Eider ducks in Canada

edited by Austin Reed

Les eiders au Canada

dirigé par Austin Reed

Canadian Wildlife Service
Report Series Number 47

Service canadien de la faune
Série de rapports nº 47

Issued under the authority of the Minister of the Environment

Canadian Wildlife Service

Available by mail
from Printing and Publishing,
Supply and Services Canada,
Ottawa, Canada K1A 0S9
or through your bookseller

Price:
Canada $19.50
Other countries $23.40
Price subject to change without notice

Catalogue No. CW65-8/47B
ISBN 0-660-53257-3
ISSN 0069-0031

Design: the Page Group
Printing: K.G. Campbell Corp.
Contract No. KN107-5-1150

Publié avec l'autorisation du Ministre de l'Environnement

Service canadien de la faune

En vente au Canada
par l'entremise de nos agents
libraires agréés et autres librairies ou
par la poste au Centre d'édition du
gouvernment du Canada
Approvisionnements et Services Canada.
Ottawa (Ontario) K1A 0S9

Prix :
Canada : 19,50 $
à l'étranger : 23,40 $
Prix sujet à changement sans préavis

N° de catalogue CW65-8/47B
ISBN 0-660-53257-3
ISSN 0069-0031

Conception graphique : the Page Group
Impression : K.G. Campbell Corp.
N° de contrat : KN107-5-1150

Cover
Top: American Eider (*Somateria mollissima dresseri*), Ile aux Pommes, Quebec (photo: A. Reed)

Lower left: American Eider, Ile aux Pommes, Quebec (photo: A. Reed)

Lower centre: American Eider, Ile Bicquette, Quebec (photo: F. Bruemmer)

Lower right: St. Helena Island, NWT (photo: A. Dzubin)

Couverture :
En haut : Somateria mollissima dresseri, île aux Pommes, Québec (photo : A. Reed)

En bas, à gauche : Somateria mollissima dresseri, île aux Pommes, Québec (photo : A. Reed)

En bas, au centre : Somateria mollissima dresseri, île Bicquette, Québec (photo : F. Bruemmer)

En bas, à droite : Île Sainte-Helena, T.N.-O. (photo : A. Dzubin)

Identification of eastern races of the Common Eider

Identification des sous-espèces de l'Eider à duvet de l'Est

H.L. Mendall

1. Abstract

Bill measurements were taken of three subspecies of eastern American Common Eiders: *Somateria mollissima borealis, S. m. dresseri*, and *S.m. sedentaria*, and also *borealis-dresseri* intergrades, as an aid in recognizing these races. Live birds and fresh specimens were primarily from Labrador, Newfoundland, Quebec, and Maine, and museum skins were from various parts of their ranges. Of three bill measurements used, the frontal extension, although helpful, did not permit racial separation as well as total bill length or distance from the nostril to the posterior extension of the frontal lobe. Either or both of the two latter measurements permitted separation among adult females of most individuals of the various subspecies and intergrades. With adult males, the total bill length alone permitted racial separation, although the other measurements were of value in borderline cases. The system of bill measurements described, when used in conjunction with shape of the frontal lobe, should materially increase accuracy of racial determination.

2. Résumé

Les dimensions des becs des trois sous-espèces de l'Eider à duvet qui habitent l'est de l'Amérique, *Somateria mollissima borealis, S.m. dresseri* et *S.m. sedentaria*, ainsi que celles des intermédiaires *borealis–dresseri*, furent mesurées afin de faciliter leur identification. Le matériel incluait des spécimens vivants ou fraîchement tués provenant du Labrador, de Terre-Neuve, du Québec et du Maine, ainsi que des spécimens conservés dans différents musées provenant de diverses parties de l'aire de distribution de l'espèce. Des trois paramètres mesurés, l'extension frontale, quoique utile, était moins discriminante que la longueur totale du bec et/ou la distance entre la narine et la limite postérieure du lobe frontal. Ces deux derniers paramètres, seuls ou en combinaison, permettaient d'identifier la sous-espèce chez la majorité des femelles adultes. Un seul de ces paramètres, la longueur du bec, suffisait pour identifier les mâles adultes, mais les autres paramètres s'avéraient utiles dans les cas marginaux. L'utilisation des mesures du bec, en combinaison avec une évaluation de la forme du lobe frontal, devrait permettre une plus grande précision dans l'identification des différentes sous-espèces.

3. Introduction

Five subspecies of the Common Eider (*Somateria mollissima*) occur in North America (Palmer 1976). Of these, *S.m. borealis* has the most extensive range, and is in contact with three other subspecies at some season of the year: with *S. m. islandica* in Greenland; with *S. m. dresseri* in Labrador during summer, and throughout Atlantic Canada and Maine during winter; and with *S. m. sedentaria* in Hudson Bay in summer. Only the western race, *S. m. v-nigra*, appears isolated from any of the other four.

