

RESEARCH ARTICLE

# Caribou crossings: the Trans-Alaska Pipeline System, conservation, and stakeholderism in the Anthropocene

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## Abstract

This article engages with notions of conservation in the Anthropocene from a history-of-science perspective. It does so by looking at an iconic case of infrastructure development that since the 1970s continues to cause controversies amongst wildlife experts: the Trans-Alaska Pipeline System (TAPS). I examine how, from the 1970s onwards, the TAPS functioned as an experimental device for ecologists to test the adaptability of migratory caribou to changed environments and their dependency on unaltered ranges. Based on archival research, published reports and interviews, I show that arguments about animal learning, despite assigning a more active role to caribou in the conservation process, did not result in more inclusive forms of development that respected ecological processes and the various stakes of the caribou. In fact, a focus on caribou crossings as an easily observable, yet sole, indicator of the pipeline's impact resulted in a simplified representation of environmental relationships, that was used by the oil industry to argue for additional extraction projects. Arguments based on the material interdependencies of caribou with their environment, though seemingly similar to traditional arguments about range preservation, emerged as part of conservationists' attempts to account for the ecological stakes of caribou, other animals and people.

Historians of ecology and nature conservation have long looked at the ways in which wildlife management has been based on traditional ontologies about wildlife habitats, idealized as pristine places, undisturbed by human influences and based on a traditional separation of wild nature and human culture.<sup>1</sup> Preservationist ideas, however, have not been based on sentiments alone. Authors have shown that scientific arguments, too, have been mobilized to argue for forms of fortress conservation.<sup>2</sup> For instance, time and again the large ranges of seasonally migrating ungulates, such as gnus, antelopes or gazelles, have been used to exclude humans from large parts of the African savannah.<sup>3</sup>

1 William Cronon, *Uncommon Ground: Toward Reinventing Nature*, New York: W.W. Norton & Company, 1995; Roderick Neumann, *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*, Berkeley: University of California Press, 1998; Jonathan Adams and Thomas McShane, *The Myth of Wild Africa: Conservation without Illusion*, Berkeley: University of California Press, 1996; Gregg Mitman, *Reel Nature: America's Romance with Wildlife on Film*, Seattle: University of Washington Press, 2012.

2 E.g. Dan Brockington, *Fortress Conservation: The Preservation of the Mkomazi Game Reserve, Tanzania*, Bloomington: Indiana University Press, 2002.

3 Thomas Lekan, *Our Gigantic Zoo: A German Quest to Save the Serengeti*, Oxford and New York: Oxford University Press, 2020; Bernhard Gissibl, *The Nature of German Imperialism: Conservation and the Politics of Wildlife in Colonial East Africa*, New York and Oxford: Berghahn Books, 2016.

Only recently, historians of science have concerned themselves with more ‘utilitarian’ forms of nature conservation that consciously distanced themselves from preservationist agendas. In fact, at least from the 1960s onwards, ambitions emerged within international conservation circles to reconcile land and resource development with ecologically sound advice and in places with a strong human presence.<sup>4</sup> Gary Kroll, for instance, has shown how, in the postwar period, prominent conservationists like Aldo Stalker Leopold were involved in managing human–wildlife interaction in the case of permeable highways. According to Kroll, highway crossings combined animal movement with human infrastructure and as such present an early example of experiments with wildlife in the Anthropocene that focus on protecting ecological processes rather than entire habitats.<sup>5</sup>

Developing this line of reasoning further, this article engages with notions of conservation in the Anthropocene from a history-of-science perspective. It does so by looking at an iconic case of infrastructure development that since the 1970s continues to cause controversies amongst conservationists and wildlife experts working for international organizations, federal and state agencies, and independent consultancy bureaus, about how to combine infrastructure development and wildlife conservation: the Trans-Alaska Pipeline System (TAPS). As one of the first large-scale industrial projects that, prior to its construction, required involved parties to produce an environmental impact statement according to the US National Environmental Policy Act (NEPA) of 1969, the project’s significance was widely recognized within the national and international conservation community. In fact, the findings from the assessment became part of the NEPA’s Council on Environmental Quality’s guidelines.<sup>6</sup> This article looks at how the TAPS became a device for wildlife researchers concerned with the pipeline’s impact to experiment with the range of migratory caribou and their annual movement. So far, authors concerned with the history of field research in the life sciences have focused predominantly on the empirics of ecological experimentation *in situ*, often in contrast to *ex situ* laboratory work. Ecological field work, then, has been shown to depend on the historical continuity of the ecological sites in their presumably natural and isolated state.<sup>7</sup> This article, however, looks at how the TAPS served as an experimental device for conservation in a doubly ‘hybrid’ space, between the field and the laboratory, containing wild ranges and human-made infrastructure.<sup>8</sup>

At the time when oil was discovered in Prudhoe Bay by the Atlantic Richfield Company (ARCO) in 1968, Alaska contained the largest patches of sparsely developed land in the United States. The pipeline’s main arm from Prudhoe Bay on Alaska’s northern shore to the ice-free port of Valdez in the south of the peninsula would cut through this

4 Raf De Bont, *Nature’s Diplomats: Science, Internationalism, and Preservation, 1920–1960*, Pittsburgh: University of Pittsburgh Press, 2021; Simone Schleper, *Planning for the Planet: Environmental Expertise and the International Union for the Conservation of Nature and Natural Resources, 1960–1980*, New York: Berghahn Books, 2019.

5 Gary Kroll, ‘An environmental history of roadkill: road ecology and the making of the permeable highway’, *Environmental History* (2015) 20(1), pp. 4–28.

6 Rabel Burdge, ‘Impact assessment and project appraisal: why is social impact assessment the orphan of the assessment process?’, *Impact Assessment and Project Appraisal* (2002) 20(1), pp. 3–9, 3.

7 Stephen Bocking, *Ecologists and Environmental Politics: A History of Contemporary Ecology*, New Haven, CT: Yale University Press, 1997, pp. 123–31; Robert Kohler, ‘Place and practice in field biology’, *History of Science* (2002) 40 (2), pp. 189–210; Amanda Rees, ‘A place that answers questions: primatological field sites and the making of authentic observations’, *Studies in History and Philosophy of Science, Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* (2006) 37(2), pp. 311–33; Jeremy Vetter, ‘Labs in the field? Rocky Mountain biological stations in the early twentieth century’, *Journal of the History of Biology* (2017) 45(4), pp. 651–80. Also see Raf De Bont, ‘Between the laboratory and the deep blue sea’, *Social Studies of Science* (2009) 39(2), pp. 199–227; Elizabeth DeLoughrey, ‘The myth of isolates: ecosystem ecologies in the nuclear Pacific’, *Cultural Geographies* (2012) 20(2), pp. 167–84.

8 Robert Kohler ‘Landscape: naturalizing the lab’, *History of Science* (2002) 4(4), pp. 473–501.

land between two national reserves, the Arctic National Wildlife Reserve (ANWR) east of Prudhoe Bay, and the US Navy Petroleum Reserve in the west, which had been federal land since the 1920s. The plans for what remains one of the world's largest pipeline systems were strongly opposed by environmentalist and indigenous groups, as has been discussed in impressive detail by Peter Coates.<sup>9</sup> The history of oil development in Alaska is inherently linked with the Alaska Native Claims Settlement Act (ANCSA), and until the present day, oil development continues to pose a threat to indigenous ways of living with the land, its flora and its fauna.

