceptibility [278]. This could also explain why antibodies for PDV or CDV were absent in spotted seals screened between 1998 and 2008 [279]. Phocids demonstrate variable morbidity and mortality to PDV, with North Atlantic harbour seals seemingly being most susceptible to fatal PDV, with >53,000 dead in the 1988 and 2002 outbreaks [280]. However, susceptibility to infection is highest in harp seals (83% of 157) followed by ringed seals (41% of 259), with grey and hooded seals seemingly being less susceptible [270,281,282]. Although there is serological evidence of exposure in walruses in the eastern Canadian Arctic, there is currently no indication that they are susceptible to PDV [281,283].

From 1980 to 1994, a longitudinal study sampling for morbillivirus in grey seals and harbour seals on the east coast of North America found the prevalence of morbillivirus-neutralizing antibodies to be significantly higher in grey seals (73%) compared to harbour seals (37%) with phocine distemper virus as the predominant titre [284]. A 15-year study from 2001–2016 sampled 2530 live ice-associated seals (bearded, ribbon, ringed, and spotted), obtaining paired blood and nasal swabs where possible; for dead animals ($n = 165$), samples were obtained from tissues and blood [5]. This longitudinal dataset is an excellent example of establishing both baseline data and comparative trends over time. By performing serology, PCR, and sequencing for widespread viral exposure, it was determined that infection with PDV was present. A particularly significant finding in this study was the presence of PDV in the Pacific Northwest, with infection rates increasing as sea ice extent declined. This study suggests a link between climate change and the introduction of PDV in ice seals.

Clinical signs of morbillivirus infection in pinnipeds include a multitude of symptoms, including lethargy, head tremors, convulsions, and seizures, with impaired swimming and diving behaviour being the most obvious and advanced neurological signs. Clinically, phocids present with serous or mucopurulent ocular and nasal discharge coughing, mucosal cyanosis, pyrexia, and dyspnoea. Pregnant females may abort. In post-mortem examinations of pinnipeds with a suspected viral cause of death, the following organs should be sampled to facilitate screening for morbillivirus, herpes virus, influenza, or parainfluenza: brain, lungs, liver, kidneys, spleen, and lymph nodes [281].

Morbillivirus is also of significant concern in cetaceans, with mass mortalities of whales being recorded due to this viral infection [285]. Cetacean morbillivirus (CeMV) has three well-characterised strains: PMV—porpoise morbillivirus; DMV—dolphin morbillivirus; and PWMV—pilot whale morbillivirus [286]. A naïve endemic Arctic species without previous morbillivirus exposure could be susceptible to infection and a high epidemic risk that could result in significant mortality. Transmission is suspected to be through the inhalation of aerosolised virus, although vertical transmission from mothers to their offspring has also been documented [287]. Clinical signs can be associated with acute mortality or the chronic course of secondary infections and chronic encephalitis. Diagnosis is usually post-mortem via histology, virus isolation (the gold-standard), immunohistochemistry, RT-PCR, or serology [288]. Characteristic post-mortem findings include encephalitis, bronchointerstitial pneumonia, and lymphoid depletion. Blood samples from 339 narwhal samples taken from 1984–2003 confirmed antibody presence to morbillivirus [100]. The bowhead whale should be considered at risk given that morbillivirus has been observed in other mysticetes, though no confirmed reports of exposure or disease exist in bowhead whales at this time [289,290].

3.5.2. Influenza A Virus

Influenza A virus is a highly contagious virus of the *Orthomyxoviridae* family, which causes acute respiratory disease with high morbidity but low mortality in most species [291]. Serological monitoring has confirmed the presence of influenza A in the Canadian Arctic, with white whales and ringed seals being serologically positive; antibodies have also been confirmed in narwhal and bowhead whales [292,293]. In addition, influenza A antibodies have also been detected in white whales in Svalbard, Norway, and in Russia, though there are no reports of clinical disease [237].

The detection of influenza A antibodies is most often achieved through competitive ELISA (cELISA) using monoclonal antibodies against the influenza A nucleoprotein. In the Nielsen et al. (2001) study including samples from 1984–1998, the virus could not be isolated, and they postulated that infection was likely sporadic and self-limiting in the ringed seals and beluga. However, there have been mortality events associated with influenza A, with 425 harbour seal carcasses on the west coast of Sweden infected with influenza A subtype H10N7 [294]. Similarly, in the US in 2011, 162 New England harbour seals died due to the presence of H3N8 influenza A virus [295].

Highly pathogenic avian influenza (HPAI) virus H5N8 has been documented in harbour seals of the German North Sea coast in 2021 in conjunction with the high levels of avian influenza in wild birds in 2020/2021, with the likely route of transmission being through the oral uptake of contaminated bird faeces by seals [291,296]. Infected seals were primarily pups less than six months old clinically presenting with signs of pneumonia. Increasing reports of influenza A outbreaks in marine mammals are of particular concern due to the epizootic and zoonotic potentials of this virus [297–299]. In the subarctic, Northwest Atlantic grey seals have been shown to be potential reservoirs; therefore, the increased interaction of seal species in the same habitats could also result in increased viral transmission [300]. While a large-scale outbreak has not been reported in the Arctic as yet, it is possible that with climate-change-driven avian range expansions, cases could increase in the future. The current (2022–2023) HPAI (EA H5N1) has been documented in the Arctic in gulls in Svalbard [301,302]. This virus has also been detected in some terrestrial mammals including red fox (*Vulpes vulpes*), black bears (*Ursus americanus*), and Kodiak brown bears (*Ursus arctos middendorffi*) in Alaska [303].

3.5.3. Coronavirus

Isolated cases of coronavirus in live animals and in animals sampled post-mortem have been documented in bottlenose dolphins and in harbour seals [304,305]. In light of the global COVID-19 pandemic, increased screening has been conducted on marine mammals in human care and in free-ranging species. Currently, this virus is not of primary concern for mortality in marine mammals; however, it does present a potential risk to marine mammals should new more pathogenetic strains occur [306].

3.5.4. Calicivirus

The most commonly found *Caliciviridae* viruses in marine mammals are vesiviruses, which are strains of vesicular exanthema of swine virus (VESV) and include the San Miguel Sea Lion viruses (SMSV). Noroviruses also occur, which are similar to those found in oysters (which can affect humans). Clinical signs of the vesivirus in pinnipeds and cetaceans include epidermal vesicles [307], but lesions appear to heal without intervention. Serum samples from 21/36 harvested bowhead whales in Alaska were found to be positive by virus neutralization for antibodies to VESV and SMSV [308]. Low levels have been documented with seropositive bowhead whales [290]. Walrus faeces collected from sea ice in the Chukchi Sea were also found to test positive for three different calicivirus isolates, and antibodies were confirmed positive to varying calicivirus strains in 7/155 walrus blood samples [309,310]. Similarly, at St Lawrence Island and at Round Island, Alaska, 18% of walrus tested (7/40) showed serological responses to one or more calicivirus [105]. With low morbidity and mortality, calicivirus is deemed to be of little concern to AMMs.

3.5.5. Adenovirus

Adenovirus infection has been documented in both pinnipeds and cetaceans. The *Mastadenovirus* genus has a wide host range in marine mammals, with several documented cases occurring in rehabilitated California sea lions with viral hepatitis being the most common finding [311]. Despite high morbidity, mortality is low. Gastrointestinal samples from bowhead whales have been found to be positive [111]. However, in seropositive

bowhead whales, no histopathological lesions were observed [290]. Given that mortality risks due to adenovirus are low, it is currently of little concern.

3.5.6. Herpesvirus

Alpha and gamma herpesviruses have been detected worldwide in phocids and cetaceans, including species in the Arctic [312,313]. With their wide global distribution and circulation in many populations, latent infections are common in their hosts with reactivation during immunosuppression. Recent research has confirmed the role of herpesvirus in California sea lion cervical cancer [314]. Herpesvirus lesions in marine mammals have been documented to range from genital lesions to fatal herpesvirus encephalitis [315,316]. Phocid seals have been confirmed positive in the northern hemisphere and in the Arctic [317,318]. Mortality appears to be rare.

3.5.7. Papillomavirus

Papillomavirus can present in marine mammals as cutaneous, genital, or lingual warts. However, these viruses are generally regarded as both host- and site-restricted. Reports exist for papillomavirus in white whales, particularly those in the contaminated St Lawrence Estuary, narwhal, and killer whales [319–323]. The presence of papillomavirus rarely impacts health or causes widespread morbidity or mortality.

3.5.8. Poxvirus

Seal pox presents as single or coalescing nodules that are usually up to 2.5 cm in diameter with characteristic histopathology and confirmation of parapoxvirus particles upon electron microscopy [324]. While the disease itself is not fatal, it does reflect general immune status; widespread poxvirus lesions are likely associated with additional pathology [325]. For example, the immunosuppressive effects of morbillivirus can lead to poxvirus infections [326].

3.5.9. Rabies Viruse

Rabies is caused by the *Rhabdoviridae* virus and is spread through bites from an infected animal, with the Arctic fox being the most important viral reservoir in the Arctic [327]. Despite large numbers of marine mammals being tested for rabies, few positive cases have been reported; single positive cases exist for a polar bear and a ringed seal in Svalbard, Norway [328–330]. Brains are examined by standard or direct fluorescent antibody test (FAT) for confirmation, and RT-PCR can be used to characterise strains [328–330]. An increase in haul-out time or time on land due to climate change could result in an increased exposure of Arctic seals to rabies. Therefore, the detection of any unusual behaviours such as neurological disorders or abnormal locations of species should consider rabies as a possible cause.

3.6. Other Climate-Change-Related Health Stressors

Climate change is likely going to increase various other sources of stress, morbidity, and mortality in AMMs, adding to cumulative risks to their health. Sea ice reductions are increasing accessibility to active shipping lanes and commercial fishing, which could in turn cause anthropogenic trauma from vessel collisions, entanglements, or by-catch and gas embolism syndrome as well as competition for fishery resources being harvested [64,68,331,332]. Studies monitoring the effects of increased shipping activity on AMM health have observed increased cortisol levels in narwhals, suggesting stress [30]. Improved diagnostic testing of cortisol in baleen could also be used to assess cumulative stressors in bowhead whales [333]. Increased fishing and shipping in the Arctic will likely continue with the opening of the Northwest Passage and Northern Sea Route [334,335]. Increased High Arctic shipping could be a particular risk to the slow-swimming bowhead whales that seasonally surface-feed [336–339].

3.6.1. Interspecific and Intraspecific Trauma

Increasing species overlaps and reduced foraging habitats for AMMs might result in intraspecific and interspecific competition for resources. Climate change is already resulting in distributional shifts and altered species interactions, changing disease exposure and mortality risk [340]. For example, killer whales are spending longer time during the ice-free season in the Arctic, where they prey on ice-dependent cetaceans and other marine mammals, causing severe lesions and direct mortality [337,341–346]. Killer whales have been reported to disrupt narwhal habitat use, which could influence the behaviour and foraging efficiency of narwhal and also reduce population size through increased predation [347–350]. Similar habitat displacement by bowhead whales has been documented while attempting to minimise the risk of killer whale predation [343].

3.6.2. Freshwater Lesions

Changes in sea temperature and salinity have been observed in Arctic areas due to warming and concomitant impacts such as increases in glacial melt, freshwater runoff, rainfall, and changing ocean currents [351,352]. Recent research has documented negative effects of freshwater exposure in bottlenose dolphins, so it is possible that this will also have consequences for other marine mammals [353,354].

3.6.3. Ice Entrapments

Ice entrapments are a potential cause of mortality for species such as white whales [355] and narwhals [356] or migratory species that are unfamiliar with Arctic sea ice patterns, such as killer whales [357,358]. Rain-on-snow events, including ice tidal surges and winter precipitation, and severe storms can result in unreliable breathing holes due to rapid ice formation preventing breathing access [352,359] as well unfavourable conditions to construct birth lairs [360]. Delayed migrations due to unseasonably warmer weather could also result in entrapment because of unpredictable ice conditions [361]. Increased harvesting of narwhals has been reported in association with entrapments, with up to 629 harvested in a single event in 2008 [361].

3.6.4. Malnutrition

Malnutrition due to a lack of prey availability or increased energetic costs of finding food through increased foraging efforts or decreased energy contents in prey that are not traditional Arctic species could also have indirect effects on AMM health [9]. For example, polar cod (*Boreogadus saida*), a preferred prey species for ringed seals, is ice-dependent during its larval and juvenile stages. The reduction in sea ice availability is already impacting the abundance of this keystone species in some Arctic areas [362–364]. Years with little sea ice have been correlated with low body condition indices in adult female ringed seals and low reproductive success [365,366]. Novel methods of assessing blubber such as proteomics and blubber metabolomics could improve our understanding of the relationship of blubber depth to nutritional status and overall health [367–369]. Malnutrition could increase host susceptibility to all of the pathogens reviewed above [19].

3.6.5. Alopecia

Extensive hair loss in seals has been observed in the Arctic intermittently, including during the recent Arctic UMEs [41]. In neonates, extensive alopecia could be a genetic anomaly, whereas in older animals, it could result from an abnormal moult or opportunistic bacterial or fungal infection. Moult can be impaired by underlying pathologies in addition to stress or poor nutrition [370]. In addition, moult is also dependent upon access to ice platforms for haul-out, so abnormalities could be associated with climate change reducing ice availability [371,372].

3.6.6. Neoplasia

While neoplasia is generally a non-infectious disease, increased trends in this disease can be indicative of overall health status in AMMs. Sporadic reports exist in the literature of neoplasia in AMMs including pulmonary mast cell tumours in walruses [373], brainstem carcinoma in white whales [374], and adenocarcinoma in ringed seals [375]. In over 1800 cetaceans examined from 1973 to 1987 from stranding networks in the USA, the diagnosis of tumours was very low (14/1800), with fibromas being found to be most numerous [323]. Infectious agents and chemical exposure have been documented to increase carcinogenesis in some species [376–378]. The current lack of neoplasia in AMMs is interesting and should be monitored closely in the future for signs of increased occurrence [322]. White whales in the Gulf of St Lawrence have demonstrated higher-than-expected rates of neoplasia, most likely due to environmental contamination [379].

4. Discussion

Infectious-disease-induced mass mortality events are likely to increase in the Arctic as climate change proceeds, with particular risk from bacterial, protozoal, and viral disease vectors. *Brucella*, morbillivirus, Influenza A virus, and *T. gondii* are likely to pose the greatest risks to AMMs because they have the potential to cause high levels of mortality. These pathogens are already found in the Arctic and are likely to become more prevalent in the future when air and water temperatures become warmer and sea ice habitats are further reduced. The relative naiveté of endemic Arctic species to these disease vectors makes them a particular concern. In the recent ice-seal UME, peaks in mortality were noted in the summer, potentially linked to increases in temperature; however, further research is needed to determine the underlying cause (<https://www.fisheries.noaa.gov/> accessed on 5 November 2022).

Whilst many of the other pathogens highlighted in this review are likely of minimal concern to AMM morbidity and mortality independently, with climate change catalysts reducing body condition and resistance, they could act synergistically to result in deleterious health effects [380–382]. From a conservation perspective, understanding the epidemiology of disease in AMMs can aid in the allocation of resources and determine the capacity of monitoring required to effectively manage populations. Screening species for the presence of several pathogens simultaneously is likely the most efficient monitoring method moving forward [238]. Active sampling, such as blood sampling for serology titres, will allow the tracking of pathogen prevalence, particularly in the same populations over time. Table 1 provides some of the biological sampling options and pathogen analyses currently available.

A targeted assessment to determine climate change linkage with the pathophysiology of diseases in AMMs is required [383]. To achieve this, improved systematic monitoring to obtain baseline species information will be vital [383]. Stock assessments can be broadened to detect changing ranges, prey shifts, and health- or body-condition parameters [384], enabling the detection of changes associated with climate change [8], which can influence disease exposure. Establishing disease screenings for AMMs across regions will allow for an improved documentation of the current situation and will permit tracking trends in the future [8,94,385,386]. Marine mammal health (condition, population sizes, and disease status) is a good proxy for marine ecosystem health; the systematic monitoring of these sentinel species in the context of climate change has been recommended repeatedly by Arctic Council working groups (CAFF, AMAP, and PAME) as well as in the scientific literature [11,19,382,387,388]. Specific cases of climate change impacting marine mammal health have been documented involving North Atlantic right whales, Hawaiian monk seals (*Neomonachus schauinslandi*), and California sea lions [383]. But currently no disease studies in the Arctic, where environmental change has been greatest, are definitively linked to climate change, although sea ice declines have been proposed as causal agents of disease outbreaks with both direct and indirect effects expected for all AMM species [42,389,390].

Table 1. The primary pathogens of concern for each Arctic marine mammal group with the recommended sampling approach for pathogen detection. Key:  = cetacean,  = pinniped,  = polar bear. Abbreviations: PCR = polymerase chain reaction, cELISA = competitive enzyme linked immunosorbent assay, RT-PCR = reverse transcription PCR.

Pathogen	Primary Taxa of Concern	Live Animal Surveillance/Monitoring Method	Post-Mortem Organ/Tissue Collection	Sample Storage	Diagnostic Test
<i>Brucella</i>	  	Serum sample	Brain, lung, lymph node, placenta, testis	Frozen −80°	Serology, PCR, prolonged culture on Farrell's medium, immunohistochemistry
Influenza A virus		Nasal swab/rectal swab	Blood/tissue: lung, brain, lymph node	Frozen −80°	cELISA, agar gel immunodiffusion, virus isolation, PCR with sequencing
<i>Leptospira</i>		Serum, urine	Blood, kidney, urine	Cold storage	Serology—MAT culture, direct immunofluorescence. PCR cELISA
Morbillivirus	 	Serum	Blowhole swab, nasal swab, brain lung, lymph node	Frozen −80°	Virus neutralisation test Real-time PCR Virus isolation and sequencing
Mycobacterium	 	Serum	Lymph nodes, sputum, tubercles, swabs.	Frozen −80°	Ziehl–Neelsen staining, prolonged culture, PCR
Rabies virus		Serum	Whole brain (cerebellum, brain stem, hippocampus)	Fresh mounted tissue, fixed or in paraffin	Antigen fluorescent antibody test RT-PCR
<i>Toxoplasma gondii</i>	  	Faeces/EDTA whole blood/urine	Blood serum Fresh/frozen tissue	Ship cold mounted slides or frozen tissue	Modified agglutination test, serology, PCR

AMMs that spend some time on land will likely experience deleterious health effects most rapidly. We already know that prolonged land usage in polar bears subsequent to losses of sea ice has been associated with increased immune reactivity with greater total white blood cell counts as compared to bears that remain on sea ice over the summer period [359,391,392]. Onshore habitat use has also impacted polar bear faecal microbiota and has also increased their proximity to humans, and both factors could influence their pathogen exposure [393,394]. In addition to the aforementioned pathogens, polar bears are also at risk of canine pathogens, with previous serological testing finding positive titres to canine distemper virus, canine adenovirus, canine morbillivirus, and canine parvovirus in Canada [236,395]. Both Arctic seals that haul-out terrestrially and ice-associated AMMs when faced with a shortage of ice such that they are forced to use terrestrial environments could experience similar situations, with increasing contact with people and dogs and other typically more southerly species [266].

The vast areas with low human population densities in the Arctic make the monitoring and physical health assessment of AMMs challenging. Although it is possible for research programmes to target some pinnipeds and smaller cetaceans via live-capture health-assessment programmes, most health data from AMMs are likely to come from

subsistence-hunt monitoring. Successful collaborative health assessments can be managed by local communities, particularly those with traditional harvests of AMMs and concerns regarding zoonosis [396]. Carcass-recovery programmes for stranded or deceased marine mammals in the Arctic, where practical, would allow for the increased monitoring and surveillance of current disease states. Increased diagnostic testing of meat harvested for human consumption could also enable the monitoring of pathogen emergence [397]. Extensive health assessments have been performed on subsistence-hunted bowhead whales in Alaska in collaboration with indigenous communities, resulting in a rich health database [398–400]. The monitoring of even small-scale sports hunts, such as the ringed seals shot annually in Svalbard or walrus in Greenland and Canada, can provide an opportunity for health screening across age demographics [401,402]. Documentation of the presence or absence of pathology is imperative to establish baseline health information.