In a recent publication (Mendall 1980), I described briefly the overlaps in ranges of *borealis* with those of other subspecies, and I discussed racial intergradation. I concluded that *borealis-dresseri* intergradation occurs regularly over an extensive portion of the central and south-central Labrador coast. I also presented indirect evidence that *borealis-sedentaria* intergradation occurs in the vicinity of Chesterfield Inlet in northwestern Hudson Bay. It seems likely, as well, that *borealis-islandica* intergrades are found in western Greenland.

With the present increased interest in eider distribution and management, it is desirable to identify individuals of the various races as accurately as possible. Differences in body size are relatively slight and plumages vary greatly by age, season, and region. The most usual identifying character has been the shape of the frontal lobes of the bill. However, identification according to this character has always been subjective and requires experience in examining many specimens. Identification becomes especially troublesome when dealing with possible intergrades or atypical specimens.

To aid in racial identification, I presented (Mendall 1980) a series of bill measurements of adult female eiders of *borealis, sedentaria, dresseri*, and *dresseri-borealis* intergrades which could be used in conjunction with the shape of the frontal process. I used only data from summer-collected adults, to permit geographic comparisons of different breeding populations. The bill measurements, in conjunction with the more subjective criteria, resulted in probable identification accuracy at the 95% level. The present paper extends this system of bill meaurements to other sex and age groups of eastern races of the Common Eider.

4. Methods

To determine subspecies and intergrades, I used the following sources: (1) live birds trapped for banding in Maine and Labrador (nesting females); (2) fresh specimens (all sex and age groups) from Maine, Newfoundland, and Quebec, examined by personnel of the Canadian Wildlife Service (CWS) and the Maine Cooperative Wildlife Research Unit; (3) preserved specimens (all sex and age groups) from the following museums: University of Maine, Bowdoin College, Museum of Comparative Zoology, Carnegie Museum, United States National Museum, Royal Ontario Museum, and National Museum of Canada.

Summer specimens of adult females from specific breeding areas were the same as those used by Mendall (1980); these have been supplemented in the present paper by adult females killed in fall, winter, and spring in eastern Canada and northeastern United States. Eiders of all other sex and age classes were from the museum collections listed except for a limited series of fresh specimens from Maine and some birds illegally killed on the north shore of the Gulf of St. Lawrence and confiscated by Quebec authorities.

In tabulations involving immature eiders (birds less than 1 year old), only specimens taken after 1 November were used.

In my previous study of adult female eiders (Mendall 1980), four bill measurements were used (Fig. 1), but it was shown that the length of the culmen midline was too variable to be satisfactory in racial determination. Thus, in the present paper only the other three measurements are used. These are defined as follows:

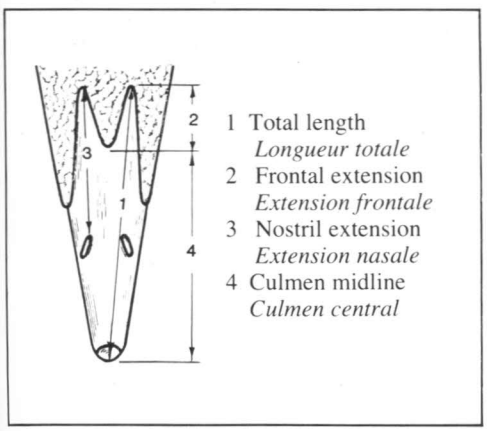
1. total length: from tip of bill to posterior end of frontal lobe;
2. frontal extension: from anterior end of feathering on top of middle of bill to posterior end of frontal lobe;
3. nostril extension: from posterior end of nasal opening to posterior end of frontal lobe.

I recorded bill measurements to the nearest 0.5 mm, and, to standardize the data, took them on the right side of the bird. Specimens with shrivelled or damaged bills were not included in the sample. Because mean bill shrinkage of museum specimens was slight (Mendall 1980) and no greater than individual human error in taking measurements, I combined museum and fresh specimens in the tabulations.

Preliminary subspecific identification was by shape of the bill processes. Frontal lobes of typical *borealis* are narrower, shorter, and much more acutely pointed than in *dresseri*; in the latter these are usually longer, broader, and more rounded. The frontal lobes of *sedentaria* resemble *dresseri* but are smaller and usually narrower, especially in females (see Figs. 2 and 3). Subspecific descriptions of eider bills have been given by several authors, particularly Snyder (1941), Todd (1963), Godfrey (1966), and Palmer (1976).

The frontal lobes of intergrades were described for adult females (Mendall 1980) as "either narrow (more so than in *dresseri* or *sedentaria*) and semi-rounded (or nearly square), or broad but conspicuously short" (see also Fig. 3). This description also appears to hold for male intergrades, although the sample is much smaller than that available for females.

