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Leslie Tuck and the Origins of Arctic Marine Bird Research in the Canadian Arctic, 1954–1957

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ABSTRACT. Leslie M. Tuck (1911–79) was a pioneer of Arctic ornithology. He made the first studies in Canada of the breeding biology of Arctic-breeding seabirds, making three visits to major seabird colonies (four colonies total at the three destinations) in the Eastern Arctic in the 1950s. His main purpose was to assess population sizes and demography of Thick-billed Murres. His aims were to better understand the impact of hunting in Newfoundland and Labrador, where probably hundreds of thousands of birds were being harvested annually, and to assess the sustainability of that hunt. His studies were the first of many that have been conducted subsequently. Using archived material, I assess the impact of Tuck's work and the degree to which it was affected by logistical constraints, highlight the contribution of local Inuit to his research, and discuss some unanswered questions that Tuck's observations posed. Despite Tuck's prolific writing, both scientific and popular, questions remain about some of his results, particularly the number of birds in the colonies at the time of his visits, a statistic very pertinent to current conservation concerns. Sadly, because of lack of information on the methods he used, these questions cannot be answered unless further historical material comes to light.

Keywords: Leslie M. Tuck; Newfoundland; Nunavut; Akpatok Island; Digges Sound; Bylot Island; Thick-billed Murre *Uria lomvia*

RÉSUMÉ. Leslie M. Tuck (1911–1979) était un précurseur de l'ornithologie dans l'Arctique. Il est reconnu pour avoir réalisé les premières études sur la biologie de la reproduction des oiseaux de mer nichant dans l'Arctique canadien. À ce titre, il a effectué trois expéditions dans des colonies d'oiseaux de mer importantes (représentant un total de quatre colonies réparties sur trois sites) de l'Arctique de l'Est au cours des années 1950. Le principal objectif de sa recherche consistait à évaluer la taille de la population de guillemots de Brünnich ainsi que sa démographie. Il cherchait à mieux comprendre les répercussions de la chasse à Terre-Neuve et au Labrador, où des centaines de milliers d'oiseaux étaient probablement récolté chaque année, et à évaluer la durabilité de cette chasse. Au fil des ans, de nombreuses recherches similaires ont été menées, mais celles-ci étaient les premières. À l'aide d'archives, j'ai évalué l'impact des travaux de Leslie M. Tuck et la mesure dans laquelle ils ont été affectés par les contraintes logistiques. Je mets aussi en évidence l'apport des Inuits de la région à sa recherche et j'aborde certaines questions sans réponse découlant de ses observations. Bien que Leslie Tuck ait produit une abondante littérature, scientifique et grand public, certains de ses résultats suscitent encore des interrogations, notamment le nombre d'oiseaux observés dans les colonies lors de ses visites. Cette donnée est importante dans le contexte actuel de la conservation. Malheureusement, il est impossible d'y répondre en l'absence d'information sur les méthodes utilisées, à moins que des renseignements historiques ne fassent surface.

Mots-clés : Leslie M. Tuck; Terre-Neuve; Nunavut; île Akpatok; détroit de Digges; île Bylot; guillemot de Brünnich; *Uria lomvia*

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INTRODUCTION

Leslie M. Tuck (1911–79) was appointed as Newfoundland's dominion wildlife officer in October 1949, after the accession of Newfoundland and Labrador to Canada. At the time of hiring, he was already a well-known naturalist living in St. John's, Newfoundland. There followed a very distinguished career in the Canadian Wildlife Service (CWS), during which he covered the full range of issues affecting wildlife in Newfoundland and Labrador, including the effects of hunting, oil spills, contaminant pollution, and the illicit sale of wildlife products. He also conducted studies of protected areas and introduced species. During his tenure with the government he wrote two important wildlife monographs on the murres (*Uria*) and snipes (*Capella*), both of which won the annual Best Wildlife Monograph award from The Wildlife Society, an unprecedented achievement. He retired from the CWS in 1976 and took up a John Lewis Paton Distinguished University Professorship in the Department

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of Psychology at Memorial University of Newfoundland (Montevecchi, 1981).

Among the most important issues facing Tuck throughout his career was the harvest of murres (*Uria* spp., known locally as turrs). This traditional harvest had been an important supplement to the winter diet of outport communities over several centuries and was unregulated prior to Newfoundland joining Canada (Montevecchi and Tuck, 1987; Elliot, 1991; Montevecchi et al., 2007). However, the *Migratory Birds Convention Act* between Canada and the United States defined *Uria* species and other seabirds, as "migratory birds" (Article I). Hence, they fell under the jurisdiction of the Government of Canada. After the accession of Newfoundland and Labrador to Canada, their hunting in Newfoundland became technically illegal under the act, which had been in force in the rest of Canada since 1917. Although the act was never enforced against hunting turrs for personal consumption, Tuck was faced with an ongoing illegal trade in the birds; something that persists to this day (Elliot, 1991; Elliot et al., 1991; W.A. Montevecchi, pers. com., 2024). Given changes in hunting styles, weapons, and boats, the question arose of how sustainable the harvest was (Elliot, 1991; Montevecchi et al., 2007).