In addition to hands-on examinations, remote visual monitoring could potentially enhance the health monitoring of AMMs in the future. Observations that can inform health status could be achieved remotely, e.g., by drone use for collecting respiratory exudate, data on body condition, and rake marks [403–405]. Abnormal respirations can be indicative of lung disease, one of the primary pathologies in compromised marine mammals [145,406]. In pinnipeds, this may manifest as nasal discharge and can be apparent via visual monitoring; in cetaceans, mucous discharge can be harder to assess, though close proximity observations of an increase in mucous or odour can be indicative of lung pathology [407]. Body condition scores can be assessed remotely with drones using photogrammetry [403]. A decreasing body condition score can provide an indication of poor nutrition quality or prey availability or generally compromised individual health status [408,409].

Discussing the effects of contaminants on health status is beyond the scope of this review; however, contaminants should be considered in the context of consequences of multiple stressors on individual populations with documented deleterious additive effects in relation to population health status [19,410,411]. Recent publications exploring the immune status of walruses in Svalbard and the effects of contaminants on their health status demonstrate the complex interplay of factors and the need for directed scientific study to answer the question regarding the impact of climate change impact health [412,413]. Similarly, it is well documented that the poor health observed in the St Lawrence white whale population was primarily due to contaminants in this area some decades ago, and that when the environment was improved, white whale health also improved [379]. In pinnipeds, health concerns specific to Baltic ringed seals (and grey seals) include renal pathology, which is proposed to be due to high organochlorine pollution in this specific geographic area [414]. Populations with ongoing contaminant stressors could therefore be more susceptible to the impacts of climate change.

This review focussed on diseases and risks via pathogen classification, but analysis of the population-specific concerns is especially warranted for successful conservation management. For example, differences within species such as between migratory and non-migratory populations means they are subject to different disease risks, and thus health assessments need to be tailored accordingly while remaining general enough to allow for circumpolar comparisons [238,283,415,416]. A coordinated disease surveillance approach could include community-based monitoring, systematic health data collection, and analysis for specified species and locations, along with longitudinal data on oceanographic conditions such as ice cover, temperature, salinity, and chemistry from regional or global observing systems. These data could be combined with ecological studies of AMMs to enable the development of an environmentally focussed AMM health map [388,417]. Advances in modelling approaches to predict species movements as the sea ice shifts will be key to predicting disease epidemics [418]. Many of the diseases discussed as potential pathogens that could cause AMM morbidity and mortality are zoonotic [419]. A decrease in AMM population numbers or increased disease status could impact subsistence hunting and indigenous lifestyles. With the reliance on marine mammals for local human communities, it is important from a One Health perspective that an interdisciplinary approach

is taken to monitor marine mammal health. Monitoring AMM health is vital to good conservation and management.

5. Conclusions

Sea ice declines and concomitant changes in ocean temperatures could be a critical catalyst in the emergence of infectious diseases in AMMs. Recent publications on climate change and marine mammal health demonstrate the gravity of the impact of changes in the environment on marine mammals [50,383,420,421]. Unfortunately, the lack of systematic monitoring for disease has resulted in knowledge gaps regarding the implications for the health status of AMMs. Pathogens of concern are likely going to vary according to species; however, viral pathogens such as morbillivirus appear to represent the greatest disease and mortality risks to AMMs. Bacterial pathogens, such as *Brucella*, are likely going to expand their geographic ranges as migratory species expand northward, increasingly overlapping with AMMs. The gap in knowledge between available baseline data and predicted outcomes in association with climate change needs to be filled by a systematic interdisciplinary approach to facilitate the effective conservation of AMMs. This review highlights methods for monitoring important potential pathogens and identifies which species to prioritise in the establishment of health assessment programmes, creating a map to monitor AMM health.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/pathogens12070937/s1>, Table S1: Index list of 35 pathogens included in this review.

Author Contributions: K.M.K. and C.L. wrote the grant that funded the study. A.B. conducted the initial literature search and manuscript drafting. All authors (A.B., S.H.F., P.O.T., C.L., K.M.K.) provided valuable inputs to the manuscript and approved the final version. All authors have read and agreed to the published version of the manuscript.

Funding: The Norwegian Ministry of Climate and Environment, Norway, provided the funding for this study via an Arctic Council support grant (Conservation of Arctic Flora and Fauna—CAFF).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: Discussions within the CAFF marine mammal network stimulated the review. Funding for this study was provided by the Norwegian Government—Arctic Council Grants Programme (to K.M.K. and C.L.). This is scientific contribution 356 from the National Marine Mammal Foundation.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Meredith, M.; Sommerkorn, M.; Cassota, S.; Derksen, C.; Ekaykin, A.; Hollowed, A.; Kofinas, G.; Mackintosh, A.; Melbourne-Thomas, J.; Muelbert, M.M.C. Polar regions. In *IPCC Special Report on the Ocean & Cryosphere in a Changing Climate*; Chapter 3; IPCC: Geneva, Switzerland, 2019; pp. 1–173. Available online: https://repository.library.noaa.gov/view/noaa/27411/noaa_27411_DS1.pdf (accessed on 22 September 2022).
2. Kovacs, K.M.; Lydersen, C. Climate change impacts on seals and whales in the North Atlantic Arctic and adjacent shelf seas. *Sci. Prog.* **2008**, *91*, 117–150. [[CrossRef](#)] [[PubMed](#)]
3. Wassmann, P.; Duarte, C.M.; Agusti, S.; Sejr, M.K. Footprints of climate change in the Arctic marine ecosystem. *Glob. Chang. Biol.* **2011**, *17*, 1235–1249. [[CrossRef](#)]
4. Box, J.E.; Colgan, W.T.; Christensen, T.R.; Schmidt, N.M.; Lund, M.; Parmentier, F.-J.W.; Brown, R.; Bhatt, U.S.; Euskirchen, E.S.; Romanovsky, V.E.; et al. Key indicators of Arctic climate change: 1971–2017. *Environ. Res. Lett.* **2019**, *14*, 045010. [[CrossRef](#)]
5. VanWormer, E.; Mazet, J.A.K.; Hall, A.; Gill, V.A.; Boveng, P.L.; London, J.M.; Gelatt, T.; Fadely, B.S.; Lander, M.E.; Sterling, J.; et al. Viral emergence in marine mammals in the North Pacific may be linked to Arctic sea ice reduction. *Sci. Rep.* **2019**, *9*, 15569. [[CrossRef](#)]

6. Ding, Q.; Schweiger, A.; L'Heureux, M.; Battisti, D.S.; Po-Chedley, S.; Johnson, N.C.; Blanchard-Wrigglesworth, E.; Harnos, K.; Zhang, Q.; Eastman, R. Influence of high-latitude atmospheric circulation changes on summertime Arctic sea ice. *Nat. Clim. Chang.* **2017**, *7*, 289–295. [\[CrossRef\]](#)
7. Moore, S.E.; Huntington, H.P. Arctic marine mammals and climate change: Impacts and resilience. *Ecol. Appl.* **2008**, *18*, S157–S165. [\[CrossRef\]](#)
8. Laidre, K.L.; Stern, H.; Kovacs, K.M.; Lowry, L.; Moore, S.E.; Regehr, E.V.; Ferguson, S.H.; Wiig, Ø.; Boveng, P.; Angliss, R.P.; et al. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. *Conserv. Biol.* **2015**, *29*, 724–737. [\[CrossRef\]](#)
9. Hamilton, C.D.; Lydersen, C.; Ims, R.A.; Kovacs, K.M. Predictions replaced by facts: A keystone species' behavioural responses to declining arctic sea-ice. *Biol. Lett.* **2015**, *11*, 20150803. [\[CrossRef\]](#)
10. Silber, G.K.; Lettrich, M.D.; Thomas, P.O.; Baker, J.D.; Baumgartner, M.; Becker, E.A.; Boveng, P.; Dick, D.M.; Fiechter, J.; Forcada, J.; et al. Projecting marine mammal distribution in a changing climate. *Front. Mar. Sci.* **2017**, *4*, 413. [\[CrossRef\]](#)
11. Kovacs, K.M.; Lydersen, C.; Overland, J.E.; Moore, S.E. Impacts of changing sea-ice conditions on Arctic marine mammals. *Mar. Biodiv.* **2011**, *41*, 181–194. [\[CrossRef\]](#)
12. Ferguson, S.H.; Higdon, J.W. How seals divide up the world: Environment, life history, and conservation. *Oecologia* **2006**, *150*, 318–329. [\[CrossRef\]](#)
13. Ferguson, S.H.; Higdon, J.W. Grouping world cetaceans according to life-history characteristics indicates two divergent strategies. *Can. Wildl. Biol. Manag.* **2013**, *2*, 51–66. Available online: <https://cwbm.ca/wp-content/uploads/2016/04/2-Vol-2-Issue-2-Ferguson-and-Higdon.pdf> (accessed on 18 September 2022).
14. Harvell, C.D.; Kim, K.; Burkholder, J.M.; Colwell, R.R.; Epstein, P.R.; Grimes, D.J.; Hofmann, E.E.; Lipp, E.K.; Osterhaus, A.; Overstreet, R.M.; et al. Emerging marine diseases—Climate links and anthropogenic factors. *Science* **1999**, *285*, 1505–1510. [\[CrossRef\]](#)
15. Harvell, D.; Altizer, S.; Cattadori, I.M.; Harrington, L.; Weil, E. Climate change and wildlife diseases: When does the host matter the most? *Ecology* **2009**, *90*, 912–920. [\[CrossRef\]](#)
16. Gulland, F.M.D.; Hall, A.J. Is marine mammal health deteriorating? Trends in the global reporting of marine mammal disease. *EcoHealth* **2007**, *4*, 135–150. [\[CrossRef\]](#)
17. Desforges, J.-P.W.; Sonne, C.; Levin, M.; Siebert, U.; De Guise, S.; Dietz, R. Immunotoxic effects of environmental pollutants in marine mammals. *Environ. Int.* **2016**, *86*, 126–139. [\[CrossRef\]](#)
18. Jenssen, B.M.; Villanger, G.D.; Gabrielsen, K.M.; Bytingsvik, J.; Bechshoft, T.; Ciesielski, T.M.; Sonne, C.; Dietz, R. Anthropogenic flank attack on polar bears: Interacting consequences of climate warming and pollutant exposure. *Front. Ecol. Evol.* **2015**, *3*, 16. [\[CrossRef\]](#)
19. Burek, K.A.; Gulland, F.M.D.; O'Hara, T.M. Effects of climate change on Arctic marine mammal health. *Ecol. Appl.* **2008**, *18*, 126–134. [\[CrossRef\]](#) [\[PubMed\]](#)
20. Venn-Watson, S. Opportunistic Pathogens of Marine Mammals. In *The Rasputin Effect: When Commensals & Symbionts Become Parasitic*; Hurst, C.J., Ed.; Springer: Cham, Switzerland, 2016; Volume 3, pp. 127–143.
21. Acevedo-Whitehouse, K.; Gulland, F.; Greig, D.; Amos, W. Disease susceptibility in California sea lions. *Nature* **2003**, *422*, 35. [\[CrossRef\]](#)
22. Harvell, C.D.; Mitchell, C.E.; Ward, J.R.; Altizer, S.; Dobson, A.P.; Ostfeld, R.S.; Samuel, M.D. Climate warming and disease risks for terrestrial and marine biota. *Science* **2002**, *296*, 2158–2162. [\[CrossRef\]](#) [\[PubMed\]](#)
23. Tryland, M.; Brun, E. Serum chemistry of the minke whale from the northeastern Atlantic. *J. Wildl. Dis.* **2001**, *37*, 332–341. [\[CrossRef\]](#) [\[PubMed\]](#)
24. Tryland, M.; Brun, E.; Derocher, A.E.; Arnemo, J.M.; Kierulf, P.; Ølberg, R.-A.; Wiig, Ø. Plasma biochemical values from apparently healthy free-ranging polar bears from Svalbard. *J. Wildl. Dis.* **2002**, *38*, 566–575. [\[CrossRef\]](#) [\[PubMed\]](#)
25. Tryland, M.; Krafft, B.A.; Lydersen, C.; Kovacs, K.M.; Thoresen, S.I. Serum chemistry values for free-ranging ringed seals (*Pusa hispida*) in Svalbard. *Vet. Clin. Pathol.* **2006**, *35*, 405–412. [\[CrossRef\]](#)
26. Tryland, M.; Lydersen, C.; Kovacs, K.M.; Rafter, E.; Thoresen, S.I. Serum biochemistry and haematology in wild and captive bearded seals (*Erignathus barbatus*) from Svalbard, Norway. *Acta Vet. Scand.* **2021**, *63*, 33. [\[CrossRef\]](#) [\[PubMed\]](#)
27. Tryland, M.; Lydersen, C.; Kovacs, K.M.; Thoresen, S.I. Serum chemistry reference values in free-ranging North Atlantic male walrus (*Odobenus rosmarus rosmarus*) from the Svalbard archipelago. *Vet. Clin. Pathol.* **2009**, *38*, 501–506. [\[CrossRef\]](#) [\[PubMed\]](#)
28. Tryland, M.; Nymo, I.H.; Nielsen, O.; Nordøy, E.S.; Kovacs, K.M.; Krafft, B.A.; Thoresen, S.I.; Åsbakk, K.; Osterrieder, K.; Roth, S.J.; et al. Serum chemistry and antibodies against pathogens in antarctic fur seals, Weddell seals, crabeater seals, and Ross seals. *J. Wildl. Dis.* **2012**, *48*, 632–645. [\[CrossRef\]](#)
29. Tryland, M.; Thoresen, S.I.; Kovacs, K.M.; Lydersen, C. Serum chemistry of free-ranging white whales (*Delphinapterus leucas*) in Svalbard. *Vet. Clin. Pathol.* **2006**, *35*, 199–203. [\[CrossRef\]](#)
30. Watt, C.A.; Simonee, J.; L'Herault, V.; Zhou, R.; Ferguson, S.H.; Marcoux, M.; Black, S. Cortisol levels in narwhal (*Monodon monoceros*) blubber from 2000 to 2019. *Arctic Sci.* **2021**, *7*, 690–698. [\[CrossRef\]](#)
31. Krafft, B.A.; Lydersen, C.; Kovacs, K.M. Serum haptoglobin concentrations in ringed seals (*Pusa hispida*) from Svalbard, Norway. *J. Wildl. Dis.* **2006**, *42*, 442–446. [\[CrossRef\]](#)

32. Kucheravy, C.E.; Trana, M.R.; Watt, C.A.; Roth, J.D.; Tomy, G.T.; Anderson, W.G.; Ferguson, S.H. Blubber cortisol in four Canadian beluga whale populations is unrelated to diet. *Mar. Ecol. Prog. Ser.* **2022**, *698*, 171–189. [\[CrossRef\]](#)
33. Patyk, K.A.; Duncan, C.; Nol, P.; Sonne, C.; Laidre, K.; Obbard, M.; Wiig, Ø.; Aars, J.; Regehr, E.; Gustafson, L.L. Establishing a definition of polar bear (*Ursus maritimus*) health: A guide to research and management activities. *Sci. Total Environ.* **2015**, *514*, 371–378. [\[CrossRef\]](#) [\[PubMed\]](#)
34. Sleeman, J.M. Has the time come for big science in wildlife health? *EcoHealth* **2013**, *10*, 335–338. [\[CrossRef\]](#) [\[PubMed\]](#)
35. Gunnarsson, S. The conceptualisation of health and disease in veterinary medicine. *Acta Vet. Scand.* **2006**, *48*, 20. [\[CrossRef\]](#) [\[PubMed\]](#)
36. Barratclough, A.; Wells, R.S.; Schwacke, L.H.; Rowles, T.K.; Gomez, F.M.; Fauquier, D.A.; Sweeney, J.C.; Townsend, F.I.; Hansen, L.J.; Zolman, E.S.; et al. Health Assessments of Common Bottlenose Dolphins (*Tursiops truncatus*): Past, Present, and Potential Conservation Applications. *Front. Vet. Sci.* **2019**, *6*, 444. [\[CrossRef\]](#) [\[PubMed\]](#)
37. Stimmelmayer, R. *Health Assessment of Subsistence Harvested Bering-Chukchi-Beaufort Seas Bowhead Whales (Balaena Mysticetus): An Overview*. Paper SC/66a/E/8, Presented to the Scientific Committee the Int. Whaling Commission. Department Wildlife Management; North Slope Borough, Barrow, AK, USA, 2015. 8p. Available online: <https://www.north-slope.org/wp-content/uploads/2022/03/SC-66a-E08.stimmelmayer.pdf> (accessed on 5 September 2022).
38. Gulland, F. Review of the marine mammal unusual mortality event response program of the National Marine Fisheries Service. In *NOAA Technical Memorandum NMFS-OPR-33*; NOAA: Washington, DC, USA, 2006. Available online: <https://repository.library.noaa.gov/view/noaa/14913> (accessed on 5 September 2022).
39. Moore, M.J.; Mitchell, G.H.; Rowles, T.K.; Early, G. Dead cetacean? Beach, bloat, float, sink. *Front. Mar. Sci.* **2020**, *7*, 333. [\[CrossRef\]](#)
40. NOAA. Request to Close the Pacific Walrus Portion of the 2011 Alaska Pinniped UME. In *NOAA Fisheries May 2014*. Available online: <https://media.fisheries.noaa.gov/dam-migration/ume-factsheet0514-akr.pdf> (accessed on 5 September 2022).
41. Burek-Huntington, K.A.; Stimmelmayer, R.; Herreman, J.; Sheffield, G.; Garlich-Miller, J.; Firth, C.; Lipkin, I.; Saliki, J.; Nielsen, O.; Mascarelli, P.; et al. Histopathological and Ancillary Diagnostic Findings from 2011 Northern Pinnipeds UME in the Arctic and Bering Strait Regions of Alaska, USA. In *Proceedings of the 2012 International Association for Aquatic Animal Medicine*, Atlanta, GA, USA, 12–16 May 2012.
42. Ferguson, S.H.; Young, B.G.; Yurkowski, D.J.; Anderson, R.; Willing, C.; Nielsen, O. Demographic, ecological, and physiological responses of ringed seals to an abrupt decline in sea ice availability. *PeerJ* **2017**, *5*, e2957. [\[CrossRef\]](#)
43. Siddon, E.C.; Zador, S.G.; Hunt, G.L., Jr. Ecological responses to climate perturbations and minimal sea ice in the northern Bering Sea. *Deep Sea Res. II Top. Stud. Oceanogr.* **2020**, *181*, 104914. [\[CrossRef\]](#)
44. Ferguson, S.H.; Young, B.G.; Thiemann, G.W.; Higdon, J.W.; Raverty, S.; Houde, M. *Unusual Mortality of Bowhead whales of the Eastern Canada-West Greenland population in Nunavut Canada in Autumn 2020*; Paper SC/68D/E/03 submitted to the IWC Scientific Committee (unpublished); International Whaling Commission Secretariat: Cambridge, UK, 2022.
45. Christiansen, F.; Rodríguez-González, F.; Martínez-Aguilar, S.; Urbán, J.; Swartz, S.; Warick, H.; Vivier, F.; Bejder, L. Poor body condition associated with an unusual mortality event in gray whales. *Mar. Ecol. Prog. Ser.* **2021**, *658*, 237–252. [\[CrossRef\]](#)
46. Tynan, C.T.; DeMaster, D.P. Observations and predictions of Arctic climatic change: Potential effects on marine mammals. *Arctic* **1997**, *50*, 308–322. Available online: <https://www.jstor.org/stable/40512109> (accessed on 12 August 2022). [\[CrossRef\]](#)
47. Prestrud, P.; Gjert, I. The most northerly harbor seal, *Phoca vitulina*, at Prins Karls Forland, Svalbard. *Mar. Mamm. Sci.* **1990**, *6*, 215–220. [\[CrossRef\]](#)
48. Rosing-Asvid, A.; Teilmann, J.; Dietz, R.; Olsen, M.T. First confirmed record of grey seals in Greenland. *Arctic* **2010**, *63*, 471–473. [\[CrossRef\]](#)
49. Storrie, L.; Lydersen, C.; Andersen, M.; Wynn, R.B.; Kovacs, K.M. Determining the species assemblage and habitat use of cetaceans in the Svalbard Archipelago, based on observations from 2002 to 2014. *Polar Res.* **2018**, *37*, 1463065. [\[CrossRef\]](#)
50. Bengtsson, O.; Lydersen, C.; Kovacs, K.M. Cetacean spatial trends from 2005 to 2019 in Svalbard, Norway. *Polar Res.* **2022**, *41*, 1–15. [\[CrossRef\]](#)
51. Bengtsson, O.; Hamilton, C.D.; Lydersen, C.; Andersen, M.; Kovacs, K.M. Distribution and habitat characteristics of pinnipeds and polar bears in the Svalbard Archipelago, 2005–2018. *Polar Res.* **2021**, *40*, 1–20. [\[CrossRef\]](#)
52. Higdon, J.W.; Ferguson, S.H. Reports of humpback and minke whales in the Hudson Bay region, eastern Canadian Arctic. *Northeast. Nat.* **2011**, *18*, 370–377. Available online: <https://www.jstor.org/stable/41315968> (accessed on 12 August 2022). [\[CrossRef\]](#)
53. Higdon, J.W.; Ferguson, S.H. Loss of Arctic sea ice causing punctuated change in sightings of killer whales (*Orcinus orca*) over the past century. *Ecol. Appl.* **2009**, *19*, 1365–1375. [\[CrossRef\]](#)
54. MacLeod, C.D. Global climate change, range changes and potential implications for the conservation of marine cetaceans: A review and synthesis. *Endanger. Spec. Res.* **2009**, *7*, 125–136. [\[CrossRef\]](#)
55. Moore, S.E.; Haug, T.; Vikingsson, G.A.; Stenson, G.B. Baleen whale ecology in arctic and subarctic seas in an era of rapid habitat alteration. *Pro. Oceanogr.* **2019**, *176*, 102118. [\[CrossRef\]](#)
56. Tsujii, K.; Otsuki, M.; Akamatsu, T.; Matsuo, I.; Amakasu, K.; Kitamura, M.; Kikuchi, T.; Miyashita, K.; Mitani, Y. The migration of fin whales into the southern Chukchi Sea as monitored with passive acoustics. *ICES J. Mar. Sci.* **2016**, *73*, 2085–2092. [\[CrossRef\]](#)
57. Lefort, K.J.; Hussey, N.E.; Jones, J.M.; Johnson, K.F.; Ferguson, S.H. Satellite-tracked sperm whale migrates from the Canadian Arctic to the subtropical western North Atlantic. *Mar. Mammal Sci.* **2022**, *38*, 1242–1248. [\[CrossRef\]](#)

