UNFAMILIAR PLUMAGE ABERRATION OBSERVED ON A RAZORBILL *ALCA TORDA* AT MACHIAS SEAL ISLAND

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ABSTRACT

Oliker, D., Diamond, A. W., & Major, H. L. (2025). Unfamiliar plumage aberration observed on a Razorbill *Alca torda* at Machias Seal Island. *Marine Ornithology*, *54*(1), 57–61. http://doi.org/to come.....

Aberrant plumage variation in seabirds can be caused by both heritable genetic mutations and non-heritable somatic mutations due to environmental stressors. In Razorbills *Alca torda*, aberrant colouration has been documented four times: three as cases of melanism and one seemingly of leucism, both heritable mutations. Here, we describe the observation and subsequent capture of a Razorbill with an unfamiliar plumage phenotype we hypothesize to be caused by a somatic mutation. To our knowledge, this is the first reported instance of a somatic mutation affecting the plumage of a Razorbill in the primary literature.

Key words: aberrant plumage, dilution, Razorbill, somatic mutation

INTRODUCTION

Among seabirds, plumage plays a critical role in various life history traits, influencing physiological, behavioural, and reproductive mechanisms (Bretagnolle, 1993; Jones, 1990). Abnormal variations in plumage have long been documented across seabird species and can be categorized into distinct classifications, depending on the underlying physiological or genetic mechanisms responsible for a given phenotype. In the field, different aberrant plumage types can often be difficult to classify, as some may appear similar phenotypically, while differing genetically (Bond & Diamond, 2016; van Grouw, 2021). In some cases, plumage variation may arise from environmental stressors, leading to non-heritable somatic mutations that can often be temporary (Diaz-Real et al., 2017; Eeva et al., 2008). Classifying the aberrant plumage type and cause in such instances is especially challenging and requires prolonged observation and monitoring, including observations between prebasic moults. The frequency of plumage variation caused by somatic mutations is thus limited, with few reported accounts in seabirds.

The dilution type "Isabel" (hereafter, "dilution") is an aberrant plumage type and is described as a quantitative reduction of melanin molecules (eumelanin), which causes normally black tissues to become greyish/silver (van Grouw, 2012, 2021). Relative to other, more commonly observed, plumage abnormalities among seabirds—including brown mutation, melanism, leucism, and progressive greying—dilution seems to occur less frequently (Bond & Diamond, 2016; Cieślińska et al., 2025). In the North Atlantic, dilution has been recorded in five individuals, four of which belong to the Alcidae, the other being a Northern Gannet *Morus bassanus* (van Grouw et al., 2011). Within the Alcidae, three records are of the Thick-billed Murre *Uria lomvia*: one collected in Hant's Harbour, Newfoundland and Labrador, in March 1951; the second observed in the Shetland Islands, United Kingdom; and the third in Greenland (Bond & Diamond, 2016, Table S1). The fourth record of dilution was for a Common Murre *U. aalge* observed at Bempton Cliffs, United Kingdom, in June 2010 (van Grouw et al., 2011). Although these cases have been confirmed as dilution (i.e., the heritable mutation resulting in a reduction of melanin molecules), dilution-like effects can manifest as somatic mutations. For instance, Bond and Diamond (2016) described an Atlantic Puffin *Fratercula arctica* with partially diluted plumage, showing grey head feathers instead of the typical black. However, they concluded it was not a case of dilution, as the rest of the bird's plumage appeared normal. High levels of stress or insufficient nutrients during moult may lead to abnormal pigmentation and may signal broader environmental change (Barta et al., 2008; Osváth et al., 2018). Monitoring the progression of individuals that experience abnormal plumage variations provides information on the relative frequency at which they occur within and across species as well as the cause and effect that plumage can have on other aspects of an individual's life history.