The attitude of the CWS towards enforcement of the *Migratory Birds Convention Act* in the case of the turr hunt was strongly affected by a lack of information about the size and trajectory of the affected populations. From inspection of the harvested birds, it was known that the majority were Thick-billed Murres (*Uria lomvia*; Arctic Murres, Brünnich's Guillemot), a largely Arctic-breeding species (Appendix F in Tuck, 1961), rather than Common Murres (*U. aalge*), which breed commonly in Newfoundland and Labrador and throughout the Gulf of St. Lawrence (Gaston and Jones, 1998). Tuck believed that about 200,000 murres (species combined) were being harvested annually in Newfoundland and Labrador at the time of joining Canada, but that by 1960 this number had halved (Tuck, 1961). This substantial harvest made knowledge of the size of the affected population critical to ongoing management. Hunter surveys in the 1970s suggested an annual kill of >300,000 (Wendt and Cooch, 1984), and more recent surveys suggest around 100,000 killed annually (Cox et al., 2024).

Because murres breed in large, obvious colonies on cliffs, often on prominent headlands, many breeding colonies had been reported by European Arctic explorers, either from their own observations or from consultations with Inuit (e.g., M'Clintock, 1859; William Baffin in Markham, 1881). Some of these colonies were believed to be extremely large. Approximate numbers were known for sites in West Greenland (Salomonsen, 1950; Salomonsen and Génsbøl, 1967), but the size of Canadian breeding colonies was unknown when Tuck started working for the CWS (Nettleship and Evans, 1985). In addition, although birds from Greenland were known, on the basis of band recoveries (Salomonsen, 1956), to be among those harvested by hunters in Newfoundland and Labrador, it was not known for certain whether Canadian populations were involved, although it seemed very likely.

In the 1950s, as a result of these information gaps, Tuck decided to investigate some Canadian Arctic Thick-billed Murre colonies with a view to improving knowledge of population numbers, movements, and reproduction. This decision resulted in three visits to major Arctic breeding colonies, during which he initiated the systematic study of seabird reproduction in the Canadian Arctic. This initiative has subsequently borne fruit in numerous colony studies that have provided a wealth of information on northern seabirds (e.g., Birkhead and Nettleship, 1981; Gaston and Nettleship, 1981; Gaston et al., 1985, 2024; Patterson et al., 2024).

Some research on Arctic-breeding Thick-billed Murres had been conducted by Russian researchers on breeding colonies in the Soviet Union in the 1930s (Krasovski, 1937; Kaftanovski, 1938; Belopol'skii, 1957), but nothing remotely resembling Tuck's studies had been carried out previously in Canada's Arctic. Moreover, much of the Russian work was not available in English when Tuck carried out his studies, although some of it became available to him before he wrote his celebrated monograph on the murres (Tuck, 1961).

Tuck made three major northern trips, in 1954 to Akpatok Island in Ungava Bay, in 1955 to Digges Sound at the northwest tip of the Ungava Peninsula, and in 1957 to the Lancaster Sound coast of Bylot Island at Cape Hay (Fig. 1). These trips were described by Tuck in reports submitted to his managers in CWS, in scientific publications he published, and in contemporary newspaper articles and radio interviews. Much of the latter material is archived in the Queen Elizabeth II Library of Memorial University of Newfoundland. Some sections of his government reports were repeated, almost unchanged, in his monograph (Tuck, 1961). The current paper describes the nature of Tuck's travels and research and his major findings and evaluates his achievements in the light of subsequent investigations. I also share my own experience of visits to all three colonies. It also discusses changes in the type of information captured by modern researchers, compared to that of the 1950s and earlier.

AKPATOK ISLAND, 1954

Tuck's Arctic research program began with the colonies on Akpatok Island (60° 25′ N, 68° 08′ W) in Ungava Bay, the ones most accessible from his home base on the island of Newfoundland. There are two Thick-billed Murre colonies on the island, the south colony being the southernmost of the major Thick-billed Murre colonies in the North Atlantic (Gaston and Jones, 1998; Fig. 2). Tuck, accompanied by CWS technician J.B. Millar and two local Inuit from Kangirsuk (Payne Bay), visited the island from 10 July to 29 August 1954 (he had intended to make the trip the previous summer but because of mechanical problems, the trip had to be aborted). In 1954, he arrived by chartered floatplane

FIG. 1. Eastern Arctic Canada, showing the Thick-billed Murre colonies visited by L.M. Tuck in the 1950s.