58. MacLeod, C.D.; Bannon, S.M.; Pierce, G.J.; Schweder, C.; Learmonth, J.A.; Herman, J.S.; Reid, R.J. Climate change and the cetacean community of north-west Scotland. *Biol. Conserv.* **2005**, *124*, 477–483. [\[CrossRef\]](#)
59. Alstrup, A.K.O.; Jensen, L.F.; Hansen, M.S.; Kinze, C.C.; Jensen, T.H. Necropsy findings of 11 white-beaked dolphins (*Lagenorhynchus albirostris*) stranded in Denmark during 2008–2014. *Aquat. Mamm.* **2016**, *42*, 292–299. [\[CrossRef\]](#)
60. Hamilton, C.D.; Lydersen, C.; Aars, J.; Acquarone, M.; Atwood, T.; Baylis, A.; Biuw, M.; Boltunov, A.N.; Born, E.W.; Boveng, P. Marine mammal hotspots across the circumpolar Arctic. *Divers. Distrib.* **2022**, *28*, 2729–2753. [\[CrossRef\]](#)
61. Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G.; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Ann. Int. Med.* **2009**, *151*, 264–269. [\[CrossRef\]](#) [\[PubMed\]](#)
62. Lesage, V. The challenges of a small population exposed to multiple anthropogenic stressors and a changing climate: The St. Lawrence Estuary beluga. *Polar Res.* **2021**, *40*, 5523. [\[CrossRef\]](#)
63. Hobbs, R.C.; Reeves, R.R.; Prewitt, J.S.; Desportes, G.; Breton-Honeyman, K.; Christensen, T.; Citta, J.J.; Ferguson, S.H.; Frost, K.J.; Garde, E. Global review of the conservation status of monodontid stocks. *Mar. Fish. Rev.* **2019**, *81*, 1–53. Available online: <http://spo.nmfs.noaa.gov/mcontent.htm> (accessed on 12 August 2022).
64. Martin, M.J.; Halliday, W.D.; Storrie, L.; Citta, J.J.; Dawson, J.; Hussey, N.E.; Juanes, F.; Loseto, L.L.; MacPhee, S.A.; Moore, L.; et al. Exposure and behavioral responses of tagged beluga whales (*Delphinapterus leucas*) to ships in the Pacific Arctic. *Mar. Mammal Sci.* **2023**, *39*, 387–421. [\[CrossRef\]](#)
65. Hendrix, A.M.; Lefebvre, K.A.; Quakenbush, L.; Bryan, A.; Stimmelmayer, R.; Sheffield, G.; Wisswaesser, G.; Willis, M.L.; Bowers, E.K.; Kendrick, P.; et al. Ice seals as sentinels for algal toxin presence in the Pacific Arctic and subarctic marine ecosystems. *Mar. Mammal Sci.* **2021**, *37*, 1292–1308. [\[CrossRef\]](#)
66. Hauser, D.D.W.; Laidre, K.L.; Stern, H.L. Vulnerability of Arctic marine mammals to vessel traffic in the increasingly ice-free Northwest Passage and Northern Sea Route. *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 7617–7622. [\[CrossRef\]](#) [\[PubMed\]](#)
67. Halliday, W.D.; Pine, M.K.; Insley, S.J. Underwater noise and Arctic marine mammals: Review and policy recommendations. *Environ. Rev.* **2020**, *28*, 438–448. [\[CrossRef\]](#)
68. Reeves, R.; Rosa, C.; George, J.C.; Sheffield, G.; Moore, M. Implications of Arctic industrial growth and strategies to mitigate future vessel and fishing gear impacts on bowhead whales. *Mar. Policy* **2012**, *36*, 454–462. [\[CrossRef\]](#)
69. Miller, W.G.; Adams, L.G.; Ficht, T.A.; Cheville, N.F.; Payeur, J.P.; Harley, D.R.; House, C.; Ridgway, S.H. Brucella-induced abortions and infection in bottlenose dolphins (*Tursiops truncatus*). *J. Zoo Wildl. Med.* **1999**, *30*, 100–110. Available online: <https://www.jstor.org/stable/20095828> (accessed on 12 August 2022). [\[PubMed\]](#)
70. Samartino, L.E.; Enright, F.M. Pathogenesis of abortion of bovine brucellosis. *Comp. Immunol. Microbiol. Infect. Dis.* **1993**, *16*, 95–101. [\[CrossRef\]](#) [\[PubMed\]](#)
71. Hernández-Mora, G.; Palacios-Alfaro, J.D.; González-Barrientos, R. Wildlife reservoirs of brucellosis: Brucella in aquatic environments. *Rev. Sci. Tech. (Int. Off. Epizoot.)* **2013**, *32*, 89–103. [\[CrossRef\]](#)
72. Jepson, P.D.; Brew, S.; MacMillan, A.P.; Baker, J.R.; Barnett, J.; Kirkwood, J.K.; Kuiken, T.; Robinson, I.R.; Simpson, V.R. Antibodies to Brucella in marine mammals around the coast of England and Wales. *Vet. Rec.* **1997**, *141*, 513–515. [\[CrossRef\]](#)
73. Bricker, B.J.; Ewalt, D.R.; MacMillan, A.P.; Foster, G.; Brew, S. Molecular characterization of Brucella strains isolated from marine mammals. *J. Clin. Microbiol.* **2000**, *38*, 1258–1262. [\[CrossRef\]](#)
74. Tryland, M.; Sørensen, K.K.; Godfroid, J. Prevalence of Brucella pinnipediae in healthy hooded seals (*Cystophora cristata*) from the North Atlantic Ocean and ringed seals (*Phoca hispida*) from Svalbard. *Vet. Microbiol.* **2005**, *105*, 103–111. [\[CrossRef\]](#)
75. Foster, G.; Nymo, I.H.; Kovacs, K.M.; Beckmen, K.B.; Brownlow, A.C.; Bailly, J.L.; Dagleish, M.P.; Muchowski, J.; Perrett, L.L.; Tryland, M.; et al. First isolation of Brucella pinnipediae and detection of Brucella antibodies from bearded seals Erignathus barbatus. *Dis. Aquat. Org.* **2018**, *128*, 13–20. [\[CrossRef\]](#)
76. Nymo, I.H.; Tryland, M.; Godfroid, J. A review of Brucella infection in marine mammals, with special emphasis on Brucella pinnipediae in the hooded seal (Cystophora cristata). *Vet. Res.* **2011**, *42*, 93. [\[CrossRef\]](#)
77. Corbel, M.J. *Brucellosis in Humans and Animals*; World Health Organization: Geneva, Switzerland, 2006.
78. Garner, M.M.; Lambourn, D.M.; Jeffries, S.J.; Hall, P.B.; Rhyan, J.C.; Ewalt, D.R.; Polzin, L.M.; Cheville, N.F. Evidence of Brucella infection in Parafilaroides lungworms in a Pacific harbor seal (Phoca vitulina richardsi). *J. Vet. Diag. Investig.* **1997**, *9*, 298–303. [\[CrossRef\]](#)
79. Perrett, L.L.; Dawson, C.E.; Davison, N.; Quinney, S. Brucella infection of lungworms from a harbour porpoise. *Vet. Rec.* **2004**, *154*, 800. [\[PubMed\]](#)
80. Rhyan, J.; Garner, M.; Spraker, T.; Lambourn, D.; Cheville, N. Brucella pinnipediae in lungworms Parafilaroides sp. and Pacific harbor seals Phoca vitulina richardsi: Proposed pathogenesis. *Dis. Aquat. Org.* **2018**, *131*, 87–94. [\[CrossRef\]](#) [\[PubMed\]](#)
81. Hernández-Mora, G.; González-Barrientos, R.; Morales, J.-A.; Chaves-Olarte, E.; Guzmán-Verri, C.; Baquero-Calvo, E.; De-Miguel, M.-J.; Marín, C.-M.; Blasco, J.-M.; Moreno, E. Neurobrucellosis in stranded dolphins, Costa Rica. *Emerg. Infect. Dis.* **2008**, *14*, 1430. [\[CrossRef\]](#) [\[PubMed\]](#)
82. Ross, H.M.; Jahans, K.L.; MacMillan, A.P.; Reid, R.J.; Thompson, P.M.; Foster, G. Brucella species infection in North Sea seal and cetacean populations. *Vet. Rec.* **1996**, *138*, 647–648. [\[CrossRef\]](#)
83. Foster, G.; MacMillan, A.P.; Godfroid, J.; Howie, F.; Ross, H.M.; Cloeckert, A.; Reid, R.J.; Brew, S.; Patterson, I.A.P. A review of Brucella sp. infection of sea mammals with particular emphasis on isolates from Scotland. *Vet. Microbiol.* **2002**, *90*, 563–580. [\[CrossRef\]](#)

84. Kershaw, J.L.; Stubberfield, E.J.; Foster, G.; Brownlow, A.; Hall, A.J.; Perrett, L.L. Exposure of harbour seals *Phoca vitulina* to *Brucella* in declining populations across Scotland. *Dis. Aquat. Org.* **2017**, *126*, 13–23. [CrossRef]
85. Nymo, I.H.; Godfroid, J.; Åsbakk, K.; Larsen, A.K.; das Neves, C.G.; Rødven, R.; Tryland, M. A protein A/G indirect enzyme-linked immunosorbent assay for the detection of anti-*Brucella* antibodies in Arctic wildlife. *J. Vet. Diag. Investig.* **2013**, *25*, 369–375. [CrossRef]
86. Tryland, M.; Derocher, A.E.; Wiig, Ø.; Godfroid, J. *Brucella* sp. antibodies in polar bears from Svalbard and the Barents Sea. *J. Wildl. Dis.* **2001**, *37*, 523–531. [CrossRef]
87. Rah, H.; Chomel, B.B.; Kasten, R.W.; Hew, C.H.; Farver, T.B.; Follmann, E.H.; Garner, G.W.; Amstrup, S.C. Serosurvey of selected zoonotic agents in polar bears (*Ursus maritimus*). *Vet. Rec.* **2005**, *156*, 7–13. [CrossRef]
88. O'Hara, T.M.; Holcomb, D.; Elzer, P.; Estep, J.; Perry, Q.; Hagius, S.; Kirk, C. *Brucella* species survey in polar bears (*Ursus maritimus*) of northern Alaska. *J. Wildl. Dis.* **2010**, *46*, 687–694. [CrossRef]
89. Atwood, T.C.; Duncan, C.; Patyk, K.A.; Nol, P.; Rhyhan, J.; McCollum, M.; McKinney, M.A.; Ramey, A.M.; Cerqueira-Cézar, C.K.; Kwok, O.C.H.; et al. Environmental and behavioral changes may influence the exposure of an Arctic apex predator to pathogens and contaminants. *Sci. Rep.* **2017**, *7*, 13193. [CrossRef] [PubMed]
90. Tryland, M.; Kleivane, L.; Alfredsson, A.; Kjeld, M.; Arnason, A.; Stuen, S.; Godfroid, J. Evidence of *Brucella* infection in marine mammals in the North Atlantic Ocean. *Vet. Rec.* **1999**, *144*, 588–592. [CrossRef]
91. Zarnke, R.L.; Saliki, J.T.; Macmillan, A.P.; Brew, S.D.; Dawson, C.E.; Ver Hoef, J.M.; Frost, K.J.; Small, R.J. Serologic survey for *Brucella* spp., phocid herpesvirus-1, phocid herpesvirus-2, and phocine distemper virus in harbor seals from Alaska, 1976–1999. *J. Wildl. Dis.* **2006**, *42*, 290–300. [CrossRef]
92. Forbes, L.B.; Nielsen, O.; Measures, L.; Ewalt, D.R. Brucellosis in ringed seals and harp seals from Canada. *J. Wildl. Dis.* **2000**, *36*, 595–598. [CrossRef] [PubMed]
93. Nymo, I.H.; Rødven, R.; Beckmen, K.; Larsen, A.K.; Tryland, M.; Quakenbush, L.; Godfroid, J. *Brucella* antibodies in Alaskan true seals and eared seals—Two different stories. *Front. Vet. Sci.* **2018**, *5*, 8. [CrossRef] [PubMed]
94. Goertz, C.E.C.; Reichmuth, C.; Thometz, N.M.; Ziel, H.; Boveng, P. Comparative health assessments of Alaskan ice seals. *Front. Vet. Sci.* **2019**, *6*, 4. [CrossRef]
95. Sonne, C.; Andersen-Ranberg, E.; Rajala, E.L.; Agerholm, J.S.; Bonefeld-Jørgensen, E.; Desforjes, J.-P.; Eulaers, I.; Jenssen, B.M.; Koch, A.; Rosing-Asvid, A.; et al. Seroprevalence for *Brucella* spp. in Baltic ringed seals (*Phoca hispida*) and East Greenland harp (*Pagophilus groenlandicus*) and hooded (*Cystophora cristata*) seals. *Vet. Immunol. Immunopathol.* **2018**, *198*, 14–18. [CrossRef]
96. Nielsen, O.; Nielsen, K.; Stewart, R.E.A. Serologic evidence of *Brucella* spp. exposure in Atlantic walruses (*Odobenus rosmarus rosmarus*) and ringed seals (*Phoca hispida*) of Arctic Canada. *Arctic* **1996**, *49*, 383–386. Available online: <https://www.jstor.org/stable/40512024> (accessed on 10 September 2022). [CrossRef]
97. Ohishi, K.; Abe, E.; Amano, M.; Miyazaki, N.; Boltunov, A.; Katsumata, E.; Maruyama, T. Detection of serum antibodies to *Brucella* in Russian aquatic mammals. *J. Vet. Med. Sci.* **2018**, *80*, 1696–1701. [CrossRef]
98. Thompson, L.A.; Goertz, C.E.C.; Quakenbush, L.T.; Burek Huntington, K.; Suydam, R.S.; Stimmelmayer, R.; Romano, T.A. Serological Detection of Marine Origin *Brucella* Exposure in Two Alaska Beluga Stocks. *Animals* **2022**, *12*, 1932. [CrossRef]
99. Sidor, I.F.; Dunn, J.L.; Tsongalis, G.J.; Carlson, J.; Frasca, S., Jr. A multiplex real-time polymerase chain reaction assay with two internal controls for the detection of *Brucella* species in tissues, blood, and feces from marine mammals. *J. Vet. Diag. Investig.* **2013**, *25*, 72–81. [CrossRef]
100. Nielsen, O.; Cobb, D.; Stewart, R.E.A.; Ryan, A.; Dunn, B.; Raverty, S.; Nielsen, K.; Harwood, L. Results of a community based disease monitoring program of marine mammals in arctic Canada. In Proceedings of the Oceans '04 MTS/IEEE Techno-Ocean '04, Kobe, Japan, 9–12 November 2004; pp. 492–498.
101. Foster, G.; Jahans, K.L.; Reid, R.J.; Ross, H.M. Isolation of *Brucella* species from cetaceans, seals and an otter. *Vet. Rec.* **1996**, *138*, 583–586. [CrossRef] [PubMed]
102. Isidoro-Ayza, M.; Ruiz-Villalobos, N.; Pérez, L.; Guzmán-Verri, C.; Muñoz, P.M.; Alegre, F.; Barberán, M.; Chacón-Díaz, C.; Chaves-Olarte, E.; González-Barrientos, R.; et al. *Brucella ceti* infection in dolphins from the Western Mediterranean sea. *BMC Vet. Res.* **2014**, *10*, 206. [CrossRef] [PubMed]
103. Muñoz, P.M.; García-Castrillo, G.; López-García, P.; González-Cueli, J.C.; De Miguel, M.J.; Marín, C.M.; Barberán, M.; Blasco, J.M. Isolation of *Brucella* species from a live-stranded striped dolphin (*Stenella coeruleoalba*) in Spain. *Vet. Rec.* **2006**, *158*, 450. [CrossRef]
104. Ohishi, K.; Bando, T.; Abe, E.; Kawai, Y.; Fujise, Y.; Maruyama, T. Long-term and large-scale epidemiology of *Brucella* infection in baleen whales and sperm whales in the western North Pacific and Antarctic Oceans. *J. Vet. Med. Sci.* **2016**, *78*, 1457–1464. [CrossRef] [PubMed]
105. Calle, P.P.; Seagars, D.J.; McClave, C.; Senne, D.; House, C.; House, J.A. Viral and bacterial serology of free-ranging Pacific walrus. *J. Wildl. Dis.* **2002**, *38*, 93–100. [CrossRef]
106. Smith, A.W.; Brown, R.J.; Skilling, D.E.; Bray, H.L.; Keyes, M.C. Naturally-occurring leptospirosis in northern fur seals (*Callorhinus ursinus*). *J. Wildl. Dis.* **1977**, *13*, 144–148. [CrossRef]
107. Dierauf, L.A.; Vandenbroek, D.J.; Roletto, J.; Koski, M.; Amaya, L.; Gage, L.J. An epizootic of leptospirosis in California sea lions. *JAVMA* **1985**, *187*, 1145–1148. Available online: <https://pubmed.ncbi.nlm.nih.gov/4077625/> (accessed on 22 August 2022).