Figure 1
Points of measurement of eider bills (from Mendall 1980)
Points de mesures des becs des eiders (d'après Mendall, 1980)



5. Results

Means, standard deviations, and ranges for the three measurements for adults of all four races, and for subadult and immature *dresseri* males, are shown in Table 1. The sample sizes for subadult and immature age classes of other races and sexes were too small to warrant separate tabulations. Subadult and immature males of *borealis* ($N=8$), intergrades ($N=3$), and *sedentaria* ($N=6$) showed only minor differences in means from those of adults, which were not significant ($P>0.05$). Although these are not included in Table 1, they probably could have been combined with adults. A contrasting situation was seen, however, with *dresseri*. Although there were insignificant differences ($P>0.05$) in measurements between immatures and subadults, the differences of these two age classes combined were significant ($P<0.05$) when compared with adults. Because a reasonably good sample of this group of *dresseri* was available, they are included in Table 1 and the subsequent analysis of the data.

Among females there were no obvious differences in bill measurements of the various age classes. It appears that data from immatures, taken in late fall and winter, and subadult (yearling) females could have been combined with that of adults. However, as with males, numbers were low for most of the groups.

I cannot satisfactorily explain the fact that size differences were noted only for *dresseri* males. It might be expected that measurements in all age classes below adults would be somewhat lower. Schiøler (1926) recorded such differences among Greenland *borealis* and *islandica*, although these were slight and were largely confined to "juvenals" (= immatures, in this paper). However, the degree of change was much less than that noted in the present study for *dresseri*.

Part of the differences that were detected is probably related to sample sizes, because *dresseri* made up the only category in which numbers of subadult and immature males were sufficient to justify tabulation. It is also possible that geographic variations occurred and that the sample was biased in this respect. With adult females, I found (Mendall 1980) that morphological clines existed, with regional differences in bill measurements. These differences were not significant ($P>0.05$) among *borealis* but they were significant ($P<0.05$) among *dresseri*; Labrador *dresseri* had the smallest measurements while those from Maine (southern limit of breeding) were largest. Unfortunately, the samples of males of the various races and intergrades were insufficient for satisfactory geographic separation.

It should be emphasized that the females in Table 1 are from all seasons of the year and from all geographic regions, whereas in my earlier paper (Mendall 1980) only summer eiders from known breeding areas were considered. Detection of geographic variations, when present, was easily noted through analysis of variance and multiple range tests by the Student-Newman-Keuls (S-N-K) procedure (Zar 1974); see the tabulations and discussion in Mendall (1980) for details. That study demonstrated the value of bill measurements of total length, nostril extension, and frontal extension (especially the two former) as aids in racial identification; and also showed the unreliability of the culmen midline measurement.

A comparison of the data in Table 1 with that in Mendall (1980) reveals no important differences in bill measurements of adult females between *borealis* and intergrades. As all available specimens of *sedentaria* were summer-collected, those two sets of data are the same. With *dresseri*, the data were grouped geographically in my earlier publication, with significant differences measured. Therefore, the present tabulation (Table 1) represents, broadly, a composite of the previous compilations, together with additional fall, winter, and early spring collections.

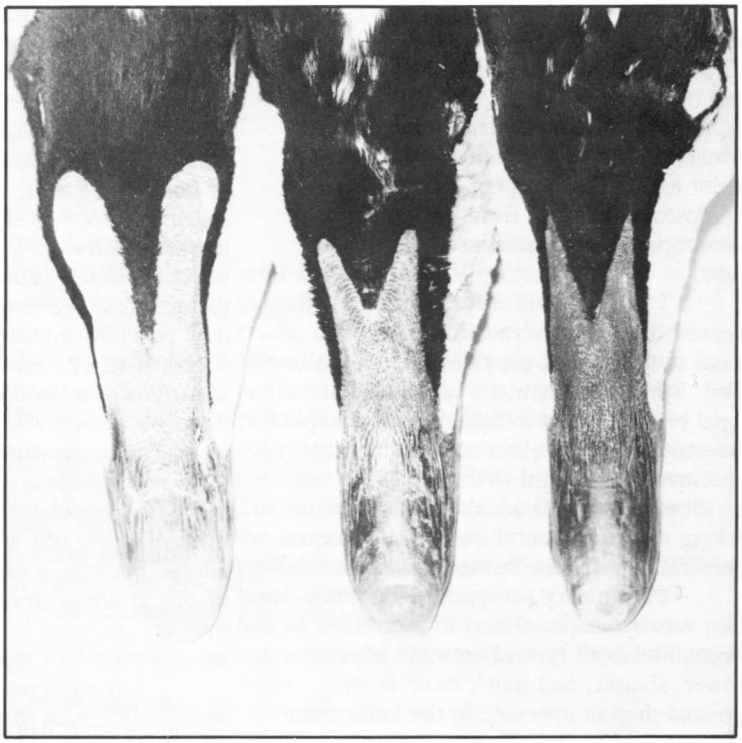
Multiple range tests by the S-N-K procedure of the data for males listed in Table 1 were slightly less specific than had been demonstrated (Mendall 1980) for adult females. The results are shown in Table 2.