From the beginning, caribou were a central topic in the protests concerning the pipeline and its impact, with three caribou herds, the West Arctic Herd, the Central Arctic Herd, and the Porcupine Caribou Herd, migrating through the Prudhoe Bay area, and another one, the Nelchina Caribou Herd, crossing the route of the planned pipeline closer towards Valdez. By the 1960s, it was known that the animals' annual migration followed a clockwise movement from spring calving grounds, to summer and finally to winter foraging grounds. Caribou were highly mobile also between periods of migration.<sup>10</sup> Especially threatened were the Central Arctic Herd, since it was feared that the pipeline would divide down the middle their summer range, located between the northern coastal area and Brooks Range, and interfere with their movements.<sup>11</sup> Environmentalist and indigenous protests and legal challenges to the project stopped all building and drilling for a period of four years.<sup>12</sup> When, in late 1973, the legal challenges to the pipeline were overruled by Richard Nixon's Trans-Alaska Pipeline Authorization Act, the oppositional discourse coalition had resulted in demands for thorough environmental impact procedures that required the oil companies involved in the TAPS to investigate adequate mitigation measures.<sup>13</sup> From the 1970s onwards, wildlife research into the impact of the pipeline on the Arctic ecosystem, and the movement of caribou in particular, elicited discussion at all levels of ecology and behavioral biology in Alaska and elsewhere.<sup>14</sup>

This article looks at the so far unexamined work by professional wildlife experts at consultancies, wildlife agencies and the University of Alaska, who were assigned the task of negotiating the construction of the linear pipeline infrastructure with the stakes of local wildlife, especially migratory caribou and their movement. The interdisciplinary social-sciences and humanities literature concerned with environmental entities as stakeholders in land development and conservation has often demanded a recognition of forms of non-human agency.<sup>15</sup> Within the discipline of geography authors such as Jamie Lorimer

9 Peter Coates, *The Trans-Alaska Pipeline Controversy: Technology, Conservation and the Frontier*, Bethlehem: Lehigh University Press, 1991; Victoria Hermann, 'The birth of petroleum path dependence: oil narratives and development in the north', *American Review of Canadian Studies* (2019) 49(2), pp. 301–31; Finis Dunaway, *Defending the Arctic Refuge: A Photographer, an Indigenous Nation, and a Fight for Environmental Justice*, Chapel Hill: The University of North Carolina Press, 2021.

10 James Hemming, 'The distribution movement patterns of caribou', *Wildlife Technical Bulletin* (1971) 1(1), pp. 1–60, 3–6; Peter Lent, *Phase III: Progress Report Caribou Investigation, Northwest Alaska*, Fairbanks: University of Alaska, 1960.

11 Robert Hinman, 'The impact of oil development on wildlife populations in northern Alaska', in Western Association of State Game and Fish Commissioners (ed.), *Fifty-Fourth Annual Conference of the Western Association of State Game and Fish Commissioners*, Boise: WAFWA, 1974, pp. 156–64.

12 Coates, op. cit. (9), pp. 304–23.

13 Henry Myers, 'Federal decisionmaking and the Trans-Alaska Pipeline', *Ecological Law Quarterly* (1975) 4(4), pp. 915–61.

14 Robert White, email to author, 15 June 2020.

15 See e.g. Daniel Sage, Andrew Dainty, Kjell Tryggestad, Lise Justesen and Jan Mouritsen, 'Building with wildlife: project geographies and cosmopolitics in infrastructure construction', *Construction Management and Economics* (2014) 32(7–8), pp. 773–86; Kjell Tryggestad, Lise Justesen and Jan Mouritsen, 'Project temporalities: how frogs can become stakeholders', *International Journal of Managing Projects in Business* (2013) 6(1), pp. 69–87.

have stressed the need to include animals as active agents in the conservation process, for instance by employing research from the behavioural sciences.<sup>16</sup> Historians of science such as Amanda Rees, Greg Radick and Angela Cassidy, on the other hand, have argued that authors concerned with animal agency should pay more attention to the different contexts and forms in which ecologists and conservationists in the life sciences have assigned what social-science scholars would call agency to their research subjects, both in their natural environments and in the creation of conservation policy.<sup>17</sup> This article extends critical voices in the history-of-science literature by looking at a scientific controversy about the stakes of the caribou in the proximity of the TAPS. Drawing on new research in behavioural biology, one group of wildlife experts promoted ecologically sound development by promoting the ability of caribou to learn how to navigate underpasses and buried sections of the pipeline. A second group, mobilizing arguments from the field of trophic ecology, pointed to potential long-term disturbances in the nutritional environment of the caribou resulting from their obstructed migration.

Historians and sociologists of science have shown how controversies between alternative approaches are excellent cases to investigate science in the making and especially its links to politics and policy making.<sup>18</sup> In the case at hand, the scientific controversy that emerged between two camps of wildlife professionals reveals much about how ideas about the combinability of conservation and development have been negotiated as part of research practices and how notions of caribou as environmental agents and stakeholders were constructed in the process. Based on archival research, the analysis of research publications and reports, and interviews and correspondence with several wildlife professionals involved in the TAPS mitigation research, I show that arguments about animal learning, despite assigning an active role to animals in the conservation process, did not result in more inclusive forms of development that respected ecological processes and the various stakes of the caribou. Caribou crossings as an easily observable, yet sole, indicator of the pipeline's impact excluded social and cultural concerns and resulted in a simplified representation of environmental relationships. In fact, behavioural research allowed the oil industry to argue for additional extraction projects. Arguments based on the material interdependencies of animals with their environment emerged as part of conservationists' attempts to discredit habituation to the pipeline. Although seemingly similar to traditional arguments on range preservation, their research into the cumulative impact of the pipeline allowed for a wider spectrum of ecological stakes and interests, including those of caribou, other animals and people.

### The pipeline as an experimental device

While concerns about caribou played an important role in the oppositional discourse coalition described by Coates, not all wildlife experts opposed the project. A number of ecologists welcomed the TAPS as an opportunity to invest in and experiment with ecologically sound conservation and development. The members of international

16 Jamie Lorimer, *Wildlife in the Anthropocene: Conservation after Nature*, Minneapolis: University of Minnesota Press, 2015; Emma Marris, *Rambunctious Garden: Saving Nature in a Post-wild World*, New York: Bloomsbury, 2011; Maan Barua, 'Infrastructure and non-human life: a wider ontology', *Progress in Human Geography* (2021) 45(6), pp. 1–23.

17 Amanda Rees, 'Animal agents? Historiography, theory and the history of science in the Anthropocene', *BJHS Themes* (2017) 2, pp. 1–10, 6; Rees, 'Wildlife agencies: practice, internationality and history in twentieth-century animal field studies', *BJHS Themes* (2017) 2, pp. 127–49; Angela Cassidy, *Vermin, Victims and Disease: British Debates over Bovine Tuberculosis and Badgers*, Cham: Palgrave Macmillan, 2019.

18 Cassidy, op. cit. (17), pp. 14–15; Sheila Jasanoff, 'Controversy studies', in George Ritzer (ed.), *The Blackwell Encyclopedia of Sociology*, Chichester: Blackwell, 2019, pp. 1–5.

conservation organizations especially, such as the International Union for Conservation of Nature and Natural Resources (IUCN), hoped that the construction of the pipeline would result in additional funding for ecological research and the inclusion of conservation advice in large-scale industrial construction projects. After all, as IUCN members pointed out, in the past, environmental research in Alaska had often focused on the modification of traditional caribou ranges for resource development in the territory, both governmental and industrial.