108. Cameron, C.E.; Zuerner, R.L.; Raverty, S.; Colegrove, K.M.; Norman, S.A.; Lambourn, D.M.; Jeffries, S.J.; Gulland, F.M. Detection of pathogenic *Leptospira* bacteria in pinniped populations via PCR and identification of a source of transmission for zoonotic leptospirosis in the marine environment. *J. Clin. Microbiol.* **2008**, *46*, 1728–1733. [\[CrossRef\]](#)
109. Colegrove, K.M.; Lowenstine, L.J.; Gulland, F.M.D. Leptospirosis in northern elephant seals (*Mirounga angustirostris*) stranded along the California coast. *J. Wildl. Dis.* **2005**, *41*, 426–430. [\[CrossRef\]](#)
110. Gulland, F.M.D.; Koski, M.; Lowenstine, L.J.; Colagross, A.; Morgan, L.; Spraker, T. Leptospirosis in California sea lions (*Zalophus californianus*) stranded along the central California coast, 1981–1994. *J. Wildl. Dis.* **1996**, *32*, 572–580. [\[CrossRef\]](#)
111. Smith, A.W.; Skilling, D.E.; Benirschke, K.; Albert, T.F.; Barlough, J.E. Serology and virology of the bowhead whale (*Balaena mysticetus* L.). *J. Wildl. Dis.* **1987**, *23*, 92–98. [\[CrossRef\]](#)
112. Miller, D.A.; Wilson, M.A.; Beran, G.W. Relationships between prevalence of *Leptospira interrogans* in cattle, and regional, climatic, and seasonal factors. *Am. J. Vet. Res.* **1991**, *52*, 1766–1768. [\[PubMed\]](#)
113. Zakharova, O.I.; Korennoy, F.I.; Iashin, I.V.; Toropova, N.N.; Gogin, A.E.; Kolbasov, D.V.; Surkova, G.V.; Malkhazova, S.M.; Blokhin, A.A. Ecological and socio-economic determinants of livestock animal leptospirosis in the Russian Arctic. *Front. Vet. Sci.* **2021**, *8*, 658675. [\[CrossRef\]](#)
114. Zarnke, R.L. Serologic survey for selected microbial pathogens in Alaskan wildlife. *J. Wildl. Dis.* **1983**, *19*, 324–329. [\[CrossRef\]](#)
115. Calle, P.; Seagars, D.J.; McClave, C.; Senne, D.; House, C.; House, J.A. Viral and bacterial serology of six free-ranging bearded seals *Erignathus barbatus*. *Dis. Aquat. Org.* **2008**, *81*, 77–80. [\[CrossRef\]](#)
116. Eldin, C.; Mélenotte, C.; Mediannikov, O.; Ghigo, E.; Million, M.; Edouard, S.; Mege, J.-L.; Maurin, M.; Raoult, D. From Q fever to *Coxiella burnetii* infection: A paradigm change. *Clin. Microbiol. Rev.* **2017**, *30*, 115–190. [\[CrossRef\]](#) [\[PubMed\]](#)
117. Duncan, C.; Kersh, G.J.; Spraker, T.; Patyk, K.A.; Fitzpatrick, K.A.; Massung, R.F.; Gelatt, T. *Coxiella burnetii* in northern fur seal (*Callorhinus ursinus*) placentas from St. Paul Island, Alaska. *Vector-Borne Zoonotic Dis.* **2012**, *12*, 192–195. [\[CrossRef\]](#) [\[PubMed\]](#)
118. Kersh, G.J.; Lambourn, D.M.; Raverty, S.A.; Fitzpatrick, K.A.; Self, J.S.; Akmajian, A.M.; Jeffries, S.J.; Huggins, J.; Drew, C.P.; Zaki, S.R.; et al. *Coxiella burnetii* infection of marine mammals in the Pacific Northwest, 1997–2010. *J. Wildl. Dis.* **2012**, *48*, 201–206. [\[CrossRef\]](#) [\[PubMed\]](#)
119. Minor, C.; Kersh, G.J.; Gelatt, T.; Kondas, A.V.; Pablonia, K.L.; Weller, C.B.; Dickerson, B.R.; Duncan, C.G. *Coxiella burnetii* in Northern Fur Seals and Steller Sea Lions of Alaska. *J. Wildl. Dis.* **2013**, *49*, 441–446. [\[CrossRef\]](#)
120. Rosales, S.M.; Vega Thurber, R. Brain meta-transcriptomics from harbor seals to infer the role of the microbiome and virome in a stranding event. *PLoS ONE* **2015**, *10*, e0143944. [\[CrossRef\]](#)
121. Duncan, C.; Gill, V.A.; Worman, K.; Burek-Huntington, K.; Pablonia, K.L.; Johnson, S.; Fitzpatrick, K.A.; Weller, C.; Kersh, G.J. *Coxiella burnetii* exposure in northern sea otters *Enhydra lutris kenyoni*. *Dis. Aquat. Org.* **2015**, *114*, 83–87. [\[CrossRef\]](#)
122. Koch, A.; Svendsen, C.B.; Christensen, J.J.; Bundgaard, H.; Vindfeld, L.; Christiansen, C.B.; Kemp, M.; Villumsen, S. Q fever in Greenland. *Emerg. Infect. Dis.* **2010**, *16*, 511–513. [\[CrossRef\]](#) [\[PubMed\]](#)
123. Ma, Y.; Destouni, G.; Kalantari, Z.; Omazic, A.; Evengård, B.; Berggren, C.; Thierfelder, T. Linking climate and infectious disease trends in the Northern/Arctic Region. *Sci. Rep.* **2021**, *11*, 20678. [\[CrossRef\]](#)
124. Su, Y.-C.; Liu, C. *Vibrio parahaemolyticus*: A concern of seafood safety. *Food Microbiol.* **2007**, *24*, 549–558. [\[CrossRef\]](#)
125. Goertz, C.E.C.; Walton, R.; Rouse, N.; Belovarac, J.; Burek-Huntington, K.; Gill, V.; Hobbs, R.; Xavier, C.; Garrett, N.; Tuomi, P. *Vibrio parahaemolyticus*, a climate change indicator in Alaska marine mammals. In Proceedings of the Responses of Arctic Marine Ecosystems to Climate Change, Anchorage, AK, USA, 26–29 March 2013; pp. 41–52. [\[CrossRef\]](#)
126. Baker-Austin, C.; Oliver, J.D.; Alam, M.; Ali, A.; Waldor, M.K.; Qadri, F.; Martinez-Urtaza, J. *Vibrio* spp. infections. *Nat. Rev. Dis. Prim.* **2018**, *4*, 1–19. [\[CrossRef\]](#)
127. Baker-Austin, C.; Trinanès, J.A.; Taylor, N.G.H.; Hartnell, R.; Siitonen, A.; Martinez-Urtaza, J. Emerging *Vibrio* risk at high latitudes in response to ocean warming. *Nat. Clim. Chang.* **2013**, *3*, 73–77. [\[CrossRef\]](#)
128. Hughes, S.N.; Greig, D.J.; Miller, W.A.; Byrne, B.A.; Gulland, F.; Harvey, J.T. Dynamics of *Vibrio* with virulence genes detected in Pacific harbor seals (*Phoca vitulina richardii*) off California: Implications for marine mammal health. *Microb. Ecol.* **2013**, *65*, 982–994. [\[CrossRef\]](#)
129. Parkinson, A.J.; Evengård, B. Climate change, its impact on human health in the Arctic and the public health response to threats of emerging infectious diseases. *Glob. Health Action* **2009**, *2*, 2075. [\[CrossRef\]](#)
130. Numberger, D.; Siebert, U.; Fulde, M.; Valentin-Weigand, P. Streptococcal infections in marine mammals. *Microorganisms* **2021**, *9*, 350. [\[CrossRef\]](#)
131. Taurisano, N.D.; Butler, B.P.; Stone, D.; Hariharan, H.; Fields, P.J.; Ferguson, H.W.; Haulena, M.; Cotrell, P.; Nielsen, O.; Raverty, S. *Streptococcus phocae* in marine mammals of northeastern Pacific and Arctic Canada: A retrospective analysis of 85 postmortem investigations. *J. Wildl. Dis.* **2018**, *54*, 101–111. [\[CrossRef\]](#)
132. Hueffer, K.; Lieske, C.L.; McGilvary, L.M.; Hare, R.F.; Miller, D.L.; O'Hara, T.M. *Streptococcus phocae* isolated from a spotted seal (*Phoca largha*) with pyometra in Alaska. *J. Zoo Wildl. Med.* **2011**, *42*, 108. [\[CrossRef\]](#)
133. Rouse, N.M.; Counihan, K.L.; Boege Tobin, D.D.; Goertz, C.E.C.; Duddleston, K.N. Habitat associations between *Streptococcus bovis/equinus* complex and *Streptococcus phocae*, the causative agents of strep syndrome in sea otters, and the marine environment. *Mar. Ecol.* **2022**, *43*, e12689. [\[CrossRef\]](#)
134. Burek Huntington, K.A.; Gill, V.A.; Berrian, A.M.; Goldstein, T.; Tuomi, P.; Byrne, B.A.; Worman, K.; Mazet, J. Causes of mortality of northern sea otters (*Enhydra lutris kenyoni*) in Alaska from 2002 to 2012. *Front. Mar. Sci.* **2021**, *8*, 630582. [\[CrossRef\]](#)

135. Goldstein, T.; Mazet, J.A.K.; Gill, V.A.; Doroff, A.M.; Burek, K.A.; Hammond, J.A. Phocine distemper virus in northern sea otters in the Pacific Ocean, Alaska, USA. *Emerg. Infect. Dis.* **2009**, *15*, 925. [CrossRef] [PubMed]
136. Dunn, J.L. *Bacterial and Mycotic Diseases of Cetaceans and Pinnipeds*; CRC Press LLC: Boca Raton, FL, USA, 1990; pp. 73–96.
137. Geraci, J.R.; Sauer, R.M.; Medway, W. Erysipelas in dolphins. *Am. J. Vet. Res.* **1966**, *27*, 597–606. [PubMed]
138. Kutz, S.; Bollinger, T.; Branigan, M.; Checkley, S.; Davison, T.; Dumond, M.; Elkin, B.; Forde, T.; Hutchins, W.; Niptanatiak, A.; et al. Erysipelothrix rhusiopathiae associated with recent widespread muskox mortalities in the Canadian Arctic. *Can. Vet. J.* **2015**, *56*, 560.
139. Ceccolini, M.E.; Wessels, M.; Macgregor, S.K.; Deaville, R.; Perkins, M.; Jepson, P.D.; John, S.K.; Guthrie, A. Systemic Erysipelothrix rhusiopathiae in seven free-ranging delphinids stranded in England and Wales. *Dis. Aquat. Org.* **2021**, *145*, 173–184. [CrossRef]
140. Ijsseldijk, L.L.; Begeman, L.; Duim, B.; Gröne, A.; Kik, M.J.L.; Klijnstra, M.D.; Lakemeyer, J.; Leopold, M.F.; Munnink, B.B.O.; Ten Doeschate, M. Harbor Porpoise Deaths Associated with Erysipelothrix rhusiopathiae, the Netherlands, 2021. *Emerg. Infect. Dis.* **2023**, *29*, 835. [CrossRef]
141. Snyder, E.; Credille, B. Mannheimia haemolytica and Pasteurella multocida in bovine respiratory disease: How are they changing in response to efforts to control them? *Vet. Clin. Food Anim. Pract.* **2020**, *36*, 253–268. [CrossRef]
142. Portis, E.; Lindeman, C.; Johansen, L.; Stoltman, G. A ten-year (2000–2009) study of antimicrobial susceptibility of bacteria that cause bovine respiratory disease complex—Mannheimia haemolytica, Pasteurella multocida, and Histophilus somni—In the United States and Canada. *J. Vet. Diagn. Investig.* **2012**, *24*, 932–944. [CrossRef] [PubMed]
143. Hansen, M.J.; Bertelsen, M.F.; Christensen, H.; Bisgaard, M.; Bojesen, A.M. Occurrence of Pasteurellaceae bacteria in the oral cavity of selected marine mammal species. *J. Zoo Wildl. Med.* **2012**, *43*, 828–835. Available online: <http://www.jstor.org/stable/23361379> (accessed on 10 August 2022). [CrossRef] [PubMed]
144. Sweeney, J.C.; Ridgway, S.H. Procedures for the clinical management of small cetaceans. *J. Am. Vet. Med. Assoc.* **1975**, *167*, 540–545.
145. Higgins, R. Bacteria and fungi of marine mammals: A review. *Can. Vet. J.* **2000**, *41*, 105. [PubMed]
146. Dziva, F.; Muhairwa, A.P.; Bisgaard, M.; Christensen, H. Diagnostic and typing options for investigating diseases associated with Pasteurella multocida. *Vet. Microbiol.* **2008**, *128*, 1–22. [CrossRef] [PubMed]
147. Miller, M.A.; Lyashchenko, K.P. *Mycobacterial Infections in Other Zoo Animals*; CABI: Wallingford, UK, 2015; Volume 15, p. 277.
148. Roe, W.D.; Lenting, B.; Kokosinska, A.; Hunter, S.; Duignan, P.J.; Gartrell, B.; Rogers, L.; Collins, D.M.; de Lisle, G.W.; Gedy, K.; et al. Pathology and molecular epidemiology of Mycobacterium pinnipedii tuberculosis in native New Zealand marine mammals. *PLoS ONE* **2019**, *14*, e0212363. [CrossRef]
149. Clayton, L.A.; Stamper, M.A.; Whitaker, B.R.; Hadfield, C.A.; Simons, B.; Mankowski, J.L. Mycobacterium abscessus pneumonia in an Atlantic bottlenose dolphin (Tursiops truncatus). *J. Zoo Wildl. Med.* **2012**, *43*, 961–965. [CrossRef]
150. Cousins, D.V.; Bastida, R.; Cataldi, A.; Quse, V.; Redrobe, S.; Dow, S.; Duignan, P.; Murray, A.; Dupont, C.; Ahmed, N.; et al. Tuberculosis in seals caused by a novel member of the Mycobacterium tuberculosis complex: Mycobacterium pinnipedii sp. nov. *Int. J. Syst. Evol. Microbiol.* **2003**, *53*, 1305–1314. [CrossRef]
151. Beck, B.M.; Rice, C.D. Serum antibody levels against select bacterial pathogens in Atlantic bottlenose dolphins, Tursiops truncatus, from Beaufort NC USA and Charleston Harbor, Charleston, SC, USA. *Mar. Environ. Res.* **2003**, *55*, 161–179. [CrossRef]
152. Leger, J.A.S.; Begeman, L.; Fleetwood, M.; Frasca, S., Jr.; Garner, M.M.; Lair, S.; Trembley, S.; Linn, M.J.; Terio, K.A. Comparative pathology of nocardiosis in marine mammals. *Vet. Pathol.* **2009**, *46*, 299–308. [CrossRef]
153. Pier, A.C.; Takayama, A.K.; Miyahara, A.Y. Cetacean nocardiosis. *J. Wildl. Dis.* **1970**, *6*, 112–118. [CrossRef] [PubMed]
154. Migaki, G.; Jones, S.R. Mycotic diseases in marine mammals. In *Pathobiology of Selected Marine Mammal Diseases*; CRC Press: Boca Raton, FL, USA, 2018; pp. 1–27.
155. Degollada, E.; Domingo, M.; Alonso, J.M.; Alegre, F.; Tello, M.; Lopez, A.L.D. Nocardiosis in a striped dolphin (Stenella coeruleoalba). In Proceedings of the Third ECS Workshop on Cetacean Pathology: Lung Pathology, Lisboa, Portugal, 14 March 1996; pp. 16–18.
156. Sweeney, J.C.; Migaki, G.; Vainik, P.M.; Conklin, R.H. Systemic mycoses in marine mammals. *J. Am. Vet. Med. Assoc.* **1976**, *169*, 946–948.
157. Davis, G.B.; Stevenson, B.J.; Kyle, R.J.; Price, M.C. Isolation of an actinomycete from a sea leopard (Hydrurga leptonyx). *N. Z. Vet. J.* **1977**, *25*, 274. [CrossRef]
158. Tryland, M.; Larsen, A.K.; Nymo, I.H. Bacterial infections and diseases. In *CRC Handbook Marine Mammal Medicine*; Dierauf, L., Gulland, F.M.D., Eds.; CRC Press: Boca Raton, FL, USA, 2018; pp. 367–388.
159. Macneill, A.C.; Gornall, T.A.; Giddens, W.E.; Boyce, J. Evidence of Nocardia sp. in a captive-born beluga whale. *Aquat. Mamm.* **1978**, *6*, 50–53. Available online: https://aquaticmammalsjournal.org/share/AquaticMammalsIssueArchives/1978/Aquatic_Mammals_6_2/Mcneill.pdf (accessed on 10 September 2022).
160. Martineau, D.; Lagace, A.; Beland, P.; Higgins, R.; Armstrong, D.; Shugart, L.R. Pathology of stranded beluga whales (Delphinapterus leucas) from the St. Lawrence Estuary, Quebec, Canada. *J. Comp. Pathol.* **1988**, *98*, 287–310. [CrossRef]
161. Beaman, B.L.; Beaman, L. Nocardia species: Host-parasite relationships. *Clin. Microbiol. Rev.* **1994**, *7*, 213–264. [CrossRef] [PubMed]
162. Perini, L.; Mogrovejo, D.C.; Tomazin, R.; Gostinčar, C.; Brill, F.H.H.; Gunde-Cimerman, N. Phenotypes associated with pathogenicity: Their expression in arctic fungal isolates. *Microorganisms* **2019**, *7*, 600. [CrossRef] [PubMed]