Whereas the total bill length and nostril extension measurements had been about equally satisfactory in racial determination of adult females, only total length permitted complete separation of the three subspecies and *borealis-dresseri* intergrades among adult males. Considering the other two measurements, some overlap in means of the subsets occurred between *borealis* and intergrades, although the overlap was slight for the frontal extension. *Sedentaria* and adult *dresseri* separated from other races and from intergrades in all three measurements.

The overlap in means of each measurement between *sedentaria* and subadult and immature *dresseri* is not of much practical concern. On the basis of present knowledge of eider distribution, *sedentaria* is virtually restricted to Hudson Bay at all seasons of the year, whereas *dresseri* is not known to occur there. Thus, the locality of collection would seem to rule out uncertainty in distinguishing these two subspecies.

Figure 2
Bill processes of Common Eiders. (A) Adult males, *borealis* (left) and *dresseri* (right). (B) Typical adult females, from left to right: *dresseri, sedentaria, borealis*. (C) Adult males, from left to right: *dresseri*, atypical *borealis*, typical *borealis*. The shape of the frontal extension of this *dresseri* is more typical than that shown in (A). (D) Day-old ducklings, both males, *dresseri* (left) and *borealis* (right)
Lobes du bec des Eiders à duvet, (A) Mâles adultes, borealis (à gauche) et dresseri (à droite). (B) Femelles adultes typiques, de gauche à droite : dresseri, sedentaria, borealis. (C) Mâles adultes, de gauche à droite : dresseri, borealis non typiques, borealis typiques. La forme de l'extension frontale de ce dresseri est plus typique que celle montrée en (A). (D) Canetons d'une journée, mâles, dresseri (à gauche) et borealis (à droite)