The first of these range experiments can be traced to early biological projects in the North American Arctic that date back to the interwar period and the Canadian Reindeer Project. In the late 1920s the Canadian government imported Scandinavian reindeer to stimulate the fur and meat trade in the northern provinces.<sup>19</sup> This translocation experiment, which at the same time was a colonial exercise, aiming to integrate native herders into the resource economy, continued into the 1960s.<sup>20</sup> In the United States, too, early Arctic ungulate research was connected to plans that aimed at opening up the Arctic territory for economic activities. In the early 1950s, two well-known naturalists, Frank Fraser Darling and Aldo Starker Leopold, visited the far west of the Alaskan Arctic to investigate the impact of increased land use on Arctic mammals. Darling's and Leopold's governmentally funded study put much emphasis on the adaptability of Arctic ungulates. In their report from 1953, the two authors proposed the use and development of Arctic natural resources, as long as the development respected ecological processes. Darling, a member of the British Nature Conservancy and director of the conservancy's Red Deer Survey, had studied the behaviour of deer in Scotland in relation to land management and agricultural development.<sup>21</sup> Applying a similar approach in the North American Arctic, Darling and Leopold believed that Alaska presented a unique opportunity for comprehensive conservation projects that combined the development of natural resources for economic use with the protection of wildlife. Strict wilderness preservation based on climax ecology and the preservation of entire ranges, in their view, was an unrealistic endeavour. 'It is almost inevitable that after occupation of a country by technological, pastoral or agricultural man, we find ourselves struggling to preserve the animals of ecological climax status, such as bison, musk-ox and caribou', Leopold and Darling wrote in their report. 'The opportunity to manage and produce game', however, remained if the land was maintained in ways that allowed for large mammals to thrive.<sup>22</sup>

Similar utilitarian ideas were shared in the international conservation circles to which Leopold and Darling belonged. These circles offered their assistance when oil companies involved in the plans for the TAPS reached out in the late 1960s. In 1967, at the fourth meeting of the scientific steering committee of the International Biological Programme (IBP), held in Rio de Janeiro, the IBP's Section on Conservation of Terrestrial Communities (IBP/CT), many of its members linked to the IUCN, had passed a resolution which described Alaska as 'in several respects uniquely fitted to serve as a scientific base

19 'Reindeer' and 'caribou' refer to the same animal (*Rangifer tarandus*), 'reindeer' being the European term, while 'caribou' is used for the North American members of the species.

20 Andrew Stuhl, 'The experimental state of nature: science and the Canadian Reindeer Project in the interwar North', in Stephen Bocking and Brad Martin (eds.), *Ice Blink: Navigating Northern Environmental History*, Calgary: University of Calgary Press, 2016, pp. 63–102.

21 For more on Darling's work see Mark Toogood, 'Ecology and rehabilitation: the West Highland Survey, 1944–1955', in Raf De Bont and Jens Lachmund (eds.), *Spatializing the History of Ecology: Sites, Journeys, Mappings*, New York and London: Routledge, 2017, pp. 99–118; Raf De Bont, 'Eating game: proteins, international conservation and the rebranding of African wildlife, 1955–1965', *BJHS* (2020) 53(2), pp. 183–205.

22 Aldo Starker Leopold and Frank Fraser Darling, *Effects of Land Use on Ranges and Populations of Moose and Caribou in Alaska*, New York: Conservation Foundation, 1953, p. 6.

for research and action on conservation'.<sup>23</sup> Research here allowed for experimentation in a partly modified terrain. In the late 1960s, Alaskan oil developers sought contact with conservation organizations such as the IUCN and their members, and invited wildlife personae such as Peter Scott from the World Wildlife Fund (WWF) and Max Nicholson, convener of the IBP/CT, to visit the pipeline construction site. Both Scott and Nicholson were determined conservationists with a strong interest in the natural world; here they were open to investigate shared ground with the extractive industry.<sup>24</sup> In 1970 and 1971, the controversy concerning the construction of the pipeline led to several visits by Nicholson and Scott, arranged by British Petroleum (BP). Scott's and Nicholson's responses to the TAPS controversy differed radically from activists' opposing voices described by Coates. 'People need oil, and now it must flow from the Arctic', Scott wrote in an essay for the applied-conservation journal *Oryx* in 1970, reporting on his visit.<sup>25</sup> In the meantime, additional research on range dependency seemed to support this view. In the early 1950s, the US Fish and Wildlife Service (FWS) and the Alaska Department for Fish and Game (ADFG) had conducted a feasibility study to determine whether historic, now depopulated caribou ranges on the Kenai peninsula, extending south below Anchorage, would again support caribou. Suitable range was found and in May 1965 fifteen caribou had been released, followed by an additional twenty-nine in 1966. When a larger group of now 120 caribou was observed in 1971, the experiment was seen as a successful translocation, resulting in expectations that the herd would multiply to two hundred animals in 1972.<sup>26</sup> The translocation experiment seemed to suggest that caribou could thrive somewhat independently of their original ranges, given that suitable alternatives were found.

In April 1971, Nicholson, for his part, supported by an eminent circle of correspondents including Darling and Scott, drafted a joint statement for the IUCN, the WWF and the IBP commenting on the construction plans for the Alaska pipeline. Assuming that the oil 'will have to come out somehow', Nicholson suggested that the members of the three organizations principally accepted that 'in view of people's needs for oil ... important reserves have somehow to be made available for their use'.<sup>27</sup> Darling supported Nicholson's report as 'clear and realistic'. 'Obviously' the oil was 'going to come out' and if conservationists did all they could to 'get it out decently', they 'should not oppose head-on its coming out'.<sup>28</sup> In the plans by the Alyeska Pipeline Service Company, at the time managing the construction, pipes were buried and mounted at regular intervals to assure free passage to all species.<sup>29</sup> Nicholson suggested that Alyeska had 'reasonably satisfied' the environmental requests and should therefore be allowed to proceed.<sup>30</sup>

Nicholson's statement portrayed Alaska as an important habitat for North American wildlife and emphasized the IUCN's scientific research interests in Alaska's flora and

23 'Resolution passed by the CT section of the IBP at the fourth meeting at Escola Chimica, Rio de Janeiro, Brazil on 7th and 10th July 1967', 1967, Edward Max Nicholson Papers, Royal Geographical Society Archives, London (subsequently EMN RGS), Box 2, folder 'Alaska visit'.

24 For a detailed discussion of the work by Nicholson and the IBP/CT section see Simone Schleper, 'Conservation compromises: the MAB and the legacy of the International Biological Program, 1964–1974', *Journal of the History of Biology* (2017) 50(1), pp. 133–67.

25 Peter Scott, 'Oil and wildlife in Alaska', *Oryx* (1970) 10(4), pp. 220–6, 221.

26 Hemming, op. cit. (10), p. 55.

27 Max Nicholson, 'Confidential', to Peter Scott, 31 March 1971, EMN RGS, Box 2, folder 'Alaska visit'; Max Nicholson, 'Draft joint statement on the Alaska Pipeline revised', 14 April 1971, EMN RGS, Box 2, folder 'Alaska visit'.

28 Frank Fraser Darling to Max Nicholson, 16 September 1971, IBP Papers, Aberdeen University Special Collections, Aberdeen (subsequently IBPP), MS.3162/8/17.