163. Reidarson, T.H.; García-Párraga, D.; Wiederhold, N.P. Marine mammal mycoses. In *CRC Handbook Marine Mammal Medicine*; Dierauf, L., Gulland, F.M.D., Eds.; CRC Press: Boca Raton, FL, USA, 2018; pp. 389–424.
164. Pearce, D.A.; Bridge, P.D.; Hughes, K.A.; Sattler, B.; Psenner, R.; Russell, N.J. Microorganisms in the atmosphere over Antarctica. *FEMS Microbiol. Ecol.* **2009**, *69*, 143–157. [CrossRef]
165. Dagleish, M.P.; Foster, G.; Howie, F.E.; Reid, R.J.; Barley, J. Fatal mycotic encephalitis caused by *Aspergillus fumigatus* in a northern bottlenose whale (*Hyperoodon ampullatus*) caused by *Aspergillus fumigatus*. *Vet. Rec.* **2008**, *163*, 602–604. [CrossRef]
166. Reidarson, T.H.; Harrell, J.H.; Rinaldi, M.G.; McBain, J. Bronchoscopic and serologic diagnosis of *Aspergillus fumigatus* pulmonary infection in a bottlenose dolphin (*Tursiops truncatus*). *J. Zoo Wildl. Med.* **1998**, *29*, 451–455. Available online: <https://www.jstor.org/stable/20095799> (accessed on 5 August 2022).
167. Domingo, M.; Visa, J.; Pumarola, M.; Marco, A.J.; Ferrer, L.; Rabanal, R.; Kennedy, S. Pathologic and immunocytochemical studies of morbillivirus infection in striped dolphins (*Stenella coeruleoalba*). *Vet. Pathol.* **1992**, *29*, 1–10. [CrossRef] [PubMed]
168. Dagleish, M.P.; Patterson, I.A.P.; Foster, G.; Reid, R.J.; Linton, C.; Buxton, D. Intracranial granuloma caused by asporogenic *Aspergillus fumigatus* in a harbour porpoise (*Phocoena phocoena*). *Vet. Rec.* **2006**, *159*, 458. [CrossRef] [PubMed]
169. Geraci, J.R.; Aubin, D.J.S. Effects of parasites on marine mammals. *Int. J. Parasitol.* **1987**, *17*, 407–414. [CrossRef]
170. Kutz, S.J.; Hoberg, E.P.; Polley, L.; Jenkins, E.J. Global warming is changing the dynamics of Arctic host–parasite systems. *Proc. Roy. Soc. Biol. Sci.* **2005**, *272*, 2571–2576. [CrossRef]
171. Bradley, M.J.; Kutz, S.J.; Jenkins, E.; O'hara, T.M. The potential impact of climate change on infectious diseases of Arctic fauna. *Int. J. Circumpolar Health* **2005**, *64*, 468–477. [CrossRef] [PubMed]
172. Viallet, J.; MacLean, J.D.; Goresky, C.A.; Staudt, M.; Routhier, G.; Law, C. Arctic trichinosis presenting as prolonged diarrhea. *Gastroenterology* **1986**, *91*, 938–946. [CrossRef]
173. Tryland, M.; Nesbakken, T.; Robertson, L.; Grahek-Ogden, D.; Lunestad, B.T. Human pathogens in marine mammal meat—A northern perspective. *Zoonoses Public Health* **2014**, *61*, 377–394. [CrossRef]
174. Jean-François, P.; MacLean, J.D.; Theresa, W.G.; Daniel, L.; Anne-Katrin, R.; Bouchra, S.; Lorry, F.; Alvin, A.G. Novel prevention program for trichinellosis in Inuit communities. *Clin. Infect. Dis.* **2002**, *34*, 1508–1514. [CrossRef]
175. Møller, L.N.; Petersen, E.; Kapel, C.M.O.; Melbye, M.; Koch, A. Outbreak of trichinellosis associated with consumption of game meat in West Greenland. *Vet. Parasitol.* **2005**, *132*, 131–136. [CrossRef]
176. Forbes, L.B. The occurrence and ecology of *Trichinella* in marine mammals. *Vet. Parasitol.* **2000**, *93*, 321–334. [CrossRef]
177. Born, E.W. *Trichinella spiralis* in walrus from the Thule district, North Greenland, and possible routes of transmission. *AGRIS* **1982**, *47*, 246–251.
178. Connell, F.H. Trichinosis in the Arctic: A review. *Arctic* **1949**, *2*, 98–107. Available online: <https://www.jstor.org/stable/40506354> (accessed on 5 December 2022). [CrossRef]
179. Thorshaug, K.; Rosted, A.F. Researches into the prevalence of trichinosis in animals in Arctic and Antarctic waters. *Nord. Vet.* **1956**, *8*, 115–129.
180. Canadian-Government-Report. *Trichinella* Alert for Pond Inlet. gov.nu.ca. 2022. Available online: <https://gov.nu.ca/health/news/trichinella-alert-pond-inlet> (accessed on 5 December 2022).
181. Larsen, T.; Kjos-Hanssen, B. *Trichinella* sp. in polar bears from Svalbard, in relation to hide length and age. *Polar Res.* **1983**, *1*, 89–96. [CrossRef]
182. Åsbakk, K.; Aars, J.; Derocher, A.E.; Wiig, Ø.; Oksanen, A.; Born, E.W.; Dietz, R.; Sonne, C.; Godfroid, J.; Kapel, C.M.O. Serosurvey for *Trichinella* in polar bears (*Ursus maritimus*) from Svalbard and the Barents Sea. *Vet. Parasitol.* **2010**, *172*, 256–263. [CrossRef] [PubMed]
183. Kurnosova, O.P.; Khrestalev, A.V.; Illarionova, N.A.; Odoevskaya, I.M. A survey of helminths of polar bears in the Russian Arctic. *Czech Polar Rep.* **2017**, *7*, 164–168. [CrossRef]
184. Martinez-Levasseur, L.M.; Simard, M.; Furgal, C.M.; Burness, G.; Bertrand, P.; Suppa, S.; Avard, E.; Lemire, M. Towards a better understanding of the benefits and risks of country food consumption using the case of walrus in Nunavik (Northern Quebec, Canada). *Sci. Total Environ.* **2020**, *719*, 137307. [CrossRef]
185. Andersen-Ranberg, E.; Lehnert, K.; Leifsson, P.S.; Dietz, R.; Andersen, S.; Siebert, U.; Sonne, C. Morphometric, molecular and histopathologic description of hepatic infection by *Orthosplanchnus arcticus* (Trematoda: Digenea: *Brachycladiidae*) in ringed seals (*Pusa hispida*) from Northwest Greenland. *Polar Biol.* **2018**, *41*, 1019–1025. [CrossRef]
186. Bishop, L. Parasite-related lesions in a bearded seal, *Erignathus barbatus*. *J. Wildl. Dis.* **1979**, *15*, 285–293. [CrossRef]
187. Fauquier, D.; Gulland, F.; Haulena, M.; Dailey, M.; Rietcheck, R.L.; Lipscomb, T.P. Meningoencephalitis in two stranded California sea lions (*Zalophus californianus*) caused by aberrant trematode migration. *J. Wildl. Dis.* **2004**, *40*, 816–819. [CrossRef]
188. Ridgway, S.H.; Dailey, M.D. Cerebral and cerebellar involvement of trematode parasites in dolphins and their possible role in stranding. *J. Wildl. Dis.* **1972**, *8*, 33–43. [CrossRef] [PubMed]
189. Vlasman, K.L.; Campbell, G.D. Field guide: Diseases and parasites of marine mammals of the Eastern Arctic. In *Canadian Cooperative Wildlife Health Centre: Newsletters & Publications*; University of Nebraska: Lincoln, NE, USA, 2004; Volume 22, Available online: <https://digitalcommons.unl.edu/icwdmccwhcnews/22> (accessed on 5 December 2022).
190. Scholz, T.; Kuchta, R. Fish-borne, zoonotic cestodes (*Diphyllbothrium* and relatives) in cold climates: A never-ending story of neglected and (re)-emergent parasites. *Food Waterborne Parasit.* **2016**, *4*, 23–38. [CrossRef]

191. Lurakhno, M.V.; Mal'tsev, V.N. *Diphyllbothrium skriabini* sp. n. (Cestoda: Diphyllbothriidae)—A parasite of the bearded seal (*Erignathus barbatus* Erx.). *Parazitologiya* **1993**, *27*, 84–89.
192. Aznar, F.J.; Agustí, C.; Littlewood, D.T.J.; Raga, J.A.; Olson, P.D. Insight into the role of cetaceans in the life cycle of the tetraphyllideans (Platyhelminthes: Cestoda). *Int. J. Parasitol.* **2007**, *37*, 243–255. [\[CrossRef\]](#)
193. Measures, L.N.; Béland, P.; Martineau, D.; Guise, S.D. Helminths of an endangered population of belugas, *Delphinapterus leucas*, in the St. Lawrence estuary, Canada. *Can. J. Zool.* **1995**, *73*, 1402–1409. [\[CrossRef\]](#)
194. Santoro, M.; Palomba, M.; Gili, C.; Marcer, F.; Marchiori, E.; Mattiucci, S. Molecular and morphological characterization of *Bolbosoma balaenae* (Acanthocephala: Polymorphidae), a neglected intestinal parasite of the fin whale *Balaenoptera physalus*. *Parasitology* **2021**, *148*, 1293–1302. [\[CrossRef\]](#) [\[PubMed\]](#)
195. Kuzmina, T.A.; Lisitsyna, O.I.; Lyons, E.T.; Spraker, T.R.; Tolliver, S.C. Acanthocephalans in northern fur seals (*Callorhinus ursinus*) and a harbor seal (*Phoca vitulina*) on St. Paul Island, Alaska: Species, prevalence, and biodiversity in four fur seal subpopulations. *Parasitol. Res.* **2012**, *111*, 1049–1058. [\[CrossRef\]](#)
196. Amin, O.; Heckmann, R.; Halajian, A.; El-Naggar, A. The morphology of an unique population of *Corynosoma strumosum* (Acanthocephala, Polymorphidae) from the Caspian seal, *Pusa caspica*, in the land-locked Caspian Sea using SEM, with special notes on histopathology. *Acta Parasitol.* **2011**, *56*, 438–445. [\[CrossRef\]](#)
197. Dailey, M.D.; Gulland, F.M.D.; Lowenstine, L.J.; Silvagni, P.; Howard, D. Prey, parasites and pathology associated with the mortality of a juvenile gray whale (*Eschrichtius robustus*) stranded along the northern California coast. *Dis. Aquat. Org.* **2000**, *42*, 111–117. [\[CrossRef\]](#)
198. Derocher, A.E. *Polar Bears: A Complete Guide to Their Biology and Behavior*; The Johns Hopkins University Press: Baltimore, MD, USA, 2012.
199. Derocher, A.E.; Lunn, N.J.; Stirling, I. Polar bears in a Warming Climate. *Integr. Comp. Biol.* **2004**, *44*, 163–176. [\[CrossRef\]](#)
200. Onderka, D.K. Prevalence and pathology of nematode infections in the lungs of ringed seals (*Phoca hispida*) of the western arctic of Canada. *J. Wildl. Dis.* **1989**, *25*, 218–224. [\[CrossRef\]](#) [\[PubMed\]](#)
201. Bourdages, M.P.T.; Provencher, J.F.; Sudlovenick, E.; Ferguson, S.H.; Young, B.G.; Pelletier, N.; Murphy, M.J.J.; D'Addario, A.; Vermaire, J.C. No plastics detected in seal (*Phocidae*) stomachs harvested in the eastern Canadian Arctic. *Mar. Pollut. Bull.* **2020**, *150*, 110772. [\[CrossRef\]](#) [\[PubMed\]](#)
202. Walden, H.S.; Bryan, A.L.; McIntosh, A.; Tuomi, P.; Hoover-Miller, A.; Stimmelmayer, R.; Quakenbush, L. Helminth fauna of ice seals in the Alaskan Bering and Chukchi seas, 2006–2015. *J. Wildl. Dis.* **2020**, *56*, 863–872. [\[CrossRef\]](#) [\[PubMed\]](#)
203. Karpiej, K.; Simard, M.; Pufall, E.; Rokicki, J. Anisakids (Nematoda: Anisakidae) from ringed seal, *Pusa hispida*, and bearded seal, *Erignathus barbatus* (Mammalia: Pinnipedia) from Nunavut region. *J. Mar. Biol. Assoc. UK* **2014**, *94*, 1237–1241. [\[CrossRef\]](#)
204. Johansen, C.E.; Lydersen, C.; Aspholm, P.E.; Haug, T.; Kovacs, K.M. Helminth parasites in ringed seals (*Pusa hispida*) from Svalbard, Norway with special emphasis on nematodes: Variation with age, sex, diet, and location of host. *J. Parasitol.* **2010**, *96*, 946–953. [\[CrossRef\]](#)
205. Hoberg, E.P.; Measures, L.N. *Anophryocephalus inuitorum* sp. nov. and *A. arcticensis* sp. nov. (Eucestoda: Tetrabothriidae) in ringed seals (*Phoca hispida hispida*) and harp seals (*Phoca groenlandica*) from high-latitude seas of eastern Canada and the Arctic basin. *Can. J. Zool.* **1995**, *73*, 34–44. [\[CrossRef\]](#)
206. Shults, L.M. Helminths of the spotted seal, *Phoca largha*, from the Bering Sea. *J. Wildl. Dis.* **1982**, *18*, 59–62. [\[CrossRef\]](#)
207. Soltysiak, Z.; Simard, M.; Rokicki, J. Pathological changes of stomach in ringed seal (*Pusa hispida*) from Arviat (North Canada) caused by anisakid nematodes. *Pol. J. Vet. Sci.* **2013**, *16*, 63–67. [\[CrossRef\]](#)
208. Pufall, E.L.; Jones-Bitton, A.; McEwen, S.A.; Brown, T.M.; Edge, V.L.; Rokicki, J.; Karpiej, K.; Peregrine, A.S.; Simard, M. Prevalence of zoonotic anisakid nematodes in Inuit-harvested fish and mammals from the eastern Canadian Arctic. *Foodborne Path. Dis.* **2012**, *9*, 1002–1009. [\[CrossRef\]](#)
209. Delyamure, S.L. *Helminthofauna of Marine Mammals (Ecology and Phylogeny)*; Israel Program for Scientific Translations: Jerusalem, Israel, 1969; Volume 10.
210. Popov, V.N. New data on the helminth fauna of the ribbon seal from the southern part of the Sea of Okhotsk. *Parazitologiya* **1975**, *9*, 403–407.
211. Macneill, A.C. *Halocercus monoceris* sp. n. (Nematoda: Metastrongyloidea) from the Narwhal, *Monodon monoceros*. *Proc. Helminth. Soc.* **1973**, *40*, 255–258. Available online: <https://bionames.org/bionames-archive/issn/0018-0130/40/255.pdf> (accessed on 12 August 2022).
212. Leonardi, M.S.; Crespo, J.E.; Soto, F.; Lazzari, C.R. How Did Seal Lice Turn into the Only Truly Marine Insects? *Insects* **2021**, *13*, 46. [\[CrossRef\]](#) [\[PubMed\]](#)
213. Leidenberger, S.; Harding, K.; Härkönen, T. Phocid seals, seal lice and heartworms: A terrestrial host–parasite system conveyed to the marine environment. *Dis. Aquat. Org.* **2007**, *77*, 235–253. [\[CrossRef\]](#)
214. Geraci, J.R.; Fortin, J.F.; Aubin, D.J.S.; Hicks, B.D. The seal louse, *Echinophthirius horridus*: An intermediate host of the seal heartworm, *Dipetalonema spirocauda* (Nematoda). *Can. J. Zool.* **1981**, *59*, 1457–1459. [\[CrossRef\]](#)
215. Leonardi, M.S.; Palma, R.L. Review of the systematics, biology and ecology of lice from pinnipeds and river otters (Insecta: Phthiraptera: Anoplura: Echinophthiriidae). *Zootaxa* **2013**, *3630*, 445–466. [\[CrossRef\]](#) [\[PubMed\]](#)
216. Mulcahy, D.M.; Fravel, V. Walrus medicine. In *CRC Handbook Marine Mammal Medicine*; Dierauf, L., Gulland, F.M.D., Eds.; CRC Press: Boca Raton, FL, USA, 2018; pp. 935–948.

217. Fay, F.H.; Furman, D.P. Nasal mites (Acari: *Halarachnidae*) in the spotted seal, *Phoca largha* Pallas, and other pinnipeds of Alaskan waters. *J. Wildl. Dis.* **1982**, *18*, 63–68. [\[CrossRef\]](#)
218. Fravel, V.; Procter, D. Successful diagnosis and treatment of *Orthohalarachne attenuata* nasal mites utilising voluntary rhinoscopy in three Pacific walrus (*Odobenus rosmarus divergens*). *Vet. Rec. Case Rep.* **2016**, *4*, e000258. [\[CrossRef\]](#)
219. Hirzmann, J.; Ebmer, D.; Sánchez-Contreras, G.J.; Rubio-García, A.; Magdowski, G.; Gärtner, U.; Taubert, A.; Hermosilla, C. The seal louse (*Echinophthirius horridus*) in the Dutch Wadden Sea: Investigation of vector-borne pathogens. *Parasites Vectors* **2021**, *14*, 96. [\[CrossRef\]](#)
220. Pfeiffer, C.J. Whale lice. In *Encyclopedia Marine Mammals*; Academic Press: San Diego, CA, USA, 2009; pp. 1220–1223.
221. Von Duyke, A.L.; Stimmelmayer, R.; Sheffield, G.; Sformo, T.; Suydam, R.; Givens, G.H.; George, J.C. Prevalence and abundance of cyamid “whale lice” (*Cyamus ceti*) on subsistence harvested bowhead whales (*Balaena mysticetus*). *Arctic* **2016**, *69*, 331–340. Available online: <https://www.jstor.org/stable/24878031> (accessed on 4 November 2022). [\[CrossRef\]](#)
222. Schell, D.M.; Rowntree, V.J.; Pfeiffer, C.J. Stable-isotope and electron-microscopic evidence that cyamids (Crustacea: Amphipoda) feed on whale skin. *Can. J. Zool.* **2000**, *78*, 721–727. [\[CrossRef\]](#)
223. Maggi, R.G.; Raverty, S.A.; Lester, S.J.; Huff, D.G.; Haulena, M.; Ford, S.L.; Nielsen, O.; Robinson, J.H.; Breitschwerdt, E.B. *Bartonella henselae* in captive and hunter-harvested beluga (*Delphinapterus leucas*). *J. Wildl. Dis.* **2008**, *44*, 871–877. [\[CrossRef\]](#) [\[PubMed\]](#)
224. Van Wick, M.; Hashem, B. Treatment of sarcoptic mange in an American black bear (*Ursus americanus*) with a single oral dose of fluralaner. *J. Wildl. Dis.* **2019**, *55*, 250–253. [\[CrossRef\]](#) [\[PubMed\]](#)
225. Niedringhaus, K.D.; Brown, J.D.; Sweeley, K.M.; Yabsley, M.J. A review of sarcoptic mange in North American Wildlife. *Int. J. Parasitol. Parasites Wildl.* **2019**, *9*, 285–297. [\[CrossRef\]](#) [\[PubMed\]](#)
226. Smith, M.M.; Van Hemert, C.; Atwood, T.C.; Sinnett, D.R.; Hupp, J.W.; Meixell, B.W.; Gustine, D.D.; Adams, L.G.; Ramey, A.M. A Serologic Survey of Francisella Tularensis Exposure in Wildlife on The Arctic Coastal Plain of Alaska. *J. Wildl. Dis.* **2022**, *58*, 746–755. [\[CrossRef\]](#)
227. Measures, L.N.; Dubey, J.P.; Labelle, P.; Martineau, D. Seroprevalence of Toxoplasma gondii in Canadian pinnipeds. *J. Wildl. Dis.* **2004**, *40*, 294–300. [\[CrossRef\]](#)
228. Jensen, S.K.; Aars, J.; Lydersen, C.; Kovacs, K.M.; Åsbakk, K. The prevalence of Toxoplasma gondii in polar bears and their marine mammal prey: Evidence for a marine transmission pathway? *Polar Biol.* **2010**, *33*, 599–606. [\[CrossRef\]](#)
229. Kirk, C.M.; Amstrup, S.; Swor, R.; Holcomb, D.; O’Hara, T.M. Morbillivirus and Toxoplasma exposure and association with hematological parameters for southern Beaufort Sea polar bears: Potential response to infectious agents in a sentinel species. *EcoHealth* **2010**, *7*, 321–331. [\[CrossRef\]](#) [\[PubMed\]](#)
230. Sharma, R.; Loseto, L.L.; Ostertag, S.K.; Tomaselli, M.; Bredtmann, C.M.; Crill, C.; Rodríguez-Pinacho, C.; Schultz, D.; Jung, D.; Shrestha, K. Qualitative risk assessment of impact of Toxoplasma gondii on health of beluga whales, Delphinapterus leucas, from the Eastern Beaufort Sea, Northwest Territories. *Arctic Sci.* **2018**, *4*, 321–337. [\[CrossRef\]](#)
231. Reiling, S.J.; Measures, L.; Feng, S.; Boone, R.; Merks, H.; Dixon, B.R. Toxoplasma gondii, Sarcocystis sp. and Neospora caninum-like parasites in seals from northern and eastern Canada: Potential risk to consumers. *Food Waterborne Parasitol.* **2019**, *17*, e00067. [\[CrossRef\]](#)
232. Dubey, J.P.; Zarnke, R.; Thomas, N.J.; Wong, S.K.; Van Bonn, W.; Briggs, M.; Davis, J.W.; Ewing, R.; Mense, M.; Kwok, O.C.H. Toxoplasma gondii, Neospora caninum, Sarcocystis neurona, and Sarcocystis canis-like infections in marine mammals. *Vet. Parasitol.* **2003**, *116*, 275–296. [\[CrossRef\]](#)
233. Simon, A.; Chambellant, M.; Ward, B.J.; Simard, M.; Proulx, J.-F.; Lévesque, B.; Bigras-Poulin, M.; Rousseau, A.N.; Ogden, N.H. Spatio-temporal variations and age effect on Toxoplasma gondii seroprevalence in seals from the Canadian Arctic. *Parasitology* **2011**, *138*, 1362–1368. [\[CrossRef\]](#)
234. Prestrud, K.W.; Åsbakk, K.; Fuglei, E.; Mørk, T.; Stien, A.; Ropstad, E.; Tryland, M.; Gabrielsen, G.W.; Lydersen, C.; Kovacs, K.M.; et al. Serosurvey for Toxoplasma gondii in arctic foxes and possible sources of infection in the high Arctic of Svalbard. *Vet. Parasitol.* **2007**, *150*, 6–12. [\[CrossRef\]](#)
235. Simon, A.; Rousseau, A.N.; Savary, S.; Bigras-Poulin, M.; Ogden, N.H. Hydrological modelling of Toxoplasma gondii oocysts transport to investigate contaminated snowmelt runoff as a potential source of infection for marine mammals in the Canadian Arctic. *J. Environ. Manag.* **2013**, *127*, 150–161. [\[CrossRef\]](#)
236. Pilfold, N.W.; Richardson, E.S.; Ellis, J.; Jenkins, E.; Scandrett, W.B.; Hernández-Ortiz, A.; Buhler, K.; McGeachy, D.; Al-Adhami, B.; Konecni, K.; et al. Long-term increases in pathogen seroprevalence in polar bears (Ursus maritimus) influenced by climate change. *Glob. Chang. Biol.* **2021**, *27*, 4481–4497. [\[CrossRef\]](#)
237. Nymo, I.H.; Siebert, U.; Baechlein, C.; Postel, A.; Breines, E.M.; Lydersen, C.; Kovacs, K.M.; Tryland, M. Pathogen Exposure in White Whales (Delphinapterus leucas) in Svalbard, Norway. *Pathogens* **2022**, *12*, 58. [\[CrossRef\]](#)
238. Alekseev, A.Y.; Reguzova, A.Y.; Rozanova, E.I.; Abramov, A.V.; Tumanov, Y.V.; Kuvshinova, I.N.; Shestopalov, A.M. Detection of specific antibodies to morbilliviruses, Brucella and Toxoplasma in the Black Sea dolphin Tursiops truncatus ponticus and the beluga whale Delphinapterus leucas from the Sea of Okhotsk in 2002–2007. *Russ. J. Mar. Biol.* **2009**, *35*, 494–497. [\[CrossRef\]](#)
239. Blanchet, M.-A.; Godfroid, J.; Breines, E.M.; Heide-Jørgensen, M.-P.; Nielsen, N.H.; Hasselmeier, I.; Iversen, M.; Jensen, S.-K.; Åsbakk, K. West Greenland harbour porpoises assayed for antibodies against Toxoplasma gondii: False positives with the direct agglutination method. *Dis. Aquat. Org.* **2014**, *108*, 181–186. [\[CrossRef\]](#) [\[PubMed\]](#)