A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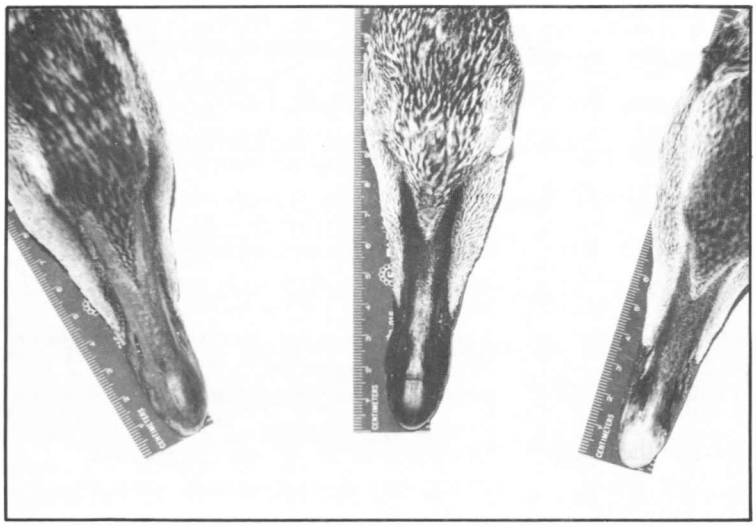
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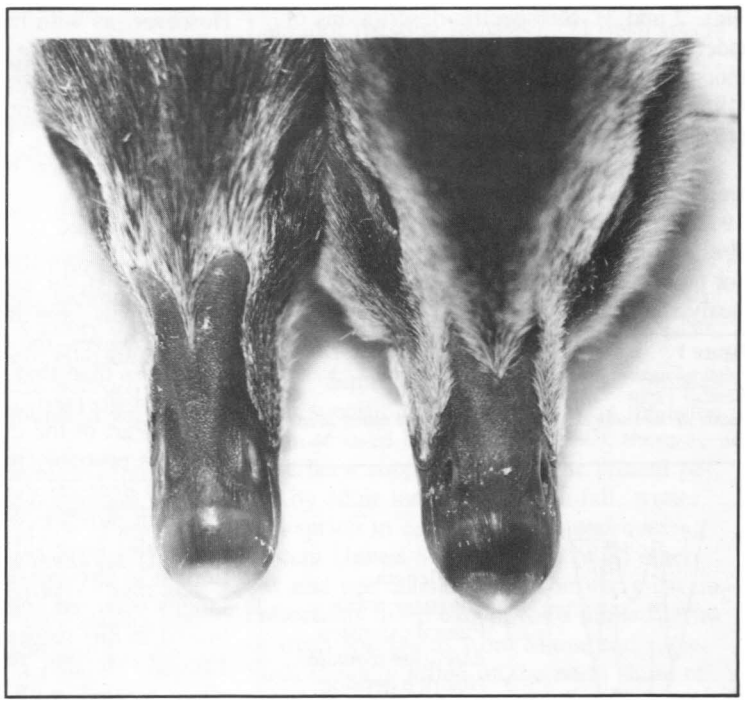
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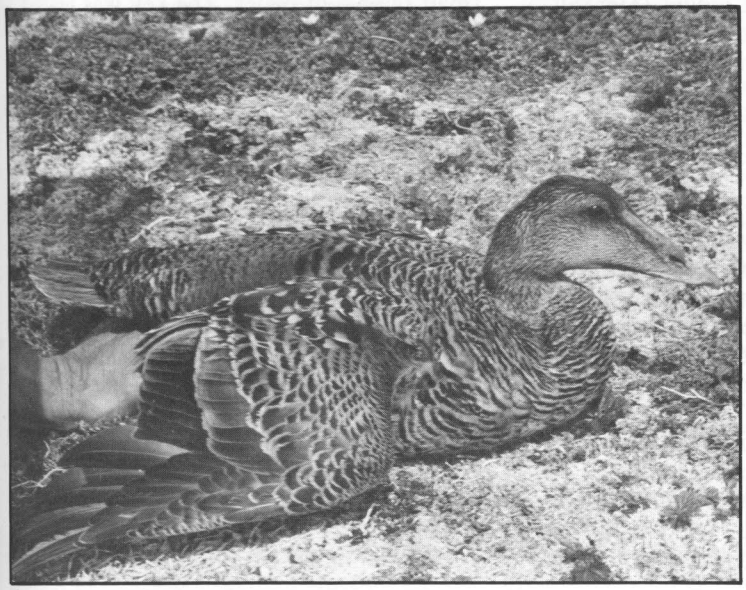
Figure 3
Bill processes of adult female Common Eiders. *Borealis-dresseri* intergrades show much variation in appearance. (A) Live-trapped *dresseri*. (B) Live-trapped intergrade. Note the position of the frontal extension in relation to the eye as compared to the *dresseri* in (A). (C) Intergrade (left) and typical *borealis* (right). (D) Gray-phase Labrador eiders, intergrade (left), and *borealis* (right)
Lobes du bec de femelles adultes de l'Eider à duvet. La sous-espèce intermédiaire borealis-dresseri démontre, en apparence, une plus grande variation. (A) Dresseri capturé vivant. (B) Sous-espèce intermédiaire capturée vivante. Remarquer la position de l'extension frontale par rapport à l'oeil comparativement au dresseri en (A). (C) Sous-espèce intermédiaire (à gauche) et borealis typique (à droite). (D) Eiders du Labrador en phase de coloration grise, sous-espèce intermédiaire (à gauche) et borealis (à droite)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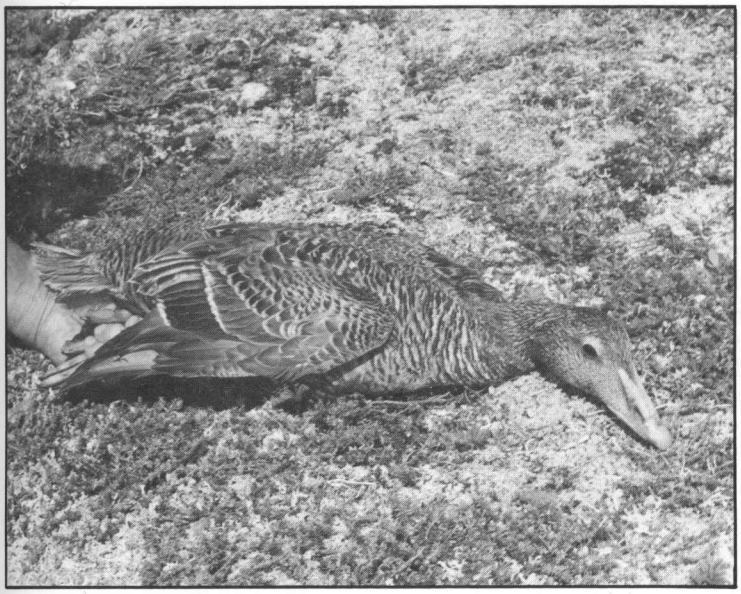
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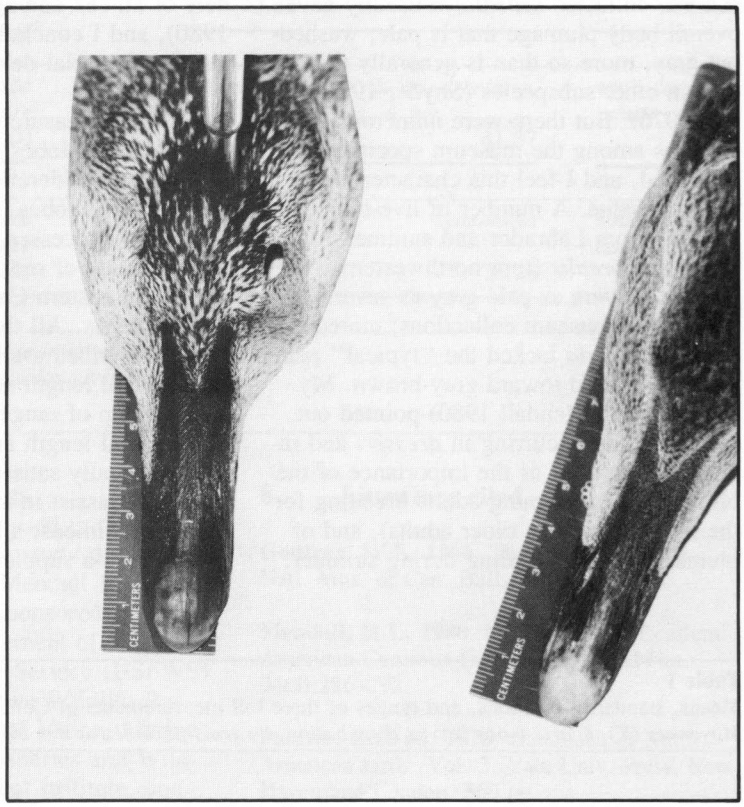