Razorbills *Alca torda* belong to the family Alcidae and are generally considered a medium-sized seabird (Lavers et al., 2020). They are distributed along the eastern and western coasts of the North Atlantic and feed primarily on small forage fish (Huettmann et al., 2005). Similar to other alcids, sexes look alike (Birkhead & Nettleship, 1985; Pyle, 2008). Adult Razorbills undergo a complete prebasic moult and a partial prealternate moult annually, and they exhibit different plumage phenotypes during the breeding versus the non-breeding season (Lavers et al., 2020; Pyle, 2008). During the breeding season, when they return to their colonies, Razorbills are in breeding (definitive alternate) plumage and have black upperparts and white underparts (Pyle, 2008). Plumage in Razorbills also consists of white feather tips to the secondaries, forming a white line, and in breeding plumage a white loral line develops between the eye and the proximal point of the culmen (Pyle, 2008). To

date, there have been four reported records of Razorbills with aberrant plumage, three of which were deemed to be melanistic and one seemingly leucistic (Bond & Diamond, 2016; Kolbeinsson, 2025; Major et al., 2024). Here, we describe the observation and subsequent capture of the first reported Razorbill to present dilution-like effects.

METHODS

Study site

Machias Seal Island (MSI) is a relatively small island (9.5 hectares [0.095 km^2]) that lies at the junction of the Gulf of Maine and the mouth of the Bay of Fundy in New Brunswick. Since 1944, MSI has been established as a migratory bird sanctuary by the Canadian Wildlife Service of Environment and Climate Change Canada, providing refuge for nine seabird species that nest there each summer. The Atlantic Laboratory for Avian Research at the University of New Brunswick has been conducting annual seabird population monitoring and research since 1995, documenting demographics and overall seabird response to changes in the marine ecosystem. Razorbills have been a key focal species since the start of the program, with an estimated 2,700 breeding pairs nesting on MSI (Atlantic Laboratory for Avian Research, 2025).

Capture and processing

Adult Razorbills are generally captured on the colony surface using box traps or noose carpets or by grubbing them from nesting crevices. During capture and processing of Razorbills, we apply a metal size-5R triangular eight-digit Bird Banding Laboratory (BBL) band to the right leg for identification and take measurements of the bill (culmen and bill depth), natural wing chord, and body mass along with five breast feather samples for genetic sexing. On 26 May 2025, we first observed an adult Razorbill with abnormal plumage colouration. This individual was observed on several occasions before its eventual capture near the south end of the island on 25 June 2025. On this day, the individual was captured off the colony surface by hand after it was observed loafing on rocks with conspecifics. The individual was processed as described above, with BBL band engraving "0895-28329." This band will allow us to monitor its plumage in future years and note any potential social behaviours it may exhibit.

Ethics statement

All birds on MSI are handled under approved Scientific and Migratory Bird Sanctuary permits issued by Environment and Climate Change Canada (AR-2025-ST2728 and AR-MBS-MSI-2025-1 Major), Bird Banding Station permits to H. Major and D. Oliker (10949A and G), and the University of New Brunswick's Animal Care Committee (2024000565).

RESULTS AND DISCUSSION

During the 2025 field season, in May, we observed a Razorbill with unfamiliar plumage near the south end of the island. It was an adult (at least 3 years old) as judged by plumage and bill dimensions and presence of more than one bill groove (Pyle, 2008). We continued to see the individual several times in May and June before capturing it by hand. Throughout our observations, we photographed the individual and documented

