

# Thick-billed Murre Hunting in West Greenland, 1988-89

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**ABSTRACT.** Thick-billed murre (*Uria lomvia*) hunting by Inuit of West Greenland was surveyed during the winter and spring of 1988/89. Kill toll levels and age structure of the kill were determined for districts between Upernavik (73°N) and Nanortalik (60°N). Based on counts of the numbers of birds available for purchase at markets and on information from processing companies, an estimated 100 000 murrens were killed for commercial trading purposes in 1988/89. Non-commercial hunting is harder to assess, but estimates based on the number of licences issued and the mean number of murrens killed per day by non-commercial hunters indicate that between 190 000 and 293 000 murrens are killed per annum. Thus the total kill toll is estimated to be between 283 000 and 386 000 murrens annually. In Central West and Southwest Greenland the peak hunting period was November and December, but hunting continued to 15 March or until ice conditions prevented sailing.

Age distribution of the kill was determined by classifying 6278 murrens as "first-year" or "older" by the development of the cranium. In Southwest Greenland the proportion of older birds in the kill was always below 9%, whereas in Central West Greenland (Nuuk) the value increased from 27.5% in October to 75.8% old birds in March. About 90% of the murrens killed in spring near major breeding colonies in Upernavik were adult breeding birds, and hunting near the breeding grounds is considered the major cause for population reductions. Murrens shot in winter are mostly birds from colonies outside Greenland, but though it has yet to be proved, the immense kill of murrens during the winter hunt probably affects the populations involved.

Recommendations for improvement of the management of murre populations in Greenland include public education programs and law enforcement, reduction of number of hunters and shortened winter hunting season. Further research is needed on the magnitude and variation of the non-commercial hunt, detailed breeding population monitoring and origin of killed birds.

**Key words:** thick-billed murre, *Uria lomvia*, Greenland, Inuit, hunting, seabirds, population structure, resource management, hunting legislation

**RÉSUMÉ.** Au cours de l'hiver et de l'été de 1988-89, on a effectué des relevés portant sur la chasse à la marmette de Brünnich (*Uria lomvia*) par les Inuit de l'ouest du Groenland. Le taux des oiseaux abattus et leur structure d'âge ont été déterminés pour les districts situés entre Upernavik (73° N.) et Nanortalik (60° N.). En s'appuyant sur le comptage du nombre d'oiseaux mis en vente sur les marchés ainsi que sur l'information obtenue auprès des compagnies de conditionnement, on a évalué à 100 000 le nombre de marmettes de Brünnich tuées à des fins commerciales en 1988-89. La chasse non commerciale est plus difficile à évaluer, mais les estimations fondées sur le nombre de permis issus et la moyenne de marmettes tuées chaque jour par des chasseurs non commerciaux indiquent qu'entre 190 000 et 293 000 marmettes sont tuées chaque année. Le nombre total de marmettes tuées annuellement se situerait donc entre 283 000 et 386 000. Dans le centre-ouest et le sud-ouest du Groenland, la saison de chasse battait son plein en novembre et décembre, mais la chasse continuait jusqu'au 15 mars ou jusqu'à ce que les conditions des glaces empêchent la navigation.

On a déterminé la distribution d'âge des oiseaux tués en classant 6278 marmettes dans deux catégories, soit « première année » ou « plus âgée » d'après le développement de la boîte crânienne. Dans le sud-ouest du Groenland, la proportion d'oiseaux plus âgés parmi les oiseaux tués était toujours inférieure à 9 p. cent, tandis que dans le centre-ouest du Groenland (Nuuk), la proportion augmentait de 27,5 p. cent en octobre à 75,8 p. cent au mois de mars. Près de 90 p. cent des marmettes de Brünnich tuées au printemps à proximité d'importantes colonies reproductrices à Upernavik étaient des adultes en âge de se reproduire, et c'est la chasse près des sites de nidification qui serait tenue en grande partie responsable de la diminution de leur population. Les marmettes abattues en hiver sont surtout des oiseaux venant de colonies situées hors du Groenland, mais, bien que cela reste encore à prouver, l'abattage massif des marmettes durant la chasse hivernale affecte probablement les populations concernées.