29 Hinman, op. cit. (11), p. 160.

30 Max Nicholson to Lynton Caldwell, 20 September 1971, IBPP, MS.3162/8/17.

fauna. Nevertheless, Alaska was seen as spacious enough to combine the protection of ecological processes with the development of oil.<sup>31</sup> This view was shared by others in Nicholson's network. In September 1971, Arthur Gore of the British Nature Conservancy wrote to Nicholson that the pipeline seemed to be 'an opportunity to explore [for conservation the effects of] the coming development' that would result from a combination of oil extraction, increased infrastructure, and hence increased tourism, in some 'comparative experimental way'.<sup>32</sup> Darling, Nicholson and Gore believed that the pipeline could provide insights into the relevance of range and habitat to animals with high mobility and a large spatial extension, a key topic for wildlife conservation and management in the 1960s and 1970s when the conservation community feared more pressure on protected areas, especially in recently independent African states.<sup>33</sup> Based on the view that ranges were somewhat interchangeable, migratory ungulates such as North American caribou played an important role in this type of research.

### Learning caribou, habituation and animal agency

As early as spring 1971, wildlife ecologists at the University of Alaska had commenced experiments with pipelines and animal movement on the construction site. Kenneth Child, a doctoral student, supervised by the wildlife biologist David Klein, conducted first experiments with simulated pipelines to understand how migratory and nomadic mammals would be affected by the pipeline infrastructure. The ecologist Klein was fascinated by the long coevolution of wildlife and humans.<sup>34</sup> The pipeline offered an opportunity to test the co-shaping of animal and human behaviour in practice. In their experiments, Child and Klein used materials such as snow fences, oil barrels and gravel ramps to imitate the future pipeline system and possible types of crossing.<sup>35</sup> Experiments seemed not very successful at first, as overall the crossing rates – the percentage of observed caribou that crossed the structure at least once – remained low.<sup>36</sup> There was some evidence, however, that over time, the animals got used to the pipeline. This early research by Child and Klein was welcomed by a larger group of conservationists who were increasingly interested in the behaviour of large moving mammals and their ability to adapt to modification in their inhabited terrain.

In 1971, Klein and Child were invited by two IUCN members, Valerius Geist and Fritz Walther, who organized an international conference on the behaviour of ungulates in Alberta, Canada, to present their results. At the conference, conservationists and wildlife professionals met researchers in behavioural ecology who shared their interests. Ecological research into the behaviour of animals, wild and tamed, was at the time growing in significance, with influential research centres in Oxford, England, and Seewiesen, Germany, where Geist had received his PhD under Konrad Lorenz in 1968. Much of the fundamental behaviour research as pioneered by Lorenz was conducted in strictly protected African national parks, where, for instance, Walther had spent long periods of

31 Nicholson, op. cit. (27).

32 Arthur Gore to Max Nicholson, 20 September 1971, IBPP, MS.3162/8/17.

33 E.g. Roderick Neumann, 'The postwar conservation boom in British colonial Africa', *Environmental History* (2002) 7(1), pp. 22–47.

34 David Klein, *The Making of an Ecologist: My Career in Alaska Wildlife Management and Conservation*, Fairbanks: University of Alaska Press, 2019, p. 340.

35 Kenneth Child, *The Reactions of Barren-Ground Caribou (Rangifer tarandus granti) to Simulated Pipeline and Pipeline Crossing Structures at Prudhoe Bay: A Completion Report of the Alaska Cooperative Wildlife Research Unit*, Fairbanks: University of Alaska, 1973.

36 David Klein, 'Problems in conservation of mammals in the north', *Biological Conservation* (1972) 4(2), pp. 97–101, 100.

time, researching the ecology of the Thomson's gazelle.<sup>37</sup> The TAPS, however, would allow research on animals living in already modified terrain and close to industrial structures. The conference facilitated critical research exchanges between ungulate researchers and conservationists, but also game wardens who had worked in North America, Africa and Scandinavia, reporting on the intersection of behaviour research and the spatial management of migratory ungulates.<sup>38</sup>

Researchers looking into the role of animal behaviour in conservation had a particular understanding of caribou as adaptable and able to learn. A central topic at the conference at large, and during the discussions of Child's and Klein's work in particular, was the behavioural concept of habituation: the idea that, over time, animals would start to ignore changes made to their environment.<sup>39</sup> The concept had its origins in behavioural field research that required the immersion of researchers into their field site. Famous behavioural researchers, such as George Schaller or Jane Goodall, whom Walther knew from his research stays in Tanzania, had shown that over time wild animals could get used to the presence of humans.<sup>40</sup> Similarly, park wardens from North American parks, which more than African parks and reserves allowed for human activities within their borders, had observed mammals habituating to humans and to human infrastructure, such as ski lifts or huts.<sup>41</sup> The Canadian caribou specialist Arthur Bergerud, who had studied caribou behaviour in Newfoundland, proposed that ontogenetic traits, those acquired within an animal's lifespan through learning and habituation, played a big role in the social behaviour of caribou and their movement. Having hand-reared two caribou, Bergerud suggested that the species did not depend on any one type of vegetation, and could adapt to different types of range.<sup>42</sup> Most participants at the conference agreed that it was important to take advantage of the learning ability of ungulates for the sake of conservation, management and research. Human disturbance could create severe alterations of behaviour and health in wild animals, but, if managed correctly, habituation could prevent extreme disruptions of natural behaviour. The experiments by Child and future research on caribou in the area of the TAPS were supposed to prove this. The pipeline was to serve as an experimental device not only for Alaska but for other places in which traditional wilderness preservation was increasingly considered problematic.

The research that was conducted into crossing successes of the different caribou herds was heavily influenced by discussions on habituation. In July 1974, with the construction of a haul road to Prudhoe Bay and the beginning of the pipeline construction work, regular observation commenced, first conducted by the ADFG and the Alaska Cooperative Wildlife Research Unit at the University of Alaska, later also by independent organizations and bureaus. From 1975 onward, the ADFG conducted annual surveys, counting caribou numbers, crossing rates and calf percentages of the observed groups, and followed marked

37 Fritz Walther, *In the Country of Gazelles*, Bloomington: Indiana University Press, 1995.

38 Fritz Walther and Valerius Geist, 'General introduction', in Walther and Geist (eds.), *The Behaviour of Ungulates and Its Relation to Management*, Morges: IUCN, 1974, p. 11.

39 Doug Whittaker and Richard Knight, 'Understanding wildlife responses to humans', *Wildlife Society Bulletin* (1998) 26(2), pp. 312–17.

40 Valerius Geist, 'A behavioural approach to the management of wild ungulates', in Eric Duffey and Alexander Watt (eds.), *The Scientific Management of Animal and Plant Communities for Conservation: The 11th Symposium of the British Ecological Society, University of East Anglia, Norwich, 7–9 July 1970*, Oxford: Blackwell Scientific Publications, 1971, p. 414; also see Robert Kohler, *Inside Science: Stories from the Field in Human and Animal Science*, Chicago and London: The University of Chicago Press, 2019, pp. 120–21; Georgina Montgomery, *Primates in the Real World: Escaping Primate Folklore and Creating Primate Science*, Charlottesville and London: University of Virginia Press, 2015, pp. 55–8.