FIG. 2. Akpatok Island (left), showing the position of the Thick-billed Murre colonies and a selection of Tuck's pictures from 1954 (right): bottom, looking north from Tuck's campsite; middle, looking south towards the murre colony from the same spot; top, closeup of part of the south colony from the clifftop.

(Convair Husky, Fig. 3) from Kangirsuk, Quebec, and departed via Peterhead boat after first circumnavigating the island, reaching Kangirsuk on 30 August. Prior to arrival, Tuck carried out an aerial reconnaissance of the island to select a suitable campsite and decided to work at the south colony, camping very close to the north end of the area occupied by the murres (Fig. 2).

Tuck's work at Akpatok involved censusing the murre colonies, measuring attendance patterns by making repeated counts of selected parts of the colony, and weighing chicks over their growth period to estimate rates of growth and determine age at departure (Tuck, 1954, 1961). However, his report was very scanty on fieldwork details; elsewhere, he mentions writing a much longer report that he never had time to complete (*in litt*. to F.G. Cooch, 31 December 1954). Serendipitously, he found that breeding birds provisioning chicks frequently dropped their food loads (usually a single fish), which accumulated at the foot of the cliff. These were collected regularly and formed the basis for a detailed analysis of chick diets (Tuck and Squires, 1955). Tuck gave final estimates of 300,000 individuals for the south colony and 900,000 for the north colony (Tuck, 1954). It appears that these numbers referred to birds on the cliffs at the time of his sample counts, although this is not specifically stated. He repeats the numbers in his monograph (Tuck, 1961), although there, it appears he may have been referring to the whole population, including pre-breeding birds. In the monograph, he estimated that x breeding pairs represented a total population of $2.5x$ birds (the breeding pairs plus $0.5x$ non-breeders). In that case, the corresponding breeding population estimates for the Akpatok Island colonies would have been 120,000 and 360,000 breeding pairs. In this interpretation (i.e., that Tuck's numbers referred to the entire population, including non-breeders) his estimates were very close to more recent estimates (Table 1).

DIGGES SOUND, 1955

In 1955, Tuck travelled to Ivujivik, in northern Quebec, to visit the large murre colony at Digges Sound. This colony

FIG. 3. The Convair Husky that delivered L.M. Tuck and J.B. Millar to the south colony at Akpatok Island in July 1954. Tuck is presumably taking the picture. The crew is standing on the intertidal wave-cut platform that juts from the base of the cliffs along most of the east coast of Akpatok Island.

was the first Canadian Arctic seabird aggregation to be seen by Europeans, having been noted by Henry Hudson on his arrival in the bay that bears his name, and visited later by his crew on their return journey to England after casting Hudson adrift in James Bay (Pricket, A., in Asher, 1860). Being close to the Hudson Bay post at Ivujivik, the colony was well-known by the time Tuck visited and had been seen by several biologists. However, no systematic study of the birds had been made (Tuck, 1961). Tuck and his assistant, J. Lowther, shared the charter cost of flying from Moosonee to Ivujivik by Canso flying boat with fellow-CWS scientist F.G. Cooch, who was to return south from Kinngait (Cape Dorset) on the same aircraft that delivered them to Ivujivik. From Ivujivik, Tuck chartered a local Peterhead boat with an Inuit crew and retained four Inuit to work with him over the period he was there. He camped first on East Digges Island, from 18 July–5 August, and then at Akpa Cove, on the mainland side of the sound, from 6–17 August (Fig. 4). Returning to Ivujivik, he was picked up by the Icebreaker *N.B. McLean* on 19 August, reaching Newfoundland on 28 August (from Tuck's report to CWS Headquarters, September 1955).

As at Akpatok, Tuck attempted to estimate numbers of birds at the colony. However, his methods were not reported, and the numbers given, of between two and three million birds, or a million breeding pairs, suggests that the estimate was not based on actual counts. In fact, he says himself, "the breeding population of the Digges Sound thick-billed murre colonies will probably never be precisely determined" (Tuck, 1961:67). Given the lack of information on how estimates were made and the rounding of numbers to the nearest million, Tuck's report gives the impression that population estimation was not a high priority in this venture. In Brown et al. (1975), the population of Digges Island is given as 600,000 pairs, and for the mainland portion of the colony, 400,000 pairs, with the citation "Tuck 1961 and pers. comm." Corresponding numbers for 1980 were 250,000 and 158,000 (Gaston et al., 1985). Hence Tuck's numbers, although much larger than recent estimates, concurred roughly with the later assessment regarding the relative size of the two sub-colonies.