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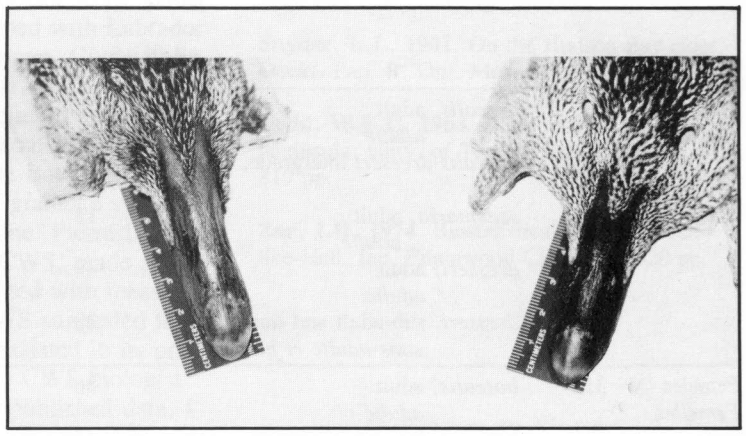
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6. Discussion

6.1. Plumage coloration and facial feature patterns □

As previously stated, plumage coloration and facial feather patterns are too variable to be of much help in racial determination. Considering adult females, summer-collected *sedentaria* usually have overall body plumage that is pale, washed-out gray, more so than is generally the case in other subspecies (Snyder 1941, Palmer 1976). But there were numerous exceptions among the museum specimens I examined, and I feel this character has minimal value. A number of live-trapped *borealis* from Labrador and summer-collected *borealis* from northwestern Greenland were as pale gray as several *sedentaria* in museum collections; moreover, some *sedentaria* lacked the "typical" paleness and tended toward gray-brown. My earlier paper (Mendall 1980) pointed out the variability occurring in *dresseri* and intergrades, as well as the importance of the bird's age (e.g., young adults breeding for the first time versus older adults), and of plumage wear and fading during summer.

With males, plumage is an even less satisfactory criterion, separation being based largely on the relative amount of greenish wash on the head.

The position of the nostril in relation to the lateral facial feathers has been used by some authors as one of the subspecific criteria. This was tested with 344 eiders of all sex and age groups (Mendall 1980), and I concluded it was of little assistance in racial determination.

6.2. Bill measurements and shape of frontal lobes □

A consideration of both the shape of the frontal lobes, and the measurements of the bill processes, will permit racial identification of most Common Eiders occurring in eastern Canada and northeastern United States. All three of the measurements described are helpful, although, with males, total length is best as it results in less overlap of ranges (Table 2). With females, total length and nostril extension are almost equally satisfactory.

To assist in identification of individual specimens, a key (App. 1) has been prepared as a supplement to Table 1. The key gives emphasis to total bill length, the most dependable parameter, followed by nostril extension, and then frontal extension and bill shape. Users should be cautioned that the key will not always prove completely reliable due to occasional atypical specimens; also because it is based, as are the data in Table 1, on a relatively small sample of males. The key was tested against the raw data used in the various compilations. It was very satisfactory when considering individual females, and appeared accurate with the majority of males as well. However, if a larger sample of males is available in the future, especially of intergrades and *sedentaria*, the ranges and means as given may require changes.

Judgement must, of course, still be called upon in many instances. A number of specimens will have measurements that are within the range of overlap in one or more of the categories. In such cases, classifying the shape of the frontal lobe, although more subjective and requiring prior experience, may be of greater help. The difference in shape between that of an atypical subspecies and that of an intergrade complicates identification in border-

Table 1
Means, standard deviations, and ranges of three bill measurements of Common Eiders collected at all seasons of the year
Moyennes ($\bar{X}$), écarts types (ET) *et distribution des trois paramètres des becs des Eiders à duvet capturés au cours de toutes les saisons de l'année*