240. Tanner, C.E.; Staudt, M.; Adamowski, R.; Lussier, M.; Bertrand, S.; Prichard, R.K. Seroepidemiological study for five different zoonotic parasites in northern Quebec. *Can. J. Public Health* **1987**, *78*, 262–266.
241. Curtis, M.A.; Rau, M.E.; Tanner, C.E.; Prichard, R.K.; Faubert, G.M.; Olpinski, S.; Trudeau, C. Parasitic zoonoses in relation to fish and wildlife harvesting by Inuit communities in northern Quebec, Canada. *Arctic Med. Res.* **1988**, *47*, 693–696. Available online: <https://europepmc.org/article/med/3272717> (accessed on 5 November 2022). [PubMed]
242. McDonald, J.C.; Gyorkos, T.W.; Alberton, B.; MacLean, J.D.; Richer, G.; Juranek, D. An outbreak of toxoplasmosis in pregnant women in northern Quebec. *J. Infect. Dis.* **1990**, *161*, 769–774. [CrossRef] [PubMed]
243. Reiling, S.J.; Dixon, B.R. Zoonotic diseases: *Toxoplasma gondii*: How an Amazonian parasite became an Inuit health issue. *Can. Commun. Dis. Rep.* **2019**, *45*, 183. [CrossRef] [PubMed]
244. Gondim, L.F.P.; Gao, L.; McAllister, M.M. Improved production of *Neospora caninum* oocysts, cyclical oral transmission between dogs and cattle, and in vitro isolation from oocysts. *J. Parasitol.* **2002**, *88*, 1159–1163. [CrossRef] [PubMed]
245. Gondim, L.F.P. *Neospora caninum* in wildlife. *Trends Parasitol.* **2006**, *22*, 247–252. [CrossRef]
246. Donahoe, S.L.; Lindsay, S.A.; Krockenberger, M.; Phalen, D.; Šlapeta, J. A review of neosporosis and pathologic findings of *Neospora caninum* infection in wildlife. *Int. J. Parasitol. Parasites Wildl.* **2015**, *4*, 216–238. [CrossRef] [PubMed]
247. Sedláč, K.; Bártošová, E. Seroprevalences of antibodies to *Neospora caninum* and *Toxoplasma gondii* in zoo animals. *Vet. Parasitol.* **2006**, *136*, 223–231. [CrossRef]
248. Mylniczzenko, N.D.; Kearns, K.S.; Melli, A.C. Diagnosis and treatment of *Sarcocystis neurona* in a captive harbor seal (*Phoca vitulina*). *J. Zoo Wildl. Med.* **2008**, *39*, 228–235. [CrossRef]
249. Fravel, V.A. *Sarcocystis neurona* Infection in a Pacific Walrus (*Odobenus rosmarus divergens*) and a Bottlenose Dolphin (*Tursiops truncatus*) under Human Care: Case Comparison. *IAAAM Conf. Proc.* 2017. Available online: <https://www.vin.com/doc/?id=7977727> (accessed on 5 November 2022).
250. Dubey, J.P.; Lindsay, D.S.; Saville, W.J.A.; Reed, S.M.; Granstrom, D.E.; Speer, C.A. A review of *Sarcocystis neurona* and equine protozoal myeloencephalitis (EPM). *Vet. Parasitol.* **2001**, *95*, 89–131. [CrossRef]
251. Burgess, T.L.; Tinker, M.T.; Miller, M.A.; Smith, W.A.; Bodkin, J.L.; Murray, M.J.; Nichol, L.M.; Saarinen, J.A.; Larson, S.; Tomoleoni, J.A.; et al. Spatial epidemiological patterns suggest mechanisms of land-sea transmission for *Sarcocystis neurona* in a coastal marine mammal. *Sci. Rep.* **2020**, *10*, 3683. [CrossRef]
252. O’Byrne, A.M.; Lambourn, D.M.; Rejmanek, D.; Haman, K.; O’Byrne, M.; VanWormer, E.; Shapiro, K. *Sarcocystis neurona* Transmission from Opossums to Marine Mammals in the Pacific Northwest. *EcoHealth* **2021**, *18*, 84–94. [CrossRef]
253. Barbosa, L.; Johnson, C.K.; Lambourn, D.M.; Gibson, A.K.; Haman, K.H.; Huggins, J.L.; Sweeny, A.R.; Sundar, N.; Raverty, S.A.; Grigg, M.E. A novel *Sarcocystis neurona* genotype XIII is associated with severe encephalitis in an unexpectedly broad range of marine mammals from the northeastern Pacific Ocean. *Int. J. Parasitol.* **2015**, *45*, 595–603. [CrossRef]
254. Carlson-Bremer, D.P.; Gulland, F.M.D.; Johnson, C.K.; Colegrove, K.M.; Van Bonn, W.G. Diagnosis and treatment of *Sarcocystis neurona*-induced myositis in a free-ranging California sea lion. *JAVMA* **2012**, *240*, 324–328. [CrossRef]
255. Britton, A.P.; Bidulka, J.; Scouras, A.; Schwantje, H.; Joseph, T. Fatal hepatic sarcocystosis in a free-ranging grizzly bear cub associated with *Sarcocystis canis*-like infection. *J. Vet. Diagn. Investig.* **2019**, *31*, 303–306. [CrossRef] [PubMed]
256. Garner, H.M.; Barr, B.C.; Packham, A.E.; Marsh, A.E.; Ka, B.H.; Wilson, R.K.; Dubney, J.P. Fatal hepatic sarcocystosis in two polar bears (*Ursus maritimus*). *J. Parasitol.* **1997**, *83*, 523–526. [CrossRef] [PubMed]
257. Dubey, J.P.; Sykes, J.E.; Shelton, G.D.; Sharp, N.; Verma, S.K.; Calero-Bernal, R.; Viviano, J.; Sundar, N.; Khan, A.; Grigg, M.E. *Sarcocystis caninum* and *Sarcocystis svanaei* n. spp. (Apicomplexa: Sarcocystidae) associated with severe myositis and hepatitis in the domestic dog (*Canis familiaris*). *J. Eukaryotic Microbiol.* **2015**, *62*, 307–317. [CrossRef]
258. Hughes-Hanks, J.M.; Rickard, L.G.; Panuska, C.; Saucier, J.R.; O’Hara, T.M.; Dehn, L.; Rolland, R.M. Prevalence of *Cryptosporidium* spp. and *Giardia* spp. in five marine mammal species. *J. Parasitol.* **2005**, *91*, 1225–1228. [CrossRef]
259. Olson, M.E.; Roach, P.D.; Stabler, M.; Chan, W. Giardiasis in ringed seals from the western Arctic. *J. Wildl. Dis.* **1997**, *33*, 646–648. [CrossRef]
260. Hueffer, K.; Parkinson, A.J.; Gerlach, R.; Berner, J. Zoonotic infections in Alaska: Disease prevalence, potential impact of climate change and recommended actions for earlier disease detection, research, prevention and control. *Int. J. Circumpolar Health* **2013**, *72*, 19562. [CrossRef]
261. Dixon, B.R.; Parrington, L.J.; Parenteau, M.; Leclair, D.; Santín, M.; Fayer, R. *Giardia duodenalis* and *Cryptosporidium* spp. in the intestinal contents of ringed seals (*Phoca hispida*) and bearded seals (*Erignathus barbatus*) in Nunavik, Quebec, Canada. *J. Parasitol.* **2008**, *94*, 1161–1163. [CrossRef] [PubMed]
262. Santín, M.; Dixon, B.R.; Fayer, R. Genetic characterization of *Cryptosporidium* isolates from ringed seals (*Phoca hispida*) in Northern Quebec, Canada. *J. Parasitol.* **2005**, *91*, 712–716. [CrossRef]
263. Appelbee, A.J.; Thompson, R.C.A.; Olson, M.E. *Giardia* and *Cryptosporidium* in mammalian wildlife—current status and future needs. *Trends Parasitol.* **2005**, *21*, 370–376. [CrossRef]
264. Raga, J.A.; Fernández, M.; Balbuena, J.A.; Aznar, F.J. Parasites. In *Encyclopedia Marine Mammals*; Wursig, B., Perrin, W.F., Thewissen, J.G.M., Eds.; Academic Press: San Diego, CA, USA, 2009; pp. 821–830.
265. McClelland, G. *Eimeria phocae* (Apicomplexa: Eimeriidae) in harbour seals *Phoca vitulina* from Sable Island, Canada. *Dis. Aquat. Org.* **1993**, *17*, 1–8. Available online: <https://www.int-res.com/articles/dao/17/d017p001.pdf> (accessed on 10 September 2022). [CrossRef]

266. Lydersen, C.; Vaquie-Garcia, J.; Lydersen, E.; Christensen, G.N.; Kovacs, K.M. Novel terrestrial haul-out behaviour by ringed seals (*Pusa hispida*) in Svalbard, in association with harbour seals (*Phoca vitulina*). *Polar Res.* **2017**, *36*, 1374124. [CrossRef]
267. Hamilton, C.D.; Kovacs, K.M.; Ims, R.A.; Aars, J.; Lydersen, C. An Arctic predator–prey system in flux: Climate change impacts on coastal space use by polar bears and ringed seals. *J. Anim. Ecol.* **2017**, *86*, 1054–1064. [CrossRef]
268. Müller, G.; Kaim, U.; Haas, L.; Greiser-Wilke, I.; Wohlsein, P.; Siebert, U.; Baumgärtner, W. Phocine distemper virus: Characterization of the morbillivirus causing the seal epizootic in northwestern Europe in 2002. *Arch. Virol.* **2008**, *153*, 951–956. [CrossRef] [PubMed]
269. Morris, S.E.; Zelner, J.L.; Fauquier, D.A.; Rowles, T.K.; Rosel, P.E.; Gulland, F.; Grenfell, B.T. Partially observed epidemics in wildlife hosts: Modelling an outbreak of dolphin morbillivirus in the northwestern Atlantic, June 2013–2014. *J. Roy. Soc. Interface* **2015**, *12*, 20150676. [CrossRef] [PubMed]
270. Duignan, P.J.; Nielsen, O.; House, C.; Kovacs, K.M.; Duffy, N.; Early, G.; Sadove, S.; Aubin, D.J.S.; Rima, B.K.; Geraci, J.R. Epizootiology of morbillivirus infection in harp, hooded, and ringed seals from the Canadian Arctic and western Atlantic. *J. Wildl. Dis.* **1997**, *33*, 7–19. [CrossRef]
271. Hall, A.J. Morbilliviruses in marine mammals. *Trends Microbiol.* **1995**, *3*, 4–9. [CrossRef]
272. Harwood, J.; Hall, A. Mass mortality in marine mammals: Its implications for population dynamics and genetics. *Trends Ecol. Evol.* **1990**, *5*, 254–257. [CrossRef]
273. Härkönen, T.; Dietz, R.; Reijnders, P.; Teilmann, J.; Harding, K.; Hall, A.; Brasseur, S.; Siebert, U.; Goodman, S.J.; Jepson, P.D.; et al. The 1988 and 2002 phocine distemper virus epidemics in European harbour seals. *Dis. Aquat. Org.* **2006**, *68*, 115–130. [CrossRef]
274. Hall, A.J.; Jepson, P.D.; Goodman, S.J.; Härkönen, T. Phocine distemper virus in the North and European Seas—Data and models, nature and nurture. *Biol. Conserv.* **2006**, *131*, 221–229. [CrossRef]
275. Laws, R.M.; Taylor, R.J.F. A mass dying of crabeater seals, *Lobodon carcinophagus* (Gray). *Proc. Zool. Soc. Lond.* **1957**, *129*, 315–324. [CrossRef]
276. Swinton, J.; Harwood, J.; Grenfell, B.T.; Gilligan, C.A. Persistence thresholds for phocine distemper virus infection in harbour seal *Phoca vitulina* metapopulations. *J. Anim. Ecol.* **1998**, *67*, 54–68. [CrossRef]
277. Lavigne, D.M.; Schmitz, O.J. Global warming and increasing population densities: A prescription for seal plagues. *Mar. Pollut. Bull.* **1990**, *21*, 280–284. [CrossRef]
278. Boveng, P.L.; Bengtson, J.L.; Buckley, T.W.; Cameron, M.F.; Dahle, S.P.; Kelly, B.P.; Megrey, B.A.; Overland, J.E.; Williamson, N.J. Status review of the spotted seal (*Phoca largha*). In *NOAA Technical Memorandum NMFS-AFSC-200*; NOAA: Washington, DC, USA, 2009; p. 169. Available online: https://repository.library.noaa.gov/view/noaa/3671/noaa_3671_DS1.pdf (accessed on 18 August 2022).
279. Quakenbush, L.; Citta, J.; Crawford, J. Biology of the Spotted Seal (*Phoca largha*) in Alaska from 1962 to 2008. Final Report to National Marine Fisheries Service. 2009. Available online: https://adfg.alaska.gov/static/research/programs/marinemammals/pdfs/biology_spotted_seal.pdf (accessed on 4 November 2022).
280. Siebert, U.; Gulland, F.; Harder, T.; Jauniaux, T.; Seibel, H.; Wohlsein, P.; Baumgärtner, W. Epizootics in harbour seals (*Phoca vitulina*): Clinical aspects. *NAMMCO Sci. Publ.* **2010**, *8*, 265–274. [CrossRef] [PubMed]
281. Duignan, P.J.; Van Bresse, M.-F.; Baker, J.D.; Barbieri, M.; Colegrove, K.M.; De Guise, S.; De Swart, R.L.; Di Guardo, G.; Dobson, A.; Duprex, W.P.; et al. Phocine distemper virus: Current knowledge and future directions. *Viruses* **2014**, *6*, 5093–5134. [CrossRef] [PubMed]
282. Stuenkel, S.; Have, P.; Osterhaus, A.; Arnemo, J.M.; Moustgaard, A. Serological investigation of virus infections in harp seals (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*). *Vet. Rec.* **1994**, *134*, 502. [CrossRef]
283. Nielsen, O.; Stewart, R.E.A.; Measures, L.; Duignan, P.; House, C. A morbillivirus antibody survey of Atlantic walrus, narwhal and beluga in Canada. *J. Wildl. Dis.* **2000**, *36*, 508–517. [CrossRef]
284. Duignan, P.J.; Saliki, J.T.; St. Aubin, D.J.; Early, G.; Sadove, S.; House, J.A.; Kovacs, K.; Geraci, J.R. Epizootiology of morbillivirus infection in North American harbor seals (*Phoca vitulina*) and gray seals (*Halichoerus grypus*). *J. Wildl. Dis.* **1995**, *31*, 491–501. [CrossRef]
285. Duignan, P.J. *Morbillivirus Infections of Marine Mammals*; Saunders: Rhodes, Australia; University of California: Los Angeles, CA, USA, 1999; Volume 4, p. 747.
286. Van Bresse, M.-F.; Duignan, P.J.; Banyard, A.; Barbieri, M.; Colegrove, K.M.; De Guise, S.; Di Guardo, G.; Dobson, A.; Domingo, M.; Fauquier, D.; et al. Cetacean morbillivirus: Current knowledge and future directions. *Viruses* **2014**, *6*, 5145–5181. [CrossRef]
287. Schulman, F.Y.; Lipscomb, T.P.; Moffett, D.; Krafft, A.E.; Lichy, J.H.; Tsai, M.M.; Taubenberger, J.K.; Kennedy, S. Histologic, immunohistochemical, and polymerase chain reaction studies of bottlenose dolphins from the 1987–1988 United States Atlantic coast epizootic. *Vet. Pathol.* **1997**, *34*, 288–295. [CrossRef]
288. Kennedy, S. Morbillivirus infections in aquatic mammals. *J. Comp. Pathol.* **1998**, *119*, 201–225. [CrossRef] [PubMed]
289. Beffagna, G.; Centellegh, C.; Franzo, G.; Di Guardo, G.; Mazzariol, S. Genomic and structural investigation on dolphin morbillivirus (DMV) in Mediterranean fin whales (*Balaenoptera physalus*). *Sci. Rep.* **2017**, *7*, 41554. [CrossRef] [PubMed]
290. Stimmelmayer, R.; Rotstein, D.; Sheffield, G.; Brower, H.K.; George, J.C. Diseases and parasites. In *The Bowhead Whale*; Academic Press: San Diego, CA, USA, 2021; pp. 471–498.
291. Fereidouni, S.; Munoz, O.; Von Dobschuetz, S.; De Nardi, M. Influenza virus infection of marine mammals. *EcoHealth* **2016**, *13*, 161–170. [CrossRef] [PubMed]