Tuck's most important activity while he was at Digges Sound was banding, which must have taken up most of his time, as the numbers banded (2002 adults and 8027 chicks; Gaston and Robertson, 2014) were unprecedented, especially given the need to access them on precipitous cliffs. In his report, Tuck said that he obtained the birds "using some alpine techniques and some catch-as-catch-can methods" (Tuck, 1955:15). This included banding 2000 birds in a single day at East Digges Island, a task that, even assuming all six people working all day, probably represents a record in seabird banding on cliffs. Otherwise, he reported on the mass of chicks at different ages and their diet based on fish seen delivered (Tuck, 1955, 1961).

CAPE HAY, BYLOT ISLAND

Tuck's venture to Cape Hay, on the north coast of Bylot Island, in the summer of 1957, was his most adventurous

TABLE 1. Estimated numbers of Thick-billed Murre at the four Arctic breeding colonies visited by Tuck, according to his reports and according to the most recent censuses. Tuck gave his estimates of individuals for the whole population; the numbers of individuals given for the 1970s and 1980s are the numbers actually counted on the cliffs: not the same measure.

Colony	Tuck's colony estimates (i = individuals; p = pairs)	Estimates in 1970s & 1980s		Reference
		Individuals	Pairs	
Akpatok South[1, 2]	300,000 i	172,000	120,000	(Chapdelaine et al., 1986)
Akpatok North[1, 2]	900,000 i	274,000	173,000	(Chapdelaine et al., 1986)
Digges Sound[1]	2–3 million i	408,000	287,000	(Gaston et al., 1985)
Cape Hay	400,000 p	140,000	—	(Birkhead and Nettleship, 1980)

[1] Tuck says in his Cape Hay report (Tuck, 1957), "I was able to refine my [census] techniques considerably [compared to the Akpatok and Digges Sound estimates]. As a consequence, I shall revise my estimates for Wolstenholme [Digges Sound] downwards some 30% [possibly to 1.6–2.4 million birds, although if he is only referring the mainland cliffs of Digges Sound, then possible more] and those for Akpatok upwards some 20% [to 1.08 million for the north colony and 360,000 for the south colony]. However, in The Murres (Tuck 1961) he did not make these adjustments.

[2] Chapdelaine et al., suggest that, given problems with the photographs, true numbers might be closer to 150,000 pairs at the South colony and 300,000 pairs at the North colony.