41 Geist, op. cit. (40), p. 416.

42 Arthur Bergerud, 'The role of the environment in the aggregation, movement and disturbance behaviour of caribou', in Walther and Geist, *The Behaviour of Ungulates*, op. cit. (38), p. 577.

individuals close to Prudhoe Bay and the surrounding areas. By 1976, at least some habituation was recognized for bulls.<sup>43</sup> In the following years, the habituation hypothesis gained additional traction. Despite negative predictions about the reaction of caribou to the pipeline by members of the ADFG and based on Child's observed crossings, aerial counts suggested that between 1972 and 1983, the Central Arctic Herd's population had gone up by 13 percent.<sup>44</sup> Caribou seemed to do well and those wildlife researchers who pointed to the adaptability of caribou behaviour seemed to be right.<sup>45</sup>

Between 1981 and 1983, two Canadian biologists working for environmental consultancy firms, David Carruthers and Ronald Jakimchuk, studied the crossing behaviour of the Nenchila Caribou Herd further south. Carruthers and Jakimchuk compared the migration routes they observed to those recorded in the 1960s.<sup>46</sup> During their aerial survey, Carruthers and Jakimchuk counted 7,909 animals in the area of the pipeline, and all except four were observed crossing. Based on additional tests with residential caribou and simulated pipelines, a lack of negative responses seemed to suggest that factors other than infrastructure were most important in changing the animals' behaviour.<sup>47</sup> At the same time, studies on highway crossings in other North American national parks suggested also to researchers less entangled with the industry that local movements of wild animals were often learnt behaviour, which could be managed by providing alternative routes.<sup>48</sup>

Research into the effects of the pipeline and adjacent road structures continued into the 1990s, with occasional support by the industry. In 1990, BP Exploration had asked researchers at the consultancy firm LGL Alaska Research Associates, who had worked with the US Bureau of Land Management on previous environmental impact assessments, for a five-year survey on the effect of infrastructure on the calving of caribou in the area. Only one year later, in 1991, the North Slope Borough, ADFG, the FWS and the Alaska Oil and Gas Association (AOGA), which included oil companies involved in the TAPS project, such as Alyeska, BP, Exxon and Conoco, established a caribou steering committee and hired LGL to report on the effectiveness of the different types of infrastructure used to mitigate the environmental impact of the TAPS. Reviewing published and unpublished material, Matthew Cronin, a biologist, who had recently joined LGL after working at the Alaska Research Center of the FWS in Anchorage, found strong indications that while calves and cows avoided the pipeline for two weeks after birth, they got used to human activities over time.<sup>49</sup> Caribou regularly entered the pipeline area and moved close to the infrastructure.<sup>50</sup> Cronin's colleague Joe Truett, in a separate study, even

43 Daniel Roby, Raymond Cameron, Kenneth Whitten and Walter Smith, *Caribou and the Trans-Alaska Pipeline: A Summary of Current Knowledge*, Fairbanks: Alaska Department of Fish and Game & Alaska Cooperative Wildlife Research Unit, 1976.

44 Raymond Cameron and Kenneth Whitten, *First Interim Report of the Effects of the Alaska Pipeline on Caribou Movement*, Juneau: Joint State/Federal Fish & Wildlife Advisory Team, 1976.

45 Arthur Bergerud, Ronald Jakimchuk and David Carruthers, 'The buffalo of the North: caribou (*Rangifer tarandus*) and human developments', *Arctic* (1984) 37(1), pp. 7–22, 11.

46 Ronald Skoog, 'Ecology of the caribou (*Rangifer tarandus granti*) in Alaska', doctoral thesis, University of California, Berkeley, Zoology Department, 1968.

47 David Carruthers and Ronald Jakimchuk, 'Migratory movements of the Nelchina Caribou Herd in relation to the Trans-Alaska Pipeline', *Wildlife Society Bulletin* (1987) 15(3), pp. 414–20.

48 Francis Singer, 'Behavior of mountain goats in relation to U.S. Highway 2, Glacier National Park, Montana', *Journal of Wildlife Management* (1978) 42(3), pp. 591–7.

49 Matthew Cronin, Warren Ballard, Joe Truett and Robert Pollard, *Mitigation of the Effects of Oil Field Development and Transportation Corridors on Caribou: Final Report to the Alaska Caribou Steering Committee*, Anchorage: LGL Alaska Research Associates, Inc., 1994.

50 Matthew Cronin, Steven Amstrup, George Durner, Lynn Noel, Trent McDonald and Warren Ballard, 'Caribou distribution during the post-calving period in relation to infrastructure in the Prudhoe Bay oil field, Alaska', *Arctic* (1998) 51(2), pp. 86–92.

suggested that during the summer months, caribou actively sought out the pipeline structure. Gravel pads and shady places under elevated pipelines seemed to provide some relief from flies and mosquitoes.<sup>51</sup> Observed individuals, here, were ascribed a degree of intentionality and the ability to decide about their movement.

The work by the LGL researchers became increasingly important in the early 2000s as the thirty-year evaluation of the TAPS land lease agreement approached. From 2000 onwards, LGL authors refined their findings, conducting observational research at the roads close to the oil field on the Alaska Arctic Coastal Plain. Using linear regression analysis, LGL researchers determined for the different years the relationship between observed distances from the infrastructure and periods of human activity. According to their observations, there were clear signs of annual rehabilitation of groups with and without calves. LGL recommended that traffic was to be limited during the calving period, but otherwise deemed the mitigation efforts sufficient.<sup>52</sup> Published in 2002, the renewed environmental impact statement for the TAPS drew heavily on the research by LGL, putting the learning of caribou centre stage, and presenting over- and underpasses as successful mitigation measures.<sup>53</sup>

The work by researchers such as Bergerud and Cronin resulted in an understanding of caribou as a species that could live in cohabitation with humans. In this understanding, caribou were not considered animals of wilderness, as there was ‘nothing “inherently wild” in wild animals, and nothing “inherently cultured” in humans’.<sup>54</sup> Breaking the nature–culture boundary that dominated traditional approaches to wildlife conservation, behavioural ecologists did not see caribou as determined by the limits of their traditional ranges, but instead recognized them as what scholars in the field of human–animal relationships might consider agents in changing environments. Essential to the behavioural understanding of caribou and their movement was that caribou could learn to adapt. Their movement, even though stimulated by triggers related to nutrition or weather, was not linked to particular routes and ranges. While not using the term ‘agency’, behavioural researchers assigned the animals an active role in the integration of wildlife conservation and human development, similar to recent calls for conservation in the Anthropocene, as the animals were considered capable of adjusting their behaviour and movement.

Supported by highly visible indicators such as crossing rates, the concept of habituation left, however, little space for definitions of environmental impact other than the pipeline’s effect on caribou observed close to the pipeline and their absolute numbers. With population numbers remaining high, habituation seemed to suggest that development in the area could be intensified. The ADFG had observed a number of additional development projects being proposed after the congressional ruling to build TAPS in 1973. Particularly concerning were plans by the Alaska Department for Transportation to expand the gravel haul road to a highway.<sup>55</sup> While researchers at the ADFG remained cautious about drawing final conclusions, the Alyeska Pipeline Company recognized habituation research as favourable for industrial purposes and from the early 1980s onwards hired independent ecological services to pursue this approach further. In the coming years, several of the companies linked to the TAPS formulated new proposals

51 Joe Truett, Robert Senner, Kenneth Kertell, Robert Rodrigues and Robert Pollard, ‘Wildlife responses to small-scale disturbances in Arctic tundra’, *Wildlife Society Bulletin* (1994) 22(2), pp. 317–24.

52 Shawn Haskell, Ryan Nielson, Warren Ballard, Matthew Cronin and Trent McDonald, ‘Dynamic responses of calving caribou to oilfields in Northern Alaska’, *Arctic* (2006) 59(2), pp. 179–90.

53 Argonne National Laboratory, *Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of Way*, vol. 3, Lemont: US Bureau of Land Management, 2002.