292. Nielsen, O.; Clavijo, A.; Boughen, J.A. Serologic evidence of influenza A infection in marine mammals of Arctic Canada. *J. Wildl. Dis.* **2001**, *37*, 820–825. [\[CrossRef\]](#)
293. Gass, J.D., Jr.; Kellogg, H.K.; Hill, N.J.; Puryear, W.B.; Nutter, F.B.; Runstadler, J.A. Epidemiology and Ecology of Influenza A Viruses among Wildlife in the Arctic. *Viruses* **2022**, *14*, 1531. [\[CrossRef\]](#)
294. Zohari, S.; Neimanis, A.; Härkönen, T.; Moraeus, C.; Valarcher, J.-F. Avian influenza A (H10N7) virus involvement in mass mortality of harbour seals (*Phoca vitulina*) in Sweden, March through October 2014. *Eurosurveillance* **2014**, *19*, 20967. [\[CrossRef\]](#) [\[PubMed\]](#)
295. Anthony, S.J.; St. Leger, J.A.; Puglianes, K.; Ip, H.S.; Chan, J.M.; Carpenter, Z.W.; Navarrete-Macias, I.; Sanchez-Leon, M.; Saliki, J.T.; Pedersen, J.; et al. Emergence of fatal avian influenza in New England harbor seals. *MBio* **2012**, *3*, e00166–12. [\[CrossRef\]](#) [\[PubMed\]](#)
296. Postel, A.; King, J.; Kaiser, F.K.; Kennedy, J.; Lombardo, M.S.; Reineking, W.; de le Roi, M.; Harder, T.; Pohlmann, A.; Gerlach, T. Infections with highly pathogenic avian influenza A virus (HPAIV) H5N8 in harbor seals at the German North Sea coast, 2021. *Emerg. Microbes Infect.* **2022**, *11*, 725–729. [\[CrossRef\]](#)
297. Ohishi, K.; Ninomiya, A.; Kida, H.; Park, C.H.; Maruyama, T.; Arai, T.; Katsumata, E.; Tobayama, T.; Boltunov, A.N.; Khuraskin, L.S. Serological evidence of transmission of human influenza A and B viruses to Caspian seals (*Phoca caspica*). *Microbiol. Immunol.* **2002**, *46*, 639–644. [\[CrossRef\]](#) [\[PubMed\]](#)
298. Leguia, M.; Garcia-Glaessner, A.; Munoz-Saavedra, B.; Juarez, D.; Barrera, P.; Calvo-Mac, C.; Jara, J.; Silva, W.; Ploog, K.; Amaro, L. Highly pathogenic avian influenza A (H5N1) in marine mammals and seabirds in Peru. *bioRxiv* **2023**. [\[CrossRef\]](#)
299. Puryear, W.; Sawatzki, K.; Hill, N.; Foss, A.; Stone, J.J.; Doughty, L.; Walk, D.; Gilbert, K.; Murray, M.; Cox, E. Highly Pathogenic Avian Influenza A (H5N1) Virus Outbreak in New England Seals, United States. *Emerg. Infect. Dis.* **2023**, *29*, 786–791. [\[CrossRef\]](#) [\[PubMed\]](#)
300. Puryear, W.B.; Keogh, M.; Hill, N.; Moxley, J.; Josephson, E.; Davis, K.R.; Bandoro, C.; Lidgard, D.; Bogomolni, A.; Levin, M. Prevalence of influenza A virus in live-captured North Atlantic gray seals: A possible wild reservoir. *Emerg. Microbes Infect.* **2016**, *5*, e81. [\[CrossRef\]](#)
301. Gass, J.D., Jr.; Dusek, R.J.; Hall, J.S.; Hallgrimsson, G.T.; Halldórsson, H.P.; Vignisson, S.R.; Ragnarsdóttir, S.B.; Jónsson, J.E.; Krauss, S.; Wong, S.S. Global dissemination of Influenza A virus is driven by wild bird migration through arctic and subarctic zones. *Mol. Ecol.* **2023**, *32*, 198–213. [\[CrossRef\]](#)
302. Kubny, H. Bird Flu Detected in the High Arctic for the First Time. *Polar Journal*. 2022. Available online: <https://polarjournal.ch/en/2022/06/27/bird-flu-detected-in-the-arctic-for-the-first-time/> (accessed on 10 September 2022).
303. USDA. USDA Online. 2023. Available online: <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/avian-influenza/hpai-2022/2022-hpai-mammals> (accessed on 5 February 2023).
304. Wang, L.; Maddox, C.; Terio, K.; Lanka, S.; Fredrickson, R.; Novick, B.; Parry, C.; McClain, A.; Ross, K. Detection and characterization of new coronavirus in bottlenose dolphin, United States, 2019. *Emerg. Infect. Dis.* **2020**, *26*, 1610. [\[CrossRef\]](#) [\[PubMed\]](#)
305. Nollens, H.H.; Wellehan, J.F.X.; Archer, L.; Lowenstine, L.J.; Gulland, F.M.D. Detection of a respiratory coronavirus from tissues archived during a pneumonia epizootic in free-ranging Pacific harbor seals *Phoca vitulina richardsii*. *Dis. Aquat. Org.* **2010**, *90*, 113–120. [\[CrossRef\]](#) [\[PubMed\]](#)
306. Mathavarajah, S.; Stoddart, A.K.; Gagnon, G.A.; Delleire, G. Pandemic danger to the deep: The risk of marine mammals contracting SARS-CoV-2 from wastewater. *Sci. Tot. Environ.* **2021**, *760*, 143346. [\[CrossRef\]](#) [\[PubMed\]](#)
307. Smith, A.W.; Skilling, D.E.; Ridgway, S. Calicivirus-induced vesicular disease in cetaceans and probable interspecies transmission. *JAVMA* **1983**, *183*, 1223–1225.
308. O'Hara, T.M.; House, C.; House, J.A.; Suydam, R.S.; George, J.C. Viral serologic survey of bowhead whales in Alaska. *J. Wildl. Dis.* **1998**, *34*, 39–46. [\[CrossRef\]](#)
309. Smith, A.W.; Ritter, D.G.; Ray, G.C.; Skilling, D.E.; Wartzok, D. New calicivirus isolates from feces of walrus (*Odobenus rosmarus*). *J. Wildl. Dis.* **1983**, *19*, 86–89. [\[CrossRef\]](#)
310. Barlough, J.E.; Berry, E.S.; Skilling, D.E.; Smith, A.W.; Fay, F.H. Antibodies to marine caliciviruses in the Pacific walrus (*Odobenus rosmarus divergens* Illiger). *J. Wildl. Dis.* **1986**, *22*, 165–168. [\[CrossRef\]](#)
311. Goldstein, T.; Colegrove, K.M.; Hanson, M.; Gulland, F.M.D. Isolation of a novel adenovirus from California sea lions *Zalophus californianus*. *Dis. Aquat. Org.* **2011**, *94*, 243–248. [\[CrossRef\]](#)
312. Maness, H.T.D.; Nollens, H.H.; Jensen, E.D.; Goldstein, T.; LaMere, S.; Childress, A.; Sykes, J.; Leger, J.S.; Lacave, G.; Latson, F.E.; et al. Phylogenetic analysis of marine mammal herpesviruses. *Vet. Microbiol.* **2011**, *149*, 23–29. [\[CrossRef\]](#) [\[PubMed\]](#)
313. Zarnke, R.L.; Harder, T.C.; Vos, H.W.; Ver Hoef, J.M.; Osterhaus, A.D.M.E. Serologic survey for phocid herpesvirus-1 and-2 in marine mammals from Alaska and Russia. *J. Wildl. Dis.* **1997**, *33*, 459–465. [\[CrossRef\]](#)
314. Deming, A.C.; Wellehan, J.F.X.; Colegrove, K.M.; Hall, A.; Luff, J.; Lowenstine, L.; Duignan, P.; Cortés-Hinojosa, G.; Gulland, F.M.D. Unlocking the role of a genital herpesvirus, otarine herpesvirus 1, in california sea lion cervical cancer. *Animals* **2021**, *11*, 491. [\[CrossRef\]](#)
315. Kennedy, S.; Lindstedt, I.J.; McAliskey, M.M.; McConnell, S.A.; McCullough, S.J. Herpesviral encephalitis in a harbor porpoise (*Phocoena phocoena*). *J. Zoo Wildl. Med.* **1992**, *23*, 374–379. Available online: <https://www.jstor.org/stable/20095242> (accessed on 1 September 2022).

316. van Elk, C.E.; van de Bildt, M.W.G.; de Jong, A.A.W.; Osterhaus, A.D.M.E.; Kuiken, T. Genital herpesvirus in bottlenose dolphins (*Tursiops truncatus*): Cultivation, epidemiology, and associated pathology. *J. Wildl. Dis.* **2009**, *45*, 895–906. [CrossRef]
317. Roth, S.J.; Tischer, B.K.; Kovacs, K.M.; Lydersen, C.; Osterrieder, N.; Tryland, M. Phocine herpesvirus 1 (PhHV-1) in harbor seals from Svalbard, Norway. *Vet. Microbiol.* **2013**, *164*, 286–292. [CrossRef]
318. Bellehumeur, C.; Nielsen, O.; Measures, L.; Harwood, L.; Goldstein, T.; Boyle, B.; Gagnon, C.A. Herpesviruses including novel gammaherpesviruses are widespread among phocid seal species in Canada. *J. Wildl. Dis.* **2016**, *52*, 70–81. [CrossRef]
319. Bossart, G.D.; Cray, C.; Solorzano, J.L.; Decker, S.J.; Cornell, L.H.; Altman, N.H. Cutaneous papillomaviral-like papillomatosis in a killer whale (*Orcinus orca*). *Mar. Mammal Sci.* **1996**, *12*, 274–281. [CrossRef]
320. De Guise, S.; Lagacé, A.; Béland, P. Gastric papillomas in eight St. Lawrence beluga whales (*Delphinapterus leucas*). *J. Vet. Diag. Investig.* **1994**, *6*, 385–388. [CrossRef]
321. Thomas, C.; Mergl, J.; Gehring, E.; Paulus, W.; Martineau, D.; Hasselblatt, M. Choroid plexus papilloma in a beluga whale (*Delphinapterus leucas*). *J. Vet. Diag. Investig.* **2016**, *28*, 461–463. [CrossRef]
322. Newman, S.J.; Smith, S.A. Marine mammal neoplasia: A review. *Vet. Pathol.* **2006**, *43*, 865–880. [CrossRef] [PubMed]
323. Geraci, J.R.; Palmer, N.C.; St. Aubin, D.J. Tumors in cetaceans: Analysis and new findings. *Can. J. Fish. Aquat. Sci.* **1987**, *44*, 1289–1300. [CrossRef]
324. Tryland, M. Parapoxvirus Infections in Northern Species and Populations. In *Arctic One Health*; Tryland, M., Ed.; Springer: Cham, Switzerland, 2022; pp. 427–436.
325. Tryland, M. Zoonoses of Arctic Marine Mammals. *Rev. Infect. Dis.* **2000**, *2*, 55–64.
326. Heide-Jørgensen, M.P.; Härkönen, T.; Dietz, R.; Thompson, P.M. Retrospective of the 1988 European seal epizootic. *Dis. Aquat. Org.* **1992**, *13*, 37–62. [CrossRef]
327. Odegaard, O.A.; Krogsrud, J. Rabies in Svalbard: Infection diagnosed in arctic fox, reindeer and seal. *Vet. Rec.* **1981**, *109*, 141–142. [CrossRef]
328. Prestrud, P.; Krogsrud, J.; Gjert, I. The occurrence of rabies in the Svalbard Islands of Norway. *J. Wildl. Dis.* **1992**, *28*, 57–63. [CrossRef]
329. Mørk, T.; Prestrud, P. Arctic rabies—A review. *Acta Vet. Scand.* **2004**, *45*, 1. [CrossRef]
330. Taylor, M.; Elkin, B.; Maier, N.; Bradley, M. Observation of a polar bear with rabies. *J. Wildl. Dis.* **1991**, *27*, 337–339. [CrossRef]
331. Huntington, H.P. A preliminary assessment of threats to arctic marine mammals and their conservation in the coming decades. *Mar. Policy* **2009**, *33*, 77–82. [CrossRef]
332. Moore, S.E.; Reeves, R.R.; Southall, B.L.; Ragen, T.J.; Suydam, R.S.; Clark, C.W. A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic. *Bioscience* **2012**, *62*, 289–295. [CrossRef]
333. Hunt, K.E.; Stimmelmayer, R.; George, C.; Hanns, C.; Suydam, R.; Brower, H.; Rolland, R.M. Baleen hormones: A novel tool for retrospective assessment of stress and reproduction in bowhead whales (*Balaena mysticetus*). *Conserv. Physiol.* **2014**, *2*, cou030. [CrossRef] [PubMed]
334. Ghosh, S.; Rubly, C. The emergence of Arctic shipping: Issues, threats, costs, and risk-mitigating strategies of the Polar Code. *Aust. J. Marit. Ocean. Aff.* **2015**, *7*, 171–182. [CrossRef]
335. Halliday, W.D.; Insley, S.J.; Hilliard, R.C.; de Jong, T.; Pine, M.K. Potential impacts of shipping noise on marine mammals in the western Canadian Arctic. *Mar. Pollut. Bull.* **2017**, *123*, 73–82. [CrossRef]
336. Rolland, R.M.; Graham, K.M.; Stimmelmayer, R.; Suydam, R.S.; George, J.C. Chronic stress from fishing gear entanglement is recorded in baleen from a bowhead whale (*Balaena mysticetus*). *Mar. Mammal Sci.* **2019**, *35*, 1625–1642. [CrossRef]
337. George, J.C.; Sheffield, G.; Reed, D.J.; Tudor, B.; Stimmelmayer, R.; Person, B.T.; Sformo, T.; Suydam, R. Frequency of injuries from line entanglements, killer whales, and ship strikes on Bering-Chukchi-Beaufort Seas bowhead whales. *Arctic* **2017**, *70*, 37–46. Available online: <http://www.jstor.org/stable/26379722> (accessed on 3 October 2022). [CrossRef]
338. Heide-Jørgensen, M.P.; Laidre, K.L.; Quakenbush, L.T.; Citta, J.J. The Northwest Passage opens for bowhead whales. *Biol. Lett.* **2012**, *8*, 270–273. [CrossRef]
339. Fortune, S.M.E.; Ferguson, S.H.; Trites, A.W.; LeBlanc, B.; LeMay, V.; Hudson, J.M.; Baumgartner, M.F. Seasonal diving and foraging behaviour of Eastern Canada-West Greenland bowhead whales. *Mar. Ecol. Prog. Ser.* **2020**, *643*, 197–217. [CrossRef]
340. van Weelden, C.; Towers, J.R.; Bosker, T. Impacts of climate change on cetacean distribution, habitat and migration. *Clim. Chang. Ecol.* **2021**, *1*, 100009. [CrossRef]
341. George, J.C.; Suydam, R. Observations of killer whale (*Orcinus orca*) predation in the northeastern Chukchi and western Beaufort Seas. *Mar. Mammal Sci.* **1998**, *14*, 330–332. [CrossRef]
342. Ferguson, S.H.; Higdon, J.W.; Chmelnitsky, E.G. The rise of killer whales as a major Arctic predator. In *A Little Less Arctic*; Springer: Dordrecht, The Netherlands, 2010; pp. 117–136.
343. Matthews, C.J.D.; Breed, G.A.; LeBlanc, B.; Ferguson, S.H. Killer whale presence drives bowhead whale selection for sea ice in Arctic seascapes of fear. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 6590–6598. [CrossRef]
344. Reinhart, N.R.; Ferguson, S.H.; Koski, W.R.; Higdon, J.W.; LeBlanc, B.; Tervo, O.; Jepson, P.D. Occurrence of killer whale *Orcinus orca* rake marks on Eastern Canada-West Greenland bowhead whales *Balaena mysticetus*. *Polar Biol.* **2013**, *36*, 1133–1146. [CrossRef]
345. Stafford, K.M. Increasing detections of killer whales (*Orcinus orca*), in the Pacific Arctic. *Mar. Mammal Sci.* **2019**, *35*, 696–706. [CrossRef]