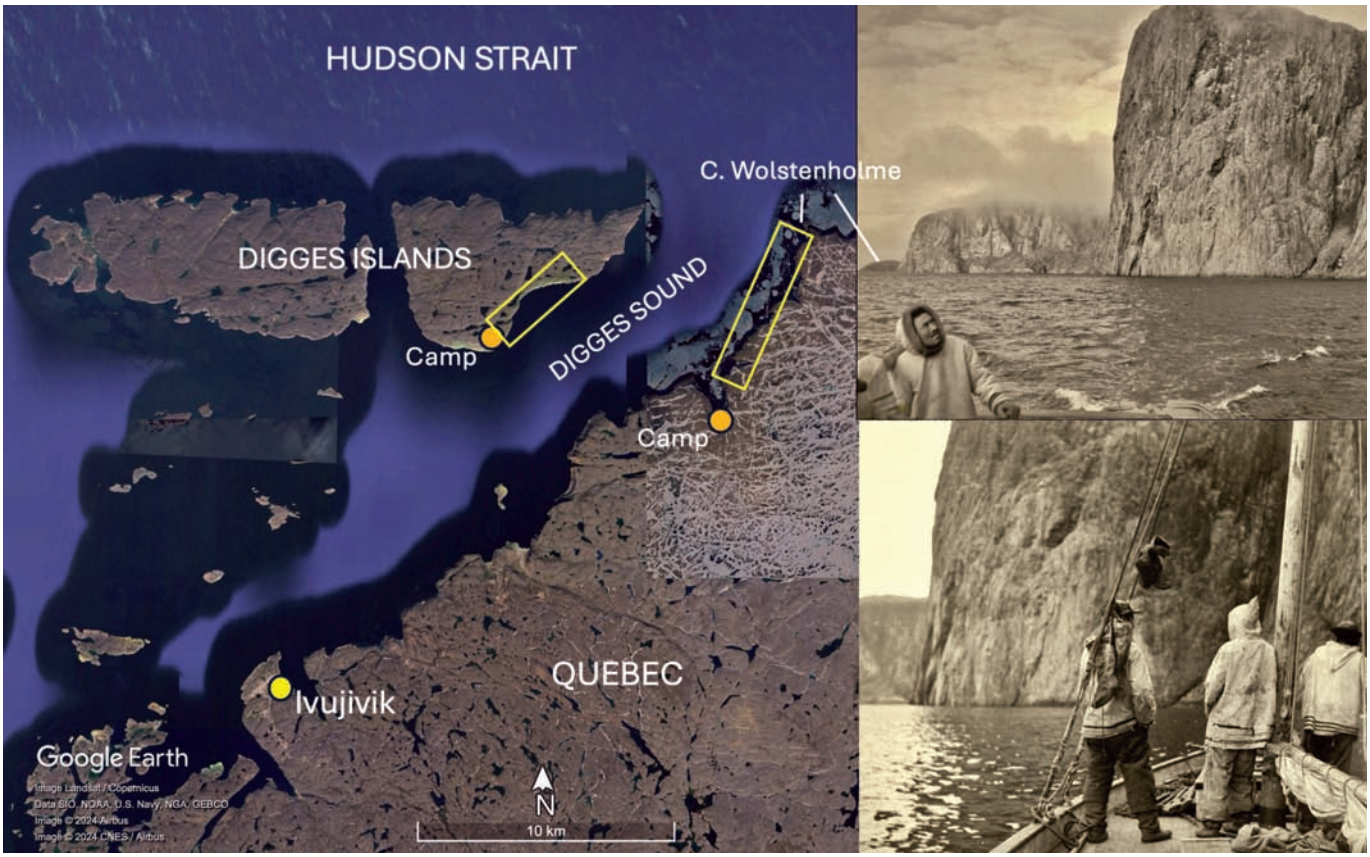

FIG. 4. Digges Sound (left) showing the position of the murre colony, the location of Tuck's campsites, and the areas occupied by murres (yellow boxes). The photographs (right) show two views of the colony cliffs southwest of Cape Wolstenholme from the deck of the Peterhead in August 1955 (L.M. Tuck).

expedition. It was also his longest. He left Newfoundland on 14 May, arrived in Mittimatalik (Pond Inlet) by chartered DC-3 on 28 May, and departed on the CCGS C.D. *Howe* on 30 August, reaching Iqaluit on 10 September, and Newfoundland, by air, on 14 September (exactly a four-months trip). He shared the flight to Mittimatalik with another CWS biologist, Louis Lemieux, who would go on to spend most of the summer studying Greater Snow Geese (*Anser caerulescens atlanticus*) on southwestern Bylot Island. Tuck and Lemieux later collaborated to provide an overview of the birds of Bylot Island (Tuck and Lemieux, 1959). Although remote, Bylot Island had already attracted some ornithological research. They incorporated many observations made a few years earlier by an American expedition based on the southwest coast (Drury and Drury, 1955; Van Tyne and Drury, 1959). In addition to a formal report (Tuck, 1957), Tuck wrote a popular account of his trip in a series of articles published in the Evening Telegraph in April and May 1958 (Tuck, 1958), which gave many more details than his departmental report, of his living arrangements and of the general natural history of the area.

From Mittimatalik, Tuck hired an Inuit couple, Muktar and Koopar, to provide transport, via dogsled, and to help out with camp and, in the case of Mucktar, the research work. The outbound trip to Cape Hay (Fig. 5) involved three dog teams, as the resident RCMP officer, Corporal Ray Johnson, along with his assistant, Toonga, accompanied Tuck. Once Tuck's camp was established close to the murre colony, Johnson continued along the north coast of Bylot Island and returned to Mittimatalik, having circumnavigated the island. Muktar transported a 22-foot (5.5 m) canoe and 15 hp outboard motor on his komatik, which was used for the return journey in late August. Tuck maintained tenuous radio contact (presumably by high-frequency radio) with a Hudson Bay post in northern Foxe Basin.

Although generally referred to as the "Cape Hay colony," the murres occupy a stretch of 300-m cliffs situated eight kilometers to the west of Cape Hay. Tuck camped near the shore at the west end of the colony (Fig. 5). Weather at Cape Hay was generally bad, with more than half of days in June, July, and August recorded as either fog, storms, heavy rain, or some combination of the three. However, Tuck made light of this in his report, saying that, owing to variation in the altitude at which the fog lay, "even on foggy days we could work either at the base or the top of the murre cliffs" (Tuck, 1957:6). He does not note, although it is apparent from the terrain, that on days when they worked along the top of the colony, access would have required a 300-m upward scramble on steep screes or a lengthy inland detour. Travel back and forth from his campsite would have required several hours.