54 Geist, op. cit. (40), p. 416.

55 Coates, op. cit. (9), pp. 306–7; Mim Dixon, *What Happened to Fairbanks? The Effects of the Trans-Alaska Oil Pipeline on the Community of Fairbanks, Alaska*, Boulder, CO: Westview Press, 1978.

to develop oil and gas in the coastal area within the ANWR. At the time Alyeska was already receiving criticism for neglecting the social and cultural implications of the pipeline on local human communities. In fact, in 1974, first plans for a significant gas pipeline project in the Canadian Mackenzie Valley had been rejected, based on the projected effects that the new pipeline would have on the members of native communities.<sup>56</sup> For ADFG researchers, however, it was the dominant idea of habituation, suggesting that animals simply adjusted to human infringements on their territory, that needed to be disproven, as it conflicted with earlier experiences and research into the tundra ecosystem as a critical habitat for Alaskan wildlife.<sup>57</sup>

### Energetic constraints and cumulative effects

Early after the construction of the TAPS, an oppositional group of wildlife professionals emerged, who focused on the nutritional ecologies of caribou and potential interruptions caused by the pipeline system. In their criticism on the TAPS impact assessment, ADFG researchers, too, studied the biophysical impact of the pipeline on migratory caribou. Yet ADFG researchers developed a radically different understanding of caribou and their potential agency. Reducing the caribou and its environment to exchanges of calories seems to contradict recent calls to seek out ways to include animal agency in environmental research and policy. Nevertheless, the almost mechanic conceptualization that resulted from modelling the energetic dependencies of caribou, here, allowed for a broader definition of the ecological stakes of the caribou. In the first instance, the energetics approach provided a new context in which to analyse the differential attitudes of cows and calves to the pipeline, when compared to grown bulls. In the second, by focusing on the cumulative impact of the pipeline, the energetics approach also allowed for the inclusion of a wider variety of ecological stakeholders, human and non-human.

In the 1970s, additional research into the Arctic tundra conducted under the umbrella of the American IBP efforts supported the concerns by wildlife researchers at the ADFG.<sup>58</sup> In fact, the ADFG, in particular the wildlife ecologist Ray Cameron and some of his colleagues, had kept a critical stance towards habituation research. Celebrating the TAPS as an example of ecologically sound development, in their view, falsely reduced environmental impact to a single indicator of caribou crossing rates. Just as with the researchers concerned with the habituation of caribou, the ADFG researchers could themselves point to earlier studies on Arctic ungulates that justified their concern and their understanding of caribou. In 1948, the FWS had initiated research into the Nelchina Caribou Herd after a period of declining numbers. Habitat, range and vegetation seemed to determine the well-being of the herd, at least to some extent. This assumption seemed to be reconfirmed in 1953, when nine wardens had been employed by the State of Alaska for wolf control. Despite the shooting of predators, the herd could not be restored to previous numbers. Lasting low numbers strongly implied that range quality, not predation, had the strongest effect on population numbers. This early research into the territorial aspects of caribou health by the FWS was further expanded by Ronald Skoog, then a doctoral student at the University of California, Berkeley's zoology department, whose dissertation on the ecology of the Alaskan caribou is still a standard reference. Skoog's dissertation from 1968

<sup>56</sup> Burdge, *op. cit.* (6).

<sup>57</sup> Klein, *op. cit.* (36), p. 100.

<sup>58</sup> For more on the American IBP see Frank Golley, *A History of the Ecosystem Concept in Ecology: More than the Sum of the Parts*, New Haven, CT: Yale University Press, 1993; Elena Aronova, Karen Baker and Naomi Oreskes, 'Big science and big data in biology: from the International Geophysical Year through the International Biological Program to the Long Term Ecological Research (LTER) Network, 1957–present', *Historical Studies in the Natural Sciences* (2010) 40(2), pp. 183–224.

focused on centres of habitation which, he proposed, served as focal points for population build-up. Controls at population level, Skoog suggested, occurred from increased mortality associated with the dispersal between regions and into marginal habitat.<sup>59</sup> These studies paved the way for new research in the 1960s and 1970s into the Arctic tundra as a habitat in which species were dependent on the availability of intact ranges.

From 1964 onward, research into the Arctic tundra was conducted as part of the IBP. This research was supposed to provide the scientific background for a strategy to utilize and manage Arctic resources as had been suggested by Darling and Nicholson.<sup>60</sup> After the discovery of Arctic oil in 1968, the IBP research, too, benefited from industrial funding. The tundra biome project was part of the IBP Section on Productivity of Terrestrial Ecosystems (IBP/PT).<sup>61</sup> Much of the IBP/PT's research focused on measuring and modelling the primary production of tundra ecosystems – the organic substances such as vegetation constituting the base of the food chain – and how these were utilized by herbivores. The metabolism of large ungulates, such as caribou, reindeer and musk oxen, played an important role. This included calculations of their physiological processes such as thermoregulation, important for survival in Arctic winter temperatures, and bioenergetics, concerned with the use of energy during activities such as resting, moving, growth and reproductive activities including lactation.<sup>62</sup>

The bioenergetics approach to the physical activities of caribou, such as their movement, was radically different from the behavioural research pioneered by Bergerud and promoted by Cronin at LGL. Rather than relying on the direct observation of individual and group behaviour, the bioenergetics approach tried to understand long-term trends in populations, using both new and historical data to quantify an entirely different set of variables. The IBP tundra biome researchers, including the metabolic biologist Robert White, defined range quality as an important factor for the health of large mammals such as caribou. In their view, the Arctic constituted a fragile ecosystem with low primary productivity. Sparse vegetation in environments such as Prudhoe Bay contributed to this vulnerability, especially with large herds of migratory mammals depending on the limited diet. These animals needed to spend the majority of their time grazing to maintain their weight and to be able to reproduce.<sup>63</sup> Forms of harassment such as traffic and obstructed passages, this type of research suggested, caused physiological stress and increased the daily energy demands of caribou that lived in an environment that was considered 'a 1000 times less productive' than the African savannahs. Human-induced stress was considered especially dangerous for pregnant cows and young animals.<sup>64</sup>

After the publication of the final synthesis of the tundra biome project in 1981, this type of research was taken up by Cameron and his colleagues at the ADFG, who felt ignored in their concerns about caribou avoidance of the pipeline, to demonstrate the effects of disturbances caused by pipeline infrastructure on the health of Arctic caribou.<sup>65</sup>

<sup>59</sup> Skoog, op. cit. (46), pp. 363, 662.

<sup>60</sup> Lawrence Bliss and David Klein, 'Current extractive industrial development, North Alaska', in Lawrence Bliss, O.W. Heal and J.J. Moore (eds.), *Tundra Ecosystems: A Comparative Analysis*, Cambridge: Cambridge University Press, 1981, pp. 754–5.

<sup>61</sup> James Cragg, 'Preface', in Bliss, Heal and Moore, op. cit. (60), pp. xxiii–xxv.

<sup>62</sup> Robert White, Fred Bunnell, Elda Gaare, Treje Skogland and Benjamin Hubert, 'Ungulates on Arctic ranges', in Bliss, Heal and Moore, op. cit. (60), pp. 444–6.

<sup>63</sup> Lawrence Bliss, Gerard Courtin, Donald Pattie, Rick Riewe, Douglas Whitfield and Paul Widden, 'Arctic tundra ecosystems', *Annual Review of Ecology and Systematics* (1973) 4, pp. 359–61; White *et al.*, op. cit. (62), p. 452.

<sup>64</sup> Klein, op. cit. (57), p.100; Bliss *et al.*, op. cit. (63).

<sup>65</sup> Raymond Cameron, Kenneth Whitten and Walter Smith, *Responses of Caribou to Petroleum-Related Development on Alaska's Arctic Slope*, vol. 7: *Progress Report Federal Aid in Wildlife Restoration Project W-21-2 and W-22-1, Job 3.18R*, Juneau: Alaska Department of Fish and Game, 1983, p. 21.