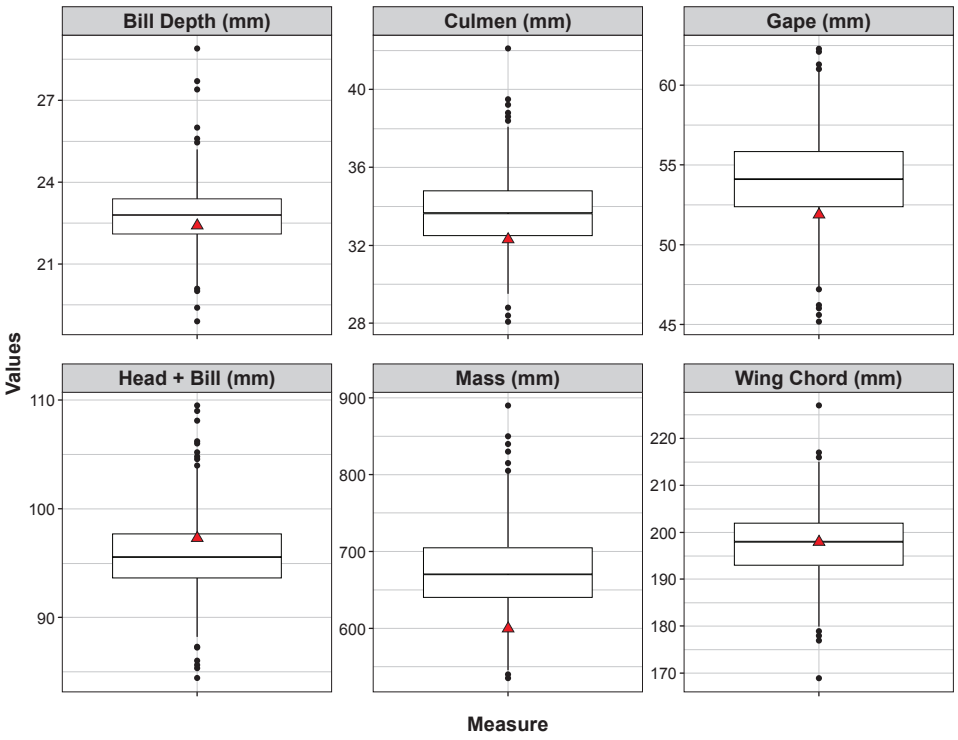

Fig. 1. Comparison of six standard morphometric measurements for adult Razorbills *Alca torda* at Machias Seal Island during 1995–2025. Box plots show median values and first and third quartiles, whiskers are 95% confidence intervals, and round black points are outliers from 1,064 adult Razorbill measurements. Red triangles are measurements taken from the adult Razorbill with unfamiliar plumage phenotype on 25 June 2025.