Tuck's work included more detailed studies of murre breeding than he had attempted previously, probably

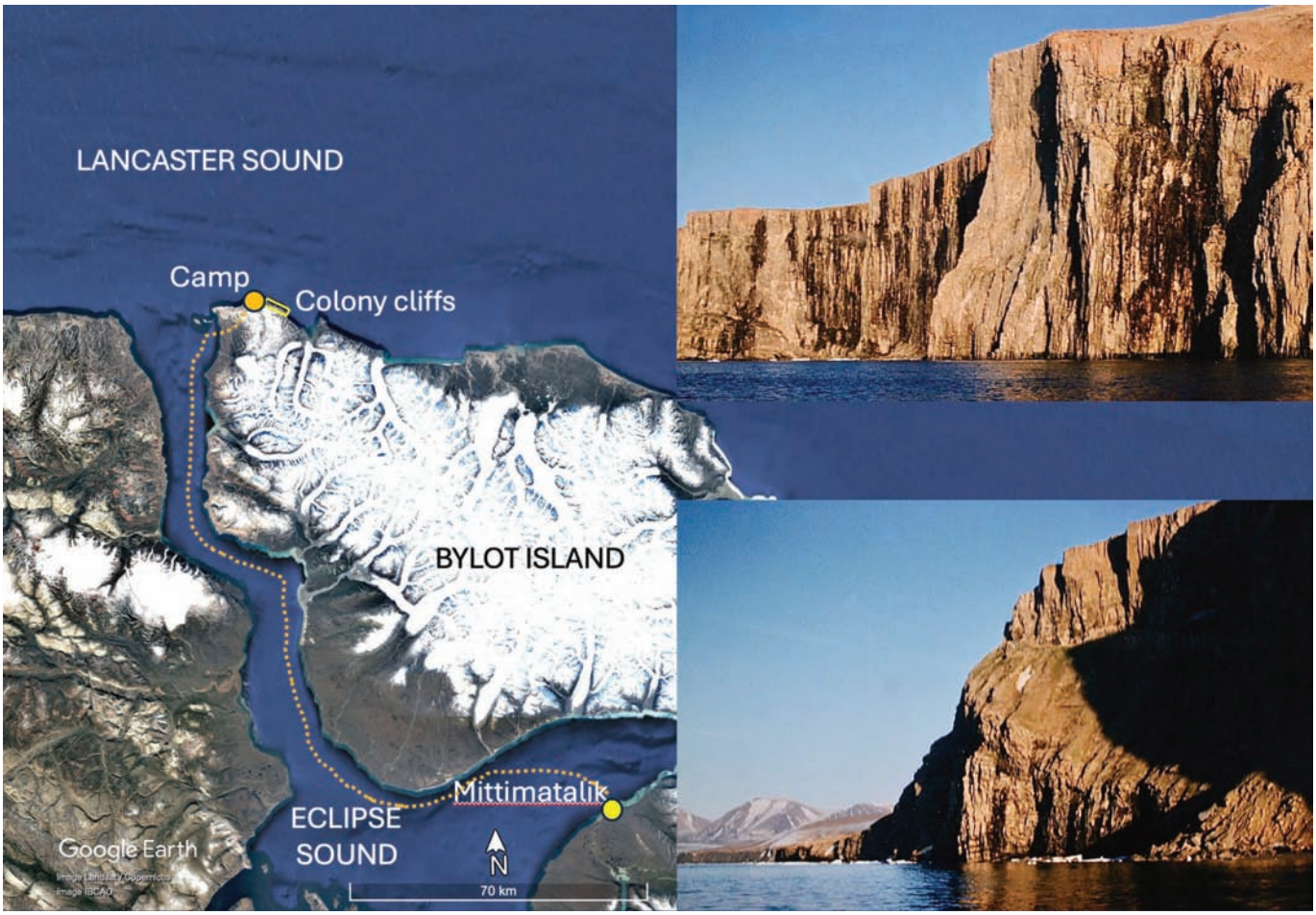

FIG. 5. Bylot Island (left). The dotted line shows Tuck's outward route from Mittimatalik to the murre cliffs. Photos (right) show two views of the murre colony cliffs taken from the water in July 1957 (L.M. Tuck).

because he had much more time at his disposal than on his other expeditions. Before egg-laying commenced, he noted pre-breeding behaviour, and, to illustrate changes in the numbers present, he initiated counts of birds at the colony that continued through the season. He also marked 50 pairs of breeders to determine their daily attendance pattern. Eggs were marked soon after laying, and their fate, and that of any chicks hatched, was recorded frequently until chicks departed, allowing timing of laying, incubation period, and breeding success to be monitored. All of these observations were repeated by later investigators, with broadly similar results (e.g., Gaston and Nettleship, 1981; Birkhead and Nettleship, 1981).