From the mid-1970s onward, Cameron and his colleagues had focused on the disturbances and avoidances by calving caribou in the areas close to the pipeline infrastructure. Their observations seemed to contradict the conclusion that caribou learned to live with the pipeline.<sup>66</sup> In the coming years, Cameron and his colleagues studied the role of traditional calving grounds in animals' seasonal movements.<sup>67</sup> During the summers of 1978 and 1979, Cameron and his colleagues conducted a survey using a Cessna propeller plane and a light truck. The paucity of calving caribou near the Prudhoe Bay complex seemed to support their earlier observations that calving caribou detoured around the developed areas.<sup>68</sup> In the summers of 1981 and 1982, Walter Smith and Cameron from the ADFG, funded by a federal wildlife restoration grant, but with additional assistance by ARCO, observed the crossing behaviour of large groups and recorded extensive detours by individual caribou. These detours were regarded as unproductive activities, resulting in the unnecessary burning of calories.<sup>69</sup> In 1983, this research allowed Cameron and Whitten to present the potential alterations to the summer movements of calving caribou and calves caused by the pipeline infrastructure as key concerns when discussing the environmental impact of oil field development.<sup>70</sup> If proven, these ramifications would have the potential to undermine the habituation hypothesis. In the following years, ADFG research increasingly drew on the bioenergetics research that had been produced by the IBP.

In experimental setups with laboratory equipment in the situated conditions of the North American Arctic, a different type of caribou was created. This caribou depended on intact environments with which it had evolved. In the early 1980s, Cameron co-supervised a PhD project at the University of Alaska, investigating the role of the energy metabolism in caribou morphology, physiology and behaviour.<sup>71</sup> In his work, the doctoral researcher Steven Fancy could draw on an earlier PhD project by Donald Russell, funded by the IBP tundra biome project. Russell had modelled the nutritious cycle of caribou based on a typical hundred-kilogram bull.<sup>72</sup> Fancy instead focused on female caribou, examining the energy metabolism of captive animals and the expenditure rates for different activities and types of movement. Eight female calves were captured and hand-reared. Their energy expenditure was determined by calorimetry in a creative design, using a respirator chamber and a custom-made hydraulic treadmill. Experiments outside were conducted in the snow using respiratory balloons. A computer recorded oxygen flow rates, barometer pressure, temperature and air humidity. Based on the experimental data and recorded observations, Fancy constructed a conceptual model in which daily energy budgets were determined by different variables such as movement, lactating and fasting. Fancy concluded that energetic constraints contributed to the vulnerability of lactating cows during migrations, as lactation was one of the biggest energy expenditures.<sup>73</sup> In the following years, the ADFG researchers' focus was firmly on the

66 Cameron and Whitten, op. cit. (44), p. 16.

67 Ronald Skoog, *Information Leaflet: Methods for Estimating Caribou Herds*, Juneau: Department of Fish and Game Alaska, 1962.

68 Raymond Cameron, Kenneth Whitten, Walter Smith and Daniel Roby, 'Caribou distribution and group composition associated with construction of the Trans-Alaska Pipeline', *Canadian Field-Naturalist* (1979) 93, pp. 155–62, 159, 162.

69 Walter Smith and Raymond Cameron, 'Reactions of large groups of caribou to a pipeline corridor on the Arctic coastal plain of Alaska', *Arctic* (1985) 38(1), pp. 53–7.

70 Cameron, Whitten and Smith, op. cit. (65), pp. 1–13.

71 Steven Fancy, 'Daily energy budgets of caribou: a simulation approach (energetics, metabolism, *Rangifer tarandus*, migration)', doctoral thesis, University of Alaska, Fairbanks, Natural Science Department, 1986.

72 Donald Russell, 'Computer simulations of *Rangifer* energetics', doctoral thesis, University of British Columbia, Vancouver, Faculty of Forestry, 1976.

73 Fancy, op. cit. (71), pp. 12–16, 105–61, 167–80.

female caribou as the potential key to translating observed disturbances on the individual level to a potential impact on the population level.

In the early 1990s, a decline in caribou numbers gave new impetus to the nutritional hypothesis.<sup>74</sup> Shortly before, Russell, now working for the Canadian Wildlife Service, and White from the University of Alaska, Fairbanks, had worked on combining a model on energetics based on observed individuals from the Porcupine Caribou Herd with a second model on population trends.<sup>75</sup> For the first time, this allowed Cameron and his colleagues at the ADFG to draw links between observed disturbances, clearly affecting individual caribou, and potential consequences for the larger population. The energetics models by White and Russell gave Cameron sufficient ground to explain that behavioural research into caribou crossings greatly underestimated the cumulative effects of relocation from their ranges on the production of caribou herds in the future.<sup>76</sup> When, in 1999, the National Academies of Science, Engineering and Mathematics composed a Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope to assess the potential impacts of future oil exploration in the ANWR on the Porcupine Caribou Herd, the committee could argue, based on the work by Cameron and the modelling by White and Russell, that the 'combined effects of industrial activity and infrastructure' would 'likely affect reproductive success' and put the herd at risk.<sup>77</sup>

This emphasis on the cumulative impact of the pipeline is important. The notion of cumulative impact had been part of the NEPA's guidelines since 1978. However, by the 1980s, critical voices expressed concerns that aggregate forms of impact, especially those including social and economic on top of environmental effects, had hardly been accounted for in US development projects.<sup>78</sup> In order to provide evidence against the compelling indicator of countable crossings, trophic ecologists resorted to complex calculations of the different effects of environmental changes on the reproduction rates within the whole caribou population. While at first sight resembling traditional notions of range preservation, the focus on intricate and interlinked dependencies allowed for an integration, albeit in limited, biophysical terms, of various other environmental stakeholders, including animal and plant life, as well as human communities, traditionally living off the land.<sup>79</sup> The nutrition research that had developed out of the IBP provided a suitable basis for interpretations that defined environmental impact as disturbed ecological relationships beyond the scope of caribou alone. When, in 2002, the TAPS's land lease agreement was renewed, the committee presented a detailed rebuttal, arguing on the basis of bioenergetics against the positive impact statement which presented

74 Stephen Murphy and Brian Lawhead, 'Caribou', in Joe Truett and Stephen Johnson (eds.), *The Natural History of an Arctic Oil Field: Development and the Biota*, San Diego: Academic Press, 2000, p. 63.

75 Donald Russell, Debbie van de Wetering, Robert White and Karen Gerhart, 'Oil and the Porcupine Caribou Herd: can we quantify the impact?', *Rangifer* (1994) 9, pp. 255–7.

76 Christian Nellemann and Raymond Cameron, 'Cumulative impacts of an evolving oil-field complex on the distribution of calving caribou', *Canadian Journal of Zoology* (1998) 76(8), pp. 1425–30, 1425, 1428–9.

77 National Research Council and Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, *Report in Brief*, Washington, DC: National Academies Press, 2003, p. 4.

78 E.g. Eugene Stakhiv, 'An evaluation paradigm for cumulative impact analysis', *Environmental Management* (1988) 12(5), pp. 725–48; Harry Spaling and Barry Smit, 'Profile: cumulative environmental change conceptual frameworks, evaluation approaches, and institutional perspectives', *Environmental Management* (1993) 17(5), pp. 587–600; François Bregha, 'The Mackenzie Valley pipeline and Canadian natural gas policy', *Canadian Public Policy/Analyse de politiques* (1977) 3(1), p. 63.