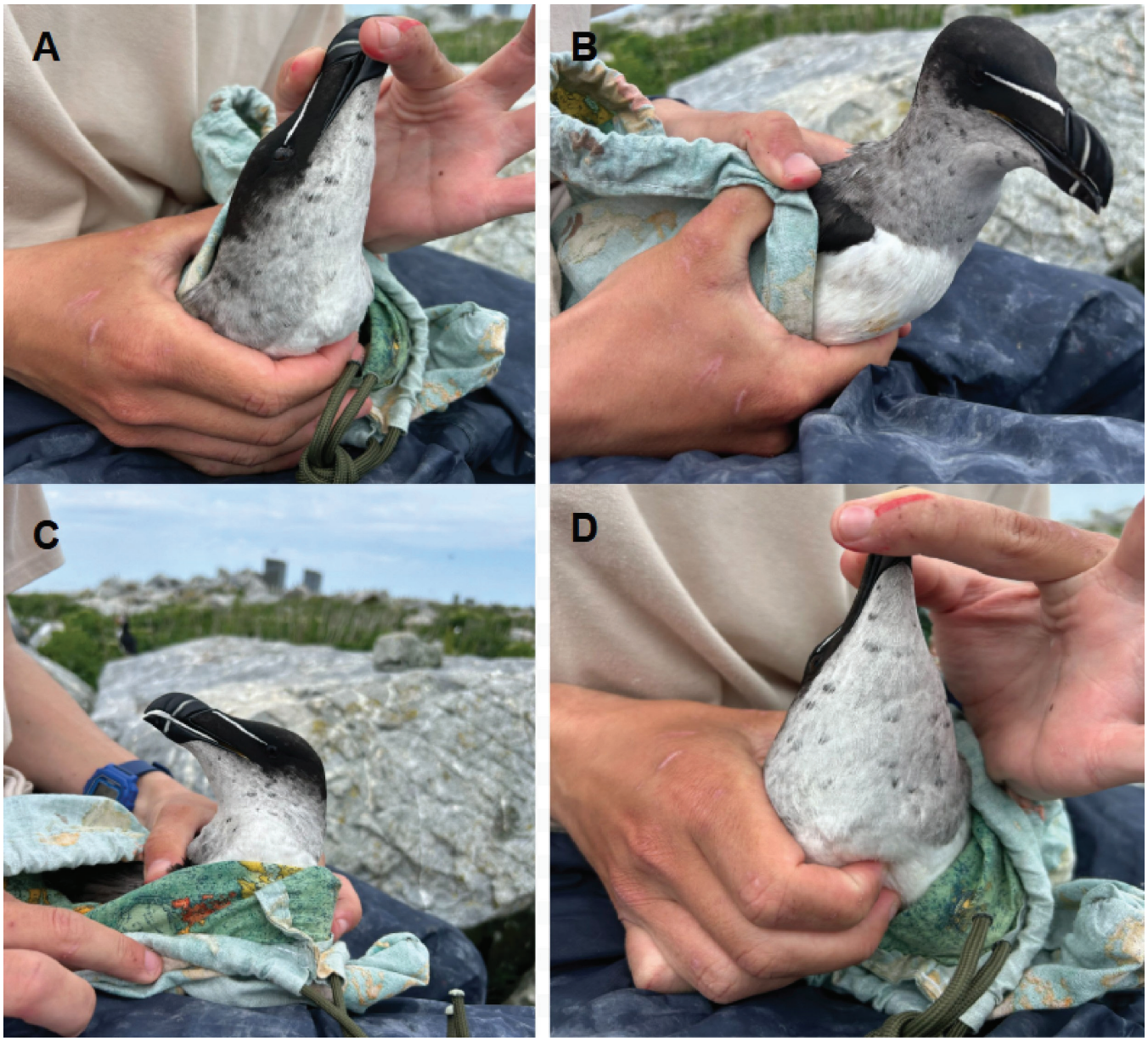

Fig. 2. Various angles of a Razorbill *Alca torda* with an unfamiliar plumage phenotype during banding and morphometric processing at Machias Seal Island, New Brunswick, Canada. (A) Right lateral view showing notably pale plumage; (B) general view highlighting the affected throat and neck feathers; (C) left lateral view of the affected plumage; and (D) ventral view of the throat plumage. Note the speckles of new black feathers emerging around the throat. Photo credit: Madelyn Talpt, Machias Seal Island, Canada, 2025

its unique plumage pattern, specifically noting the pale, greyish primaries on the wings and the grey/silver-looking throat with speckles of new black throat feathers. Interestingly, the affected parts of the bird (wing and throat) are areas that contain naturally lower concentrations of melanin pigment (McGraw et al., 2005), whereas the areas with higher concentrations were unaffected. During observation we did see the individual allopreening another Razorbill, suggesting it is close to or of sexual maturity, but we did not see any mounting or direct mating behaviour. We did not see it go into any rock crevices/potential nests. We tried to find the bird at night several times, searching the rock crevices near where it had been seen loafing, but we were not successful in locating the individual. It was not observed carrying fish, so we assume it did not breed in 2025.

In comparison to all adult Razorbills captured and measured at MSI since 1995, this aberrantly coloured individual was slightly smaller than other Razorbills in all measurements except head + bill length and wing chord length (Fig. 1). The bird had 1.5 bill grooves (typical of pre-breeding 3 year olds) and no brood patch, adding to our assumption that it did not breed in 2025. During handling, the bird showed high levels of energy and aggression and quickly flew off upon release, suggesting it was in decent condition. The dilution-like plumage was most prominent on the ventral side of the throat and spread dorsally around the neck (Fig. 2). Specks of new black feathers were present on the affected part of the throat, however, which could signal that the bird may return to a normal plumage phenotype. It could be that the black-spotted feathers were replaced earlier or later within