Les recommandations en vue d'améliorer la gestion des populations de marmettes de Brünnich au Groenland comprennent des programmes éducatifs et l'application stricte des lois, la réduction du nombre de chasseurs et le raccourcissement de la saison de chasse hivernale. D'autres recherches sont nécessaires concernant l'ampleur et la variation de la chasse non commerciale, une surveillance détaillée de la population reproductrice et la provenance des oiseaux tués.

**Mots clés:** marmette de Brünnich, *Uria lomvia*, Groenland, Inuit, chasse, oiseaux marins, structure de la population, gestion des ressources, législation concernant la chasse

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## INTRODUCTION

As an abundant and widespread seabird along the coast of West Greenland, the thick-billed murre (*Uria lomvia*) has long been a very important quarry of Inuit subsistence hunting. But a growing human population with access to fast boats and effective shotguns has created increased pressure on the seabird resource, and as a result, murre colonies near human settlements have suffered marked declines and even extinctions (Salomonsen, 1970; Nettleship and Evans, 1985; Evans and Kampp, 1991; Kampp, 1991).

In order to formulate a management policy, detailed knowledge of the murre population status and key mortality factors is necessary. Based on patterns of band recoveries and on dissimilar rates of population declines observed in the different murre colonies in West Greenland, the traditional summer hunt near the breeding areas was identified as a major cause

for the population decrease (Evans and Kampp, 1991; Kampp, 1991). Previously, murrens suffered a high mortality from entanglement in salmon driftnets (Tull *et al.*, 1972; Christensen and Lear, 1977), but this has now been reduced to a very low level (Falk and Durinck, 1991).

Substantial numbers of thick-billed murrens are known to be killed in the winter hunt in Newfoundland (Wendt and Cooch, 1984; Elliot, 1986, 1987; Elliot *et al.*, 1991) and Greenland (Salomonsen, 1967, 1970; Evans, 1984; Kampp, 1983, 1991; Kampp *et al.*, in press). Although the murre hunt in Newfoundland has been subject to intensive research in recent years, knowledge of the winter hunt in West Greenland comes only from band recoveries and old hunting statistics from the 1950s (Kampp, 1988, 1991; Kampp *et al.*, in press). In Greenland there are no official records of the number of birds killed, so the magnitude of the winter murre hunt before 1988/89 is unknown. In 1987, the local spring/summer hunting pressure

in the Upernavik district was estimated by interviewing hunters in most settlements (Evans, 1987; Evans and Kampp, 1991), but no detailed field investigations have been conducted. Furthermore, the age structure of the kill has only been roughly estimated from band recoveries (Kampp, 1991). Knowledge of the age structure of the kill toll is essential for evaluating the effect of hunting on the population and is important when formulating specific management recommendations.

In this paper, we describe the results of the first field survey of the murre hunt in West Greenland, emphasizing the winter kill toll. The aim was to 1) measure the size of the hunt through the winter season and to estimate the total kill for each region, 2) determine the age distribution of the kill, and 3) on the basis of survey results and associated information, make recommendations for management and further research of the murre populations in West Greenland.

As the common murre (*Uria aalge*) is a scarce breeder in Greenland and rarely shot by hunters, all conclusions arrived at in this paper have bearing only on the thick-billed murre (Salomonsen, 1967; Evans, 1984; Nettleship and Evans, 1985).

There is a general trend towards the adoption of Greenlandic place names, which are used throughout this paper (Fig. 1), but the equivalent previous Danish/English names are given in the Appendix. The term "town" is used for the admin-

istrative centers of each municipality/district (Fig. 1), and "settlement" is used for villages and small communities. With a few exceptions, towns are much larger than settlements. In this paper we refer to the following regions of West Greenland: Southwest Greenland (Nanortalik to Qaqortoq), Central West Greenland (Paamiut to Aasiaat) and Northwest Greenland