346. Willoughby, A.L.; Ferguson, M.C.; Stimmelmayer, R.; Clarke, J.T.; Brower, A.A. Bowhead whale (*Balaena mysticetus*) and killer whale (*Orcinus orca*) co-occurrence in the US Pacific Arctic, 2009–2018: Evidence from bowhead whale carcasses. *Polar Biol.* **2020**, *43*, 1669–1679. [\[CrossRef\]](#)
347. Breed, G.A.; Matthews, C.J.D.; Marcoux, M.; Higdon, J.W.; LeBlanc, B.; Petersen, S.D.; Orr, J.; Reinhart, N.R.; Ferguson, S.H. Sustained disruption of narwhal habitat use and behavior in the presence of Arctic killer whales. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 2628–2633. [\[CrossRef\]](#)
348. Laidre, K.L.; Heide-Jørgensen, M.P.; Logdson, M.L.; Hobbs, R.C.; Heagerty, P.; Dietz, R.; Jørgensen, O.A.; Treble, M.A. Seasonal narwhal habitat associations in the high Arctic. *Mar. Biol.* **2004**, *145*, 821–831. [\[CrossRef\]](#)
349. Lefort, K.J.; Garroway, C.J.; Ferguson, S.H. Killer whale abundance and predicted narwhal consumption in the Canadian Arctic. *Glob. Chang. Biol.* **2020**, *26*, 4276–4283. [\[CrossRef\]](#)
350. Watt, C.A.; Heide-Jørgensen, M.P.; Ferguson, S.H. How adaptable are narwhal? A comparison of foraging patterns among the world's three narwhal populations. *Ecosphere* **2013**, *4*, 1–15. [\[CrossRef\]](#)
351. Learmonth, J.A.; MacLeod, C.D.; Santos, M.B.; Pierce, G.J.; Crick, H.; Robinson, R. Potential effects of climate change on marine mammals. *Oceanogr. Mar. Biol.* **2006**, *44*, 431. [\[CrossRef\]](#)
352. Berger, J.; Hartway, C.; Gruzdev, A.; Johnson, M. Climate degradation and extreme icing events constrain life in cold-adapted mammals. *Sci. Rep.* **2018**, *8*, 1156. [\[CrossRef\]](#)
353. Duignan, P.J.; Stephens, N.S.; Robb, K. Fresh water skin disease in dolphins: A case definition based on pathology and environmental factors in Australia. *Sci. Rep.* **2020**, *10*, 21979. [\[CrossRef\]](#)
354. McClain, A.M.; Daniels, R.; Gomez, F.M.; Ridgway, S.H.; Takeshita, R.; Jensen, E.D.; Smith, C.R. Physiological effects of low salinity exposure on bottlenose dolphins (*Tursiops truncatus*). *J. Zool. Bot. Gard.* **2020**, *1*, 61–75. [\[CrossRef\]](#)
355. Trana, M.R.; Roth, J.D.; Tomy, G.T.; Anderson, W.G.; Ferguson, S.H. Increased blubber cortisol in ice-entrapped beluga whales (*Delphinapterus leucas*). *Polar Biol.* **2016**, *39*, 1563–1569. [\[CrossRef\]](#)
356. Laidre, K.L.; Heide-Jørgensen, M.P. Arctic sea ice trends and narwhal vulnerability. *Biol. Conserv.* **2005**, *121*, 509–517. [\[CrossRef\]](#)
357. Matthews, C.J.D.; Raverty, S.A.; Noren, D.P.; Arragutainaq, L.; Ferguson, S.H. Ice entrapment mortality may slow expanding presence of Arctic killer whales. *Polar Biol.* **2019**, *42*, 639–644. [\[CrossRef\]](#)
358. Westdal, K.H.; Higdon, J.W.; Ferguson, S.H. Review of killer whale (*Orcinus orca*) ice entrapments and ice-related mortality events in the Northern Hemisphere. *Polar Biol.* **2017**, *40*, 1467–1473. [\[CrossRef\]](#)
359. Pagano, A.M.; Williams, T.M. Physiological consequences of Arctic sea ice loss on large marine carnivores: Unique responses by polar bears and narwhals. *J. Exp. Biol.* **2021**, *224*, jeb228049. [\[CrossRef\]](#)
360. Smith, T.G.; Lydersen, C. Availability of suitable land-fast ice and predation as factors limiting ringed seal populations, *Phoca hispida*, in Svalbard. *Polar Res.* **1991**, *10*, 585–594. [\[CrossRef\]](#)
361. Laidre, K.; Heide-Jørgensen, M.P.; Stern, H.; Richard, P. Unusual narwhal sea ice entrapments and delayed autumn freeze-up trends. *Polar Biol.* **2012**, *35*, 149–154. [\[CrossRef\]](#)
362. David, C.; Lange, B.; Krumpfen, T.; Schaafsma, F.; van Franeker, J.A.; Flores, H. Under-ice distribution of polar cod *Boreogadus saida* in the central Arctic Ocean and their association with sea-ice habitat properties. *Polar Biol.* **2016**, *39*, 981–994. [\[CrossRef\]](#)
363. Fossheim, M.; Primicerio, R.; Johannesen, E.; Ingvaldsen, R.B.; Aschan, M.M.; Dolgov, A.V. Recent warming leads to a rapid borealization of fish communities in the Arctic. *Nat. Clim. Chang.* **2015**, *5*, 673–677. [\[CrossRef\]](#)
364. Hop, H.; Gjøsaeter, H. Polar cod (*Boreogadus saida*) and capelin (*Mallotus villosus*) as key species in marine food webs of the Arctic and the Barents Sea. *Mar. Biol. Res.* **2013**, *9*, 878–894. [\[CrossRef\]](#)
365. Harwood, L.A.; Smith, T.G.; Melling, H. Variation in reproduction and body condition of the ringed seal (*Phoca hispida*) in western Prince Albert Sound, NT, Canada, as assessed through a harvest-based sampling program. *Arctic* **2000**, *53*, 422–431. [\[CrossRef\]](#)
366. Ferguson, S.H.; Yurkowski, D.J.; Young, B.G.; Fisk, A.T.; Muir, D.C.G.; Zhu, X.; Thiemann, G.W. Comparing temporal patterns in body condition of ringed seals living within their core geographic range with those living at the edge. *Ecography* **2020**, *43*, 1521–1535. [\[CrossRef\]](#)
367. Derous, D.; Ten Doeschate, M.; Brownlow, A.C.; Davison, N.J.; Lusseau, D. Toward new ecologically relevant markers of health for cetaceans. *Front. Mar. Sci.* **2020**, *7*, 367. [\[CrossRef\]](#)
368. Ogloff, W.R.; Anderson, R.A.; Yurkowski, D.J.; Debets, C.D.; Anderson, W.G.; Ferguson, S.H. Spatiotemporal variation of ringed seal blubber cortisol levels in the Canadian Arctic. *J. Mammal.* **2022**, *103*, 1208–1220. [\[CrossRef\]](#) [\[PubMed\]](#)
369. Kershaw, J.L.; Botting, C.H.; Brownlow, A.; Hall, A.J.J.C.p. Not just fat: Investigating the proteome of cetacean blubber tissue. *Conser. Physiol.* **2018**, *6*, coy003. [\[CrossRef\]](#)
370. Burek, K.; Beckmen, K.; Blake, J.; Atkinson, S.; Tuomi, P.; Small, R. Investigation into the Etiology of the “Hairless” (Alopecic) Ringed Seals (*Phoca hispida*) in the Bering Sea. In Proceedings of the 51st Annual Wildlife Disease Association Conference, Arcata, CA, USA, 28 July–1 August 2002.
371. Thometz, N.M.; Hermann-Sorensen, H.; Russell, B.; Rosen, D.A.S.; Reichmuth, C. Molting strategies of Arctic seals drive annual patterns in metabolism. *Conser. Physiol.* **2021**, *9*, coaa112. [\[CrossRef\]](#) [\[PubMed\]](#)
372. Laidre, K.L.; Stirling, I.; Lowry, L.F.; Wiig, Ø.; Heide-Jørgensen, M.P.; Ferguson, S.H. Quantifying the sensitivity of Arctic marine mammals to climate-induced habitat change. *Ecol. Appl.* **2008**, *18*, S97–S125. [\[CrossRef\]](#)
373. Seguel, M.; Stimmelmayer, R.; Howerth, E.; Gottdenker, N. Pulmonary mast cell tumor and possible paraganglioma in a free-ranging Pacific walrus (*Odobenus rosmarus divergens*), Barrow, Alaska, USA. *J. Wildl. Dis.* **2016**, *52*, 407–410. [\[CrossRef\]](#)

374. Ridgway, S.H.; Marino, L.; Lipscomb, T.P. Description of a poorly differentiated carcinoma within the brainstem of a white whale (*Delphinapterus leucas*) from magnetic resonance images and histological analysis. *Anat. Rec.* **2002**, *268*, 441–449. [\[CrossRef\]](#)
375. Mikaelian, I.; Leclair, D.; Inukpuk, J. Adenocarcinoma of the small intestine in a ringed seal from Hudson Bay. *J. Wildl. Dis.* **2001**, *37*, 379–382. [\[CrossRef\]](#)
376. Gulland, F.M.D.; Trupkiewicz, J.G.; Spraker, T.R.; Lowenstine, L.J. Metastatic carcinoma of probable transitional cell origin in 66 free-living California sea lions (*Zalophus californianus*), 1979 to 1994. *J. Wildl. Dis.* **1996**, *32*, 250–258. [\[CrossRef\]](#) [\[PubMed\]](#)
377. Ylitalo, G.M.; Stein, J.E.; Hom, T.; Johnson, L.L.; Tilbury, K.L.; Hall, A.J.; Rowles, T.; Greig, D.; Lowenstine, L.J.; Gulland, F.M.D. The role of organochlorines in cancer-associated mortality in California sea lions (*Zalophus californianus*). *Mar. Pollut. Bull.* **2005**, *50*, 30–39. [\[CrossRef\]](#) [\[PubMed\]](#)
378. De Guise, S.; Lagace, A.; B  land, P. Tumors in St. Lawrence beluga whales (*Delphinapterus leucas*). *Vet. Pathol.* **1994**, *31*, 444–449. [\[CrossRef\]](#)
379. Martineau, D.; Lemberger, K.; Dallaire, A.; Labelle, P.; Lipscomb, T.P.; Michel, P.; Mikaelian, I. Cancer in wildlife, a case study: Beluga from the St. Lawrence estuary, Qu  bec, Canada. *Environ. Health Perspect.* **2002**, *110*, 285–292. [\[CrossRef\]](#)
380. Reeves, R.R.; Ewins, P.J.; Agbayani, S.; Heide-J  rgensen, M.P.; Kovacs, K.M.; Lydersen, C.; Suydam, R.; Elliott, W.; Polet, G.; van Dijk, Y. Distribution of endemic cetaceans in relation to hydrocarbon development and commercial shipping in a warming Arctic. *Mar. Policy* **2014**, *44*, 375–389. [\[CrossRef\]](#)
381. Atkinson, S.; Dierauf, L.A. Stress and marine mammals. In *CRC Handbook Marine Mammal Medicine*; CRC Press: Boca Raton, FL, USA, 2018; pp. 153–168.
382. George, J.C.; Druckenmiller, M.L.; Laidre, K.L.; Suydam, R.; Person, B. Bowhead whale body condition and links to summer sea ice and upwelling in the Beaufort Sea. *Prog. Oceanogr.* **2015**, *136*, 250–262. [\[CrossRef\]](#)
383. Gulland, F.M.D.; Baker, J.; Howe, M.; LaBrecque, E.; Leach, L.; Moore, S.E.; Reeves, R.R.; Thomas, P.O. A Review of Climate Change Effects on Marine Mammals in United States Waters: Past Predictions, Observed Impacts, Current Research and Conservation Imperatives. *Clim. Chang. Ecol.* **2022**, *3*, 100054. [\[CrossRef\]](#)
384. NMFS. NMFS-PD 02-204-01 Draft Revisions to the Guidelines for Preparing Stock Assessment Reports (noaa.gov). 2023. Available online: https://www.fisheries.noaa.gov/s3/2023-02/02-204-01-Final%20GAMMS%20IV%20Revisions%20clean_kdr.pdf (accessed on 8 February 2023).
385. Roman, J.; Altman, I.; Dunphy-Daly, M.M.; Campbell, C.; Jasny, M.; Read, A.J. The Marine Mammal Protection Act at 40: Status, recovery, and future of US marine mammals. *Ann. N. Y. Acad. Sci.* **2013**, *1286*, 29–49. [\[CrossRef\]](#)
386. Lydersen, C.; Kovacs, K.M. A review of the ecology and status of white whales (*Delphinapterus leucas*) in Svalbard, Norway. *Polar Res.* **2021**, *40*, 1–12. [\[CrossRef\]](#)
387. Moore, S.E. Marine mammals as Ecosystem Sentinels. *J. Mammal.* **2008**, *89*, 534–540. [\[CrossRef\]](#)
388. Moore, S.E.; Gulland, F.M.D. Linking marine mammal and ocean health in the ‘New Normal’ Arctic. *Ocean. Coast. Manag.* **2014**, *102*, 55–57. [\[CrossRef\]](#)
389. Sanderson, C.E.; Alexander, K.A. Uncharted waters: Climate change likely to intensify infectious disease outbreaks causing mass mortality events in marine mammals. *Glob. Chang. Biol.* **2020**, *26*, 4284–4301. [\[CrossRef\]](#)
390. Cheung, W.W.L.; Lam, V.W.Y.; Sarmiento, J.L.; Kearney, K.; Watson, R.; Pauly, D. Projecting global marine biodiversity impacts under climate change scenarios. *Fish Fish.* **2009**, *10*, 235–251. [\[CrossRef\]](#)
391. Rode, K.D.; Wilson, R.R.; Regehr, E.V.; St. Martin, M.; Douglas, D.C.; Olson, J. Increased land use by Chukchi Sea polar bears in relation to changing sea ice conditions. *PLoS ONE* **2015**, *10*, e0142213. [\[CrossRef\]](#)
392. Whiteman, J.P.; Harlow, H.J.; Durner, G.M.; Regehr, E.V.; Amstrup, S.C.; Ben-David, M. Heightened immune system function in polar bears using terrestrial habitats. *Physiol. Biochem. Zool.* **2019**, *92*, 1–11. [\[CrossRef\]](#)
393. Wilson, R.R.; Regehr, E.V.; Martin, M.S.; Atwood, T.C.; Peacock, E.; Miller, S.; Divoky, G. Relative influences of climate change and human activity on the onshore distribution of polar bears. *Biol. Conserv.* **2017**, *214*, 288–294. [\[CrossRef\]](#)
394. Watson, S.E.; Hauffe, H.C.; Bull, M.J.; Atwood, T.C.; McKinney, M.A.; Pindo, M.; Perkins, S.E. Global change-driven use of onshore habitat impacts polar bear faecal microbiota. *ISME J.* **2019**, *13*, 2916–2926. [\[CrossRef\]](#)
395. Philippa, J.D.W.; Martina, B.E.E.; Kuiken, T.; Van de Bildt, M.W.G.; Osterhaus, A.; Leighton, F.A.; Daoust, P.Y.; Nielsen, O.; Pagliarulo, M.; Schwantje, H.; et al. Antibodies to selected pathogens in free-ranging terrestrial carnivores and marine mammals in Canada. *Vet. Rec.* **2004**, *155*, 135–140. [\[CrossRef\]](#)
396. Young, B.G.; Koski, W.R.; Kilabuk, R.; Watt, C.A.; Ryan, K.P.; Ferguson, S.H. Collaborative field research using drones for whale photo-identification studies in Cumberland Sound, Nunavut. *Drone Syst. Appl.* **2022**, *10*, 256–265. [\[CrossRef\]](#)
397. Hassell, J.M.; Newbold, T.; Dobson, A.P.; Linton, Y.-M.; Franklins, L.H.V.; Zimmerman, D.; Pagenkopp Lohan, K.M. Towards an ecosystem model of infectious disease. *Nat. Ecol. Evol.* **2021**, *5*, 907–918. [\[CrossRef\]](#) [\[PubMed\]](#)
398. Stimmelmayer, R.; George, J.C.; Clarke, J.; Ferguson, M.; Willoughby, A.; Brower, A.; Sheffield, G.; Stafford, K.; Givens, G.; Von Duyke, A.; et al. 2018–2019 Health Report for the Bering-Chukchi-Beaufort Seas Bowhead Whales-Preliminary Findings; NOAA: Washington, DC, USA, 2020; SC/68b/ASW. Available online: <https://repository.library.noaa.gov/view/noaa/40566> (accessed on 8 August 2022).
399. Stimmelmayer, R.; Rotstein, D.; Seguel, M.; Gottdenker, N. Hepatic lipomas and myelolipomas in subsistence-harvested bowhead whales *Balaena mysticetus*, Alaska (USA): A case review 1980–2016. *Dis. Aquat. Org.* **2017**, *127*, 71–74. [\[CrossRef\]](#)

400. George, J.C.; Suydam, R.; Stimmelmayer, R. *A Possible Structure for a Bowhead Whale Health Report*; International Whaling Commission: Impington, UK, 2016; Paper SC/66b/BRG/14.
401. Bengtsson, O.; Lydersen, C.; Kovacs, K.M.; Lindstrøm, U. Ringed seal (*Pusa hispida*) diet on the west coast of Spitsbergen, Svalbard, Norway: During a time of ecosystem change. *Polar Biol.* **2020**, *43*, 773–788. [CrossRef]
402. Wiig, Ø.; Born, E.W.; Stewart, R.E.A. Management of Atlantic walrus (*Odobenus rosmarus rosmarus*) in the arctic Atlantic. *NAMMCO Sci. Publ.* **2014**, *9*, 315–341. [CrossRef] [PubMed]
403. Palomino-González, A.; Kovacs, K.M.; Lydersen, C.; Ims, R.A.; Lowther, A.D. Drones and marine mammals in Svalbard, Norway. *Mar. Mammal Sci.* **2021**, *37*, 1212–1229. [CrossRef]
404. Pirotta, V.; Smith, A.; Ostrowski, M.; Russell, D.; Jonsen, I.D.; Grech, A.; Harcourt, R. An economical custom-built drone for assessing whale health. *Front. Mar. Sci.* **2017**, *4*, 425. [CrossRef]
405. Schiffman, R. Drones flying high as new tool for field biologists. *Science* **2014**, *344*, 459. [CrossRef]
406. Venn-Watson, S.; Daniels, R.; Smith, C. Thirty year retrospective evaluation of pneumonia in a bottlenose dolphin *Tursiops truncatus* population. *Dis. Aquat. Org.* **2012**, *99*, 237–242. [CrossRef]
407. Hunt, K.E.; Moore, M.J.; Rolland, R.M.; Kellar, N.M.; Hall, A.J.; Kershaw, J.; Raverty, S.A.; Davis, C.E.; Yeates, L.C.; Fauquier, D.A.; et al. Overcoming the challenges of studying conservation physiology in large whales: A review of available methods. *Conserv. Physiol.* **2013**, *1*, cot006. [CrossRef]
408. Pettis, H.M.; Rolland, R.M.; Hamilton, P.K.; Knowlton, A.R.; Burgess, E.A.; Kraus, S.D. Body condition changes arising from natural factors and fishing gear entanglements in North Atlantic right whales *Eubalaena glacialis*. *Endanger. Species Res.* **2017**, *32*, 237–249. [CrossRef]
409. Stewart, J.D.; Durban, J.W.; Fearnbach, H.; Barrett-Lennard, L.G.; Casler, P.K.; Ward, E.J.; Dapp, D.R. Survival of the fattest: Linking body condition to prey availability and survivorship of killer whales. *Ecosphere* **2021**, *12*, e03660. [CrossRef]
410. Pirotta, E.; Thomas, L.; Costa, D.P.; Hall, A.J.; Harris, C.M.; Harwood, J.; Kraus, S.D.; Miller, P.J.; Moore, M.; Photopoulou, T. Understanding the combined effects of multiple stressors: A new perspective on a longstanding challenge. *Sci. Total Environ.* **2022**, *821*, 153322. [CrossRef] [PubMed]
411. Ross, P.S. The role of immunotoxic environmental contaminants in facilitating the emergence of infectious diseases in marine mammals. *Hum. Ecol. Risk Assess. Int. J.* **2002**, *8*, 277–292. [CrossRef]
412. Routti, H.; Diot, B.; Panti, C.; Duale, N.; Fossi, M.C.; Harju, M.; Kovacs, K.M.; Lydersen, C.; Scotter, S.E.; Villanger, G.D.; et al. Contaminants in Atlantic walruses in Svalbard Part 2: Relationships with endocrine and immune systems. *Environ. Pollut.* **2019**, *246*, 658–667. [CrossRef]
413. Scotter, S.E.; Tryland, M.; Nymo, I.H.; Hanssen, L.; Harju, M.; Lydersen, C.; Kovacs, K.M.; Klein, J.; Fisk, A.T.; Routti, H. Contaminants in Atlantic walruses in Svalbard part 1: Relationships between exposure, diet and pathogen prevalence. *Environ. Pollut.* **2019**, *244*, 9–18. [CrossRef]
414. Bergman, A.; Bergstrand, A.; Bignert, A. Renal lesions in Baltic grey seals (*Halichoerus grypus*) and ringed seals (*Phoca hispida botnica*). *AMBIO* **2001**, *30*, 397–409. [CrossRef]
415. Lydersen, C.; Martin, A.R.; Kovacs, K.M.; Gjert, I. Summer and Autumn movements of white whales *Delphinapterus leucas* in Svalbard, Norway. *Mar. Ecol. Prog. Ser.* **2001**, *219*, 265–274. [CrossRef]
416. Suydam, R.S.; Lowry, L.F.; Frost, K.J.; O’Corry-Crowe, G.M.; Pikok, D., Jr. Satellite tracking of eastern Chukchi Sea beluga whales into the Arctic Ocean. *Arctic* **2001**, *54*, 237–243. Available online: <https://www.jstor.org/stable/40512343> (accessed on 8 August 2022). [CrossRef]
417. Altizer, S.; Ostfeld, R.S.; Johnson, P.T.J.; Kutz, S.; Harvell, C.D. Climate change and infectious diseases: From evidence to a predictive framework. *Science* **2013**, *341*, 514–519. [CrossRef]
418. Silber, G.K.; Lettrich, M.; Thomas, P.O. Report of a workshop on best approaches and needs for projecting marine mammal distributions in a changing climate. In *NOAA Technical Memorandum NMFS-OPR-54*; NOAA: Washington, DC, USA, 2016. Available online: https://nora.nerc.ac.uk/id/eprint/513734/1/climate_change_and_marine_mammals_workshop_rept_noaa_tech_memo_opr54.pdf (accessed on 8 August 2022).
419. Tryland, M. Zoonoses and public health. In *CRC Handbook Marine Mammal Medicine*; Dierauf, L., Gulland, F.M.D., Eds.; CRC Press: Boca Raton, FL, USA, 2018; pp. 47–62.
420. Kebke, A.; Samarra, F.; Deros, D. Climate change and cetacean health: Impacts and future directions. *Phil. Trans. Roy. Soc. B* **2022**, *377*, 20210249. [CrossRef] [PubMed]
421. Peters, K.J.; Stockin, K.A.; Saltré, F. On the rise: Climate change in New Zealand will cause sperm and blue whales to seek higher latitudes. *Ecol. Indic.* **2022**, *142*, 109235. [CrossRef]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.