Tuck took particular interest in demographic data, especially breeding success, as that provided material for assessing the impact of hunting mortality. Although he had no way to know the age of birds he was watching, subsequent observations of known-age birds showed that he had a remarkable understanding of the role of pre-breeding birds in determining changes in numbers through the season. Many of Tuck's observations added substantially to knowledge about the genus. In addition to his work on murres, Tuck kept notes on other aspects of natural history, and he was the first researcher to witness the strong migrations of marine mammals, especially beluga (*Delphinapterus leucas*), narwhal (*Monodon monoceras*), and harp seals (*Pagophilusa groenlandicus*), from Baffin Bay westwards into Lancaster Sound (Tuck, 1957).

DISCUSSION

Logistics

Tuck's Arctic field work took place just before the establishment of the Polar Continental Shelf Project (PCSP) by the Government of Canada (Cabinet Directive, 5 April 1958; Hobson, 1981). From 1960 onwards, the type of research he had carried out in the 1950s would almost certainly have been supported by PCSP, using SToL aircraft (Beaver, Otter, Twin Otter) or helicopters. Without such support, he had had to make do, in those early years, with what was commercially available, or with contacts through the RCMP, the Coast Guard, or the Hudson Bay Company. At both Akpatok and Digges Sound, he made use of water landings, by floatplane and seaplane, a method rarely available in today's Arctic, especially since the Canso seaplane was no longer available for charter. The

Canso was very versatile for putting in and taking out expeditions where coasts or large lakes were available. More importantly, from the biology perspective, they could operate in the season when the birds were actually present, rather than the much longer period when landing on skis is possible but the birds are absent.

At all three study sites Tuck hired local Inuit to help him, and at Digges Sound and Cape Hay they were essential to facilitating his living arrangements, travel, and research. He was especially grateful to Mucktar, his assistant at Cape Hay: "Most of the projects were joint endeavours. Much of the success of this summer's field studies is due to him [Muktar]" (Tuck, 1957:7). In this respect, he operated in the same style as other CWS personnel working in the Arctic during that period (e.g., F.G. Cooch (pers. comm.); L. Lemieux [Tuck, 1958]; A.G. Loughrey [1959]). All these researchers spoke at least rudimentary Inuktitut, and all spent long periods travelling and living with Inuit. All worked without southern companions for months at a time. Reaching the study site by dogsled and departing by Hudson Bay Company or RCMP supply ship was the routine used by most Arctic field researchers prior to the creation of the PCSP. The long periods that researchers had to spend away from their families created challenges for the individuals involved, but it meant that, for migratory bird studies, researchers were present throughout the period when the birds occupied their breeding sites. This had important consequences for the collection of certain types of natural history information, especially arrival and egg-laying dates.

Tuck's Impact on Turr Harvest Management

Tuck's northern work provided the first estimates of the size of Canadian Arctic murre colonies, suggesting that there were at least as many birds breeding in Canada as at the better-known Greenlandic colonies (Salomonsen, 1950). Moreover, the banding of more than 10,000 Thick-billed Murres at Digges Sound and another 2500 at Cape Hay showed that, while the majority of recoveries (of banded individuals) of Cape Hay birds occurred in West Greenland (82% of adults, 60% of chicks), the majority of Digges Sound recoveries (> 90%) occurred in the turr harvest in Newfoundland and Labrador (Gaston and Robertson, 2014). Given the concern about the impact of the turr harvest on murre populations, this was important information, suggesting that any effect of the harvest in Canada was more likely to be found among the Hudson Strait colonies than those in the High Arctic. The latter were more likely to be affected by harvest levels or other mortality factors occurring in Greenland. Tuck's work, together with similar data from banding studies in Greenland (Salomonsen, 1956; Tuck, 1971), gradually developed a picture of the movements and harvest pressures on western Atlantic Thick-billed Murres.

Some caveats are in order. Tuck studied breeding success at Cape Hay using a group of 500 pairs of murres, mostly banded, for which all the eggs were numbered as laid. However, it is very hard to catch murres before they have laid their single egg. Without an egg, the adults have no need to remain at the site if danger threatens (e.g., they see people approaching; pers. obs.). Consequently, most of Tuck's trapping of adults for banding must have been done after laying. Apparently, most birds were caught with dip nets (the only method mentioned in his reports), which would have caused panic among nearby birds. The resulting departures of incubating birds would have led to egg losses (pers. obs.). Tuck took several steps to correct his results for potential disturbance effects by omitting eggs lost during disturbances. However, omitting pairs that lost eggs through disturbance tends to eliminate pairs on poor quality breeding sites, where eggs are easily lost. Hence, his estimates of breeding success may not have been representative of undisturbed situations. Later researchers took a hands-off approach to measuring breeding success (e.g. Birkhead and Nettleship, 1980, 1981; Gaston and Nettleship, 1981).