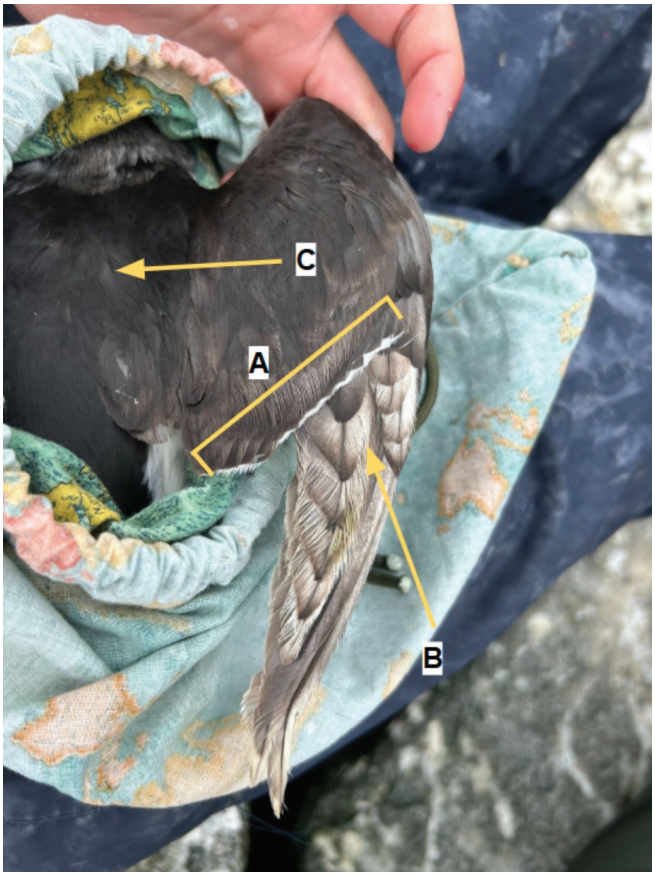

Fig. 3. View of the affected pale primary wing feathers of the Razorbill *Alca torda* with an unfamiliar plumage phenotype. (A) highlights the normal colouration of the white line formed by the secondaries; (B) denotes the pale greyish/whitish pigmentation of the primaries and primary coverts; and (C) highlights the normal black colouration of the back feathers. Photo credit: Madelyn Talpt, Machias Seal Island, Canada, 2025

the definitive prealternate moult as compared with plumage deposition cycles, a "moult-plumage interaction" that has been noted in Common Murres (Pyle, 2013). The primaries and outer primary coverts also appeared greyish in colour, with some feathers having notable white pigmentation closer to the stem (Fig. 3). Dilution of the primaries was even on both wings, with no noticeable asymmetry. The darker (more normally coloured) innermost primary could also be a moult-plumage interaction, thus indicating that earlier-replaced feathers were more normally pigmented and possibly indicating that the dark throat feathers were replaced earlier during the definitive prealternate moult.

Given the fact that the individual has new, normally coloured black throat feathers, it is likely that the plumage aberration was not caused by dilution (the heritable mechanism responsible for lower pigment concentrations) but instead could be due to environmental/physiological stressors resulting in a somatic mutation causing a temporary dilution-like appearance. The smaller morphometrics of the individual may also reflect environmental stressors that affected growth and led to slower development. The link between environmental stressors and plumage colour expression has been previously documented in birds (Osváth et al., 2018; van Grouw, 2018). For instance, low-quality diet, increased environmental temperatures, or illness during early years can increase the expression of stress-related genes that in turn affect a bird's ability to moult and produce melanin pigments (Diaz-Real et al., 2017). We hypothesize that the plumage colouration of this Razorbill is due to environmental stressors and is not caused by a heritable mutation. The appearance of new black throat feathers could indicate it has developed coping mechanisms or recovered from the external stressors that previously impeded normal feather colouration and that it may return to the typical plumage phenotype for Razorbills. We will continue to monitor this individual for any changes in plumage as well as its overall social behaviour and breeding status.

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