79 National Research Council and Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*, Washington, DC: National Academies Press, 2003, pp. 16, 89.

habituation as a proof of mitigation success.<sup>80</sup> Up to today, research into the cumulative effects of oil and gas development, trophic changes and climate change continues to play an important role in countering development plans that focus on single environmental pointers alone.<sup>81</sup>

### Conclusion: the stakes for the caribou

Animal agency has become an important, though often vaguely defined, concept in interdisciplinary research concerned with ecology and conservation in the Anthropocene. The emphasis here has often been on looking at behaviour and species' adaptability, rather than fixed relationships between animals and their environments. After all, it is argued, in the past the 'territorial trap' of strict habitat conservation has resulted in forms of fortress conservation and preservationist politics.<sup>82</sup> Without denying forms of animal agency or the need to rethink preservationist practices, this article has followed calls from within the history of science to critically reflect on the ways in which the natural sciences have sought to give access to animal agency.<sup>83</sup> In particular, it has shown that the recognition of forms of agency is not the same as respecting environmental stakeholdership.

In this article, I have looked at two ways of approaching Alaskan wildlife conservation in the context of the construction and maintenance of the TAPS that have emerged since the 1970s. These resulted in two diverging conceptualizations of caribou, their vulnerabilities and their environmental stakes. The behavioural approach by Cronin and his colleagues at LGL focused on caribou learning. Despite seemingly granting caribou an active role in environmental development and conservation, their studies, based on highly visible indicators such as crossing behaviour, left little space for definitions of environmental impact other than avoidance or a decline in absolute numbers. Cronin and Ballard, for instance, stressed that they had observed a by far larger number of caribou than Cameron and his colleagues, which, according to them, made their research more concise and reliable.<sup>84</sup> Within the behavioural approach, this focus on observations of caribou walking in and out of areas close to the pipeline has dominated until today. For instance, Shawn Haskell, who formerly worked with Ballard on several habituation studies, insists on the observation of crossing behaviour as providing all necessary proof: 'If you want a real understanding of how those animals interact with the oil field just go watch ... there's really been no measurable impact to anything'.<sup>85</sup> Observation of behaviour and habituation, then, has resulted in an understanding of caribou as highly flexible and adaptable agents.

In the case at hand, however, assigning animals a more active role did not lead to respecting various ecological stakes. At least to some degree, the proposed adaptable nature of wildlife allowed oil companies involved in the TAPS to celebrate their mitigation efforts as successful. Despite a disastrous oil spill by an Exxon tanker off the coast of Valdez in 1989, in 1992 Alan Maki, Exxon's senior science adviser, explained that 'wildlife populations are ever changing in relation to numerous stress agents', such as weather,

80 National Research Council and Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, op. cit. (79), pp. 106–17.

81 Donald Russell and Anne Gunn, *Vulnerability Analysis of the Porcupine Caribou Herd to Potential Development of the 1002 Lands in the Arctic National Wildlife Refuge, Alaska*, Whitehorse: Shadow Lake Environmental Inc., 2019.

82 Lorimer, op. cit. (16), p. 162; Marris op. cit. (16), p. 3.

83 Rees, 'Animal agents', op. cit. (17).

84 Cronin et al., op. cit. (50), p. 92.

85 Shawn Haskell, interview by the author, 5 June 2020.

predators and human development.<sup>86</sup> Given the implemented mitigation measures and signs of habituation by caribou, the pipeline, according to Maki, clearly was a success and Exxon doing a fine job. In this interpretation caribou in the behavioural approach have clearly been assigned ‘too much agency’ in a ‘too narrow form’, as the geographer Leah Gibbs has put it.<sup>87</sup> Ideas about habituation were readily supported by the industry and seemed to have led to additional development plans in protected areas, such as the ANWR. Recognizing this is more relevant than ever, given the continued push by the Republican Party to open up the ANWR coastal area for drilling.<sup>88</sup>

The alternative approach by Cameron and his colleagues at the ADFG drew from nutritious ecology to understand more the complex changes to the environment caused by the pipeline. The former IBP researcher Russell recalls,

I remember one of the industry biologist consultants saying; ‘so what if feeding declines by 5%, show me the bodies’. In other words that these documented effects have an impact at the population level. So that was the challenge. How do you integrate from the bottom-up distribution, habitat, activity, diet, body condition, population?<sup>89</sup>

To counter the highly visible indicators of animal behaviour, trophic ecologists collected evidence in the field and in the lab, and measured various indicators related to the metabolism of the caribou. Although based on complicated calculations of the energetic dependencies of the caribou on their environment, their conceptualization of impact was less reductionistic than that ascribed to traditional forms of range preservation. Focusing on the cumulative impact of the pipeline eventually allowed for the integration of claims of a wide range of ecological stakes.

This article, then, has done more than simply recounting a scientific controversy between behavioural and trophic ecologists. Looking at the TAPS as an important early example of environmental impact assessment, it has examined how in the 1960s and 1970s wildlife professionals and researchers were already concerned with conservation in what can be considered Anthropocenic landscapes. The conflict between the behavioural and the energetics approaches discussed in this article continues, as recovering birth rates and population numbers of the Central Arctic Herd since 1996 seem to support ideas of limited impact and habituation.<sup>90</sup> While recent calls for conservation in the Anthropocene highlight the need to recognize wildlife agency in the conservation process, the case at hand demonstrates that it is also necessary to contextualize how different

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<sup>86</sup> Alan Maki, ‘Of measured risks: the environmental impacts of the Prudhoe Bay, Alaska, oil field’, *Environmental Toxicology and Chemistry* (1992) 11(12), pp. 1691–1707, 1704.

<sup>87</sup> Leah Gibbs, ‘Agency in human–shark encounter’, *Environment and Planning E: Nature and Space* (2020) 4(2), pp. 645–66.

<sup>88</sup> E.g. Brad Plumer and Henry Fountain, ‘Trump administration finalizes plan to open oil drilling in Alaska’s Arctic Refuge’, *New York Times*, 17 August 2020, at [www.nytimes.com/2020/08/17/climate/alaska-oil-drilling-anwr.html](https://www.nytimes.com/2020/08/17/climate/alaska-oil-drilling-anwr.html) (accessed 18 August 2020); Paul Wight, ‘How the Alaska Pipeline is fueling the push to drill in the Arctic Refuge’, *Yale Environment360*, 16 November 2017, at <https://e360.yale.edu/features/trans-alaska-pipeline-is-fueling-the-push-to-drill-arctic-refuge> (accessed 7 January 2021).

<sup>89</sup> Donald Russell, email to author, 15 June 2020.

<sup>90</sup> Murphy and Lawhead, op. cit. (74), p. 63; Lynn Noel, Keith Parker and Matthew Cronin, ‘Caribou distribution near an oilfield road on Alaska’s North Slope, 1978–2001’, *Wildlife Society Bulletin* (2004) 32(3), pp. 757–71; Kyle Joly, Christian Nellemann and Ingunn Vistnes, ‘A reevaluation of caribou distribution near an oilfield road on Alaska’s North Slope’, *Wildlife Society Bulletin* (2006) 34(3), pp. 866–9; Lynn Noel, Keith Parker and Matthew Cronin, ‘Response to Joly et al. (2006), a reevaluation of caribou distribution near an oilfield road on Alaska’s North Slope’, *Wildlife Society Bulletin* (2006) 34(3), pp. 870–3.

scientific approaches to forms of animal agency have advanced different forms of environmental stakeholderhood.

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