There is also the vexing question, which has come up repeatedly with later studies (e.g. Nettleship and Evans, 1985; Gaston et al., 2012), of the difference between his colony size estimates and those made more recently, mostly using counts from photographs. Tuck's estimates for the Digges Sound and Cape Hay colonies were more than twice as large as more recent estimates (Table 1). Unfortunately, despite his assertions that he put a lot of work into counting the murres and developing population estimates, Tuck nowhere tells us exactly how he reached the numbers he gave, other than saying that, for Cape Hay specifically, "... birds were censused by defining various sections of the cliff faces, counting the number of birds occupying these sections, and mathematically determining the percentage of the colony so examined" (Tuck, 1961), a method used by some subsequent workers (e.g., Chapdelaine et al., 1986). However, we cannot evaluate the likely accuracy of this method without knowing how the sections counted were selected and what proportion of the colony was covered.

Because murres make no nest, and because it is very difficult to know whether a bird seated on the cliff is covering an egg/chick or not, estimates of breeding populations are currently made by counting all individuals present and then correcting that number by the expected ratio of birds present to the number of breeding pairs (Gaston, 2002). This ratio is derived from a subsample of the colony where intensive observations have allowed the number of breeders to be determined exactly (Birkhead and Nettleship, 1980; Gaston et al., 1983). It seems that Tuck would have had the relevant data to do that, but he nowhere mentions doing so. Because his numbers are given to the nearest 100,000 birds, or in the case of Digges Sound, the nearest million, we cannot tell how many birds he actually counted. Nor is it always clear whether his estimates included non-breeders. It is tempting to think that populations have declined very substantially since the 1950s (Table 1; e.g., Nettleship and Evans, 1985). However, two

other colony estimates made in the 1950s, at Coats Island (A.G. Loufhrey in Tuck, 1961) and Cape Graham Moore, Bylot Island (D.S. Moodie in Tuck, 1961), were actually smaller than estimates made by more recent observers (Gaston et al., 2012, 2017). Without better information on Tuck's methods or any of the raw data, any inferences about population change must remain very tentative.

Climbing

Banding Thick-billed Murres requires climbing on precipitous cliffs, as, unlike Common Murres (*Uria aalge*), Thick-billed Murres very rarely lay their eggs on extensive flat rocks (Tuck, 1961). Despite working on some of the highest and most precipitous cliffs in Canada's Arctic, Tuck was not trained in climbing, as this request directed to "Chief, CWS" on 6 June 1955 illustrates: "I have one additional request: 200 feet of nylon rope. This rope is required for climbing cliffs. I am not familiar with nylon rope. I understand that it is very strong and so one quarter inch might suffice. It should be capable of being able to stand a sudden jolt of 150 lbs or so." (Tuck, *in litt* to CWS HQ). He probably intended the type of braided nylon rope used on sailing boats. Dynamic kernmantle climbing ropes that stretch to prevent a jerk when put under stress were not developed until the 1960s.

The fact that Tuck carried out no banding at Akpatok suggests that his climbing there was restricted to areas close to the clifftop, where scrambling sufficed. As he took 10,000 bands to Digges Sound, he clearly intended from the outset to do a lot of climbing. Although he camped on both sides of the sound, birds are much more accessible on the island than on the mainland side, so it is likely that most of the banding took place there. That is also where the local Inuit harvest the majority of the eggs they take for subsistence purposes (Gaston et al., 1985). The idea of someone without training and with what, today, would be regarded as very inadequate equipment, clambering all over the 200 m cliffs of Digges Island seems very risky. However, Inuit from Ivujivik visit the colony every year to collect eggs (Gaston et al., 1985). They are agile and experienced climbers, and it is likely that their guidance was crucial in Tuck's banding success. They would have been able to guide him to places where birds were easily accessible. At some points on the cliffs, boulders were piled up to forms crude steps, facilitating climbing. The encrusting lichen suggested that they have been used for centuries (pers. obs., 1980).

The guidance of local Inuit notwithstanding, Tuck and Lowther must have taken risks that would be regarded as totally unacceptable today. The situation at Cape Hay would have been similar, and Tuck himself said of that colony, "Only the angels could be happy banding there" (1957:8). A possibly apocryphal story that illustrates his attitude to risk holds that Tuck was trying to catch murres at the edge of a cliff, with a net stretched between him and an assistant, when he fell over the edge, being saved only by his assistant hanging on grimly to the other end of the net. Supposedly his first words on regaining the cliff top were "Right, let's try it another way..." or something to that effect.

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