			Bill measurements, mm *Paramètres des becs, mm*		
			Frontal extension *Extension frontale*	Nostril extension *Extension nasale*	Total length *Longueur totale*
		N	$\bar{X} \pm$ SD (Range) $\bar{X} \pm$ ET *(Distribution)*	$\bar{X} \pm$ SD (Range) $\bar{X} \pm$ ET *(Distribution)*	$\bar{X} \pm$ SD (Range) $\bar{X} \pm$ ET *(Distribution)*
Males ($N = 134$) *Mâles*	*borealis*, adult *adulte*	26	18.87 ± 1.47 (17–22)	32.40 ± 1.90 (27.5–36)	68.23 ± 2.11 (64–71.5)
	borealis-dresseri intergrade, adult *adulte*	10	20.50 ± 1.67 (18–22)	33.00 ± 1.13 (31–34.5)	70.95 ± 2.06 (66–73)
	sedentaria, adult *adulte*	11	22.82 ± 1.55 (20–24.5)	40.96 ± 1.96 (38–44)	78.23 ± 2.63 (75–82)
	dresseri, adult *adulte*	49	28.03 ± 2.50 (23–34.5)	45.12 ± 2.78 (40–51)	81.96 ± 3.26 (75–90)
	dresseri, sub-adult and immature* *sous-adulte et juvénile**	38	24.08 ± 2.96 (19–32)	41.37 ± 2.65 (35–46)	78.12 ± 3.88 (69–86)
Females ($N = 318$) *Femelles*	*borealis*, adult *adulte*	86	17.12 ± 1.79 (13.5–21)	28.27 ± 2.22 (22–32.5)	63.40 ± 2.50 (59–71)
	borealis-dresseri intergrade, adult *adulte*	47	18.25 ± 2.15 (14–23)	31.48 ± 2.29 (27.5–36)	66.40 ± 2.37 (62–72)
	sedentaria, adult *adulte*	22	20.07 ± 1.96 (17–23)	34.80 ± 1.93 (31–39)	70.48 ± 2.03 (67.5–74)
	dresseri, adult *adulte*	163	22.16 ± 2.01 (17.5–27)	36.96 ± 1.94 (32–41.5)	72.66 ± 2.46 (68–80)

* Includes only immatures taken after 1 November. This is an arbitrary date, selected to allow for relatively late physical development of some young of the year in a retarded breeding season.

* *Comprend seulement les juvéniles capturés après le 1er novembre. Cette date est arbitraire et a été choisie pour tenir compte du développement physique relativement tardif de quelques jeunes de l'année produits dans une saison de reproduction tardive.*

Table 2

Multiple range test for means of three bill measurements, in millimetres, of male Common Eiders ($N = 134$). (Solid lines under group means indicate homogenous subsets, no pairs of which have means that differ by more than the shortest significant range (95%) for a subset of that size)

Test de distribution multiple pour connaître les moyennes des trois paramètres des becs (en mm) du mâle de l'Eider à duvet ($N = 134$). (Les moyennes des groupes soulignées indiquent des sous-ensembles homogènes où aucun couple n'a une moyenne qui diffère de plus que la plus petite distribution significative (95 %) pour un sous-ensemble de cette taille)

Frontal extension *Extension frontale*	Group *Groupe*	*borealis*	intergrade* *intermédiaire**	*sedentaria*	s.a. & im.† *dresseri* *s.-a. & juv.†*	adult *dresseri* *adulte*
	Group mean *Moyenne du groupe*	18.87	20.50	22.82	24.08	28.03
Nostril extension *Extension nasale*	Group *Groupe*	*borealis*	intergrade *intermédiaire*	*sedentaria*	s.a. & im. *dresseri* *s.-a. & juv.*	adult *dresseri* *adulte*
	Group mean *Moyenne du groupe*	32.40	33.00	40.96	41.37	45.12
Total length *Longueur totale*	Group *Groupe*	*borealis*	intergrade *intermédiaire*	s.a. & im. *dresseri* *s.-a. & juv.*	*sedentaria*	adult *dresseri* *adulte*
	Group mean *Moyenne du groupe*	68.23	70.95	78.12	78.23	81.96

**Borealis-dresseri* intergrades.
†Subadults; also immatures taken after 1 November.

** Borealis-dresseri, sous-espèce intermédiaire.*
† Sous-adultes; comprend aussi les juvéniles capturés après le 1er novembre.

line cases. An example may be seen in the bill of the male eider shown in the center of Figure 2*c*. From the appearance of the frontal lobe, I was uncertain whether the bird was a slightly atypical *borealis* or an intergrade. The measurement of the nostril extension indicated it could be either. However, both the total length (the best measurement for males) and the frontal extension were slightly below the means for *borealis* and considerably lower than the means for intergrades. Thus, I concluded the bird was probably a *borealis*.

More variation is to be expected in shape of the frontal lobes of intergrades see Figure 3*b*, *c*, and *d* than in "pure" races. With any given intergrade, there is no certainty if the bird is the direct offspring of subspecific parents or if it may be several generations removed, and with disproportional genetic makeup.

Based on the eiders examined during this study, it appears that about 95% can be classified as to race with probable accuracy. From the standpoint of field or laboratory checks by wildlife biologists, this is likely to be adequate for most management purposes. To strive for greater accuracy would involve detailed taxonomic study, including skeletal characteristics, and access to a considerable amount of preserved material from numerous geographic regions.

7. Acknowledgments

Most of the data used in this paper were obtained during the study described in my earlier publication (Mendall 1980). That study was jointly sponsored by the Division of Law Enforcement of the United States Fish and Wildlife Service (USFWS) and the Maine Cooperative Wildlife Research Unit (University of Maine, Marine Department of Inland Fisheries and Wildlife, Wildlife Management Institute, and USFWS cooperating).

I especially appreciate the assistance of William Snow, former special agent, USFWS, during the Labrador work. Other USFWS agents who helped with Labrador studies were Howard Brown, Clyde Bolin, and the late Donald Blais. Assistance in measuring museum specimens was given by my wife, Emma Mendall; and by William Sarbello, Myrtle Bateman, and Carl Korschgen, former graduate students of the University of Maine. Pierre Dupuis and André Bourget, of CWS, made specimens available and assisted with measurements. Austin Reed, CWS suggested the key (Appendix 1), and assisted in its preparation. I am indebted to CWS biologist Douglas Gillespie for unpublished data. I thank the following museum personnel for access to collections: Charles Huntington, Raymond Paynter, Jr., Marshall Howe, Ross James, and Kenneth Parkes. Computer programming and statistical assistance was provided by Wayne Persons, University of Maine Computer Center. Maxine Horne kindly typed the manuscript.

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Appendix 1

A key to aid in determining races of Common Eiders (*Somateria mollissima*) of northeastern North America

Females			
1. Total bill length	<62.0 mm		*borealis*
	>74.0 mm		*dresseri*
	62.0–67.5 mm	*borealis* or intergrade*	2
	67.6–72.0 mm	*borealis*, intergrade, *sedentaria*, or *dresseri*	3
	72.1–74.0 mm	*dresseri* or *sedentaria*	3;5
2. Nostril extension	*a*) <27.5 mm		*borealis*
	b) >32.5 mm		*intergrade*
	c) 27.5–32.5 mm	(*i*) frontal extension >21	*intergrade*
		(*ii*) frontal extension ≤21	4
3. Nostril extension	*a*) <31.0 mm	*borealis* or intergrade	2
	b) >39.0 mm		*dresseri*
	c) 31.0–36.0 mm	(*i*) frontal extension >23.0	*dresseri*
		(*ii*) frontal extension <17.0 *borealis* or intergrade	2
		(*iii*) frontal extension 17.0–23.0	4
	d) 36.1–39.0 mm	(*i*) frontal extension >23.0	*dresseri*
		(*ii*) frontal extension ≤23.0 *dresseri* or *sedentaria*	5
4. Bill process shape	*a*) narrow, usually acutely pointed		*borealis*
	b) broad, well rounded, usually long	*dresseri* or *sedentaria*	5
	c) not acutely pointed or well rounded; often narrow and/or short		intergrade
5. Geographic separation	*a*) specimen obtained in Hudson Bay region west or north of approximate intersection of longitude 75°E and latitude 55°N		*sedentaria*
	b) specimen obtained east or south of approximate intersection of longitude 75°E and latitude 55°N		*dresseri*
Males			
1. Total bill length	<66.0 mm		*borealis*
	>82.0 mm		*dresseri*
	66.0–74.0 mm	*borealis*, intergrade or s.a. *dresseri*	2
	74.1–82.0 mm	*sedentaria* or *dresseri*	3;5
2. Nostril extension	*a*) <31.0 mm		*borealis*
	b) ≥31.0 mm	(*i*) frontal extension <18.0	*borealis*
		(*ii*) frontal extension >22.0	s.a. *dresseri*
		(*iii*) frontal extension 18.0–22.0 *borealis* or intergrade	4
3. Nostril extension	*a*) <40.0 mm	s.a. *dresseri* or *sedentaria*	5
	b) >44.0 mm		*dresseri*
	c) 40.0–44.0 mm	(*i*) frontal extension >24.5	*dresseri*
		(ii) frontal extension ≤24.5 *dresseri* or *sedentaria*	5
4. Bill process shape	*a*) narrow, usually acutely pointed		*borealis*
	b) broad, well rounded, usually long	*dresseri* or *sedentaria*	5
	c) not acutely pointed or well rounded; often narrow and/or short		intergrade
5. Geographic separation	*a*) specimen obtained in Hudson Bay region west or north of approximate intersection of longitude 75°E and latitude 55°N		*sedentaria*
	b) specimen obtained east or south of approximate intersection of longitude 75°E and latitude 55°N		*dresseri*

*Refers to *borealis-dresseri* intergrades throughout.

†As explained in the text, male *dresseri* require separate age tabulations. In this key, subadults (s.a.) also include birds of the year (immatures) taken after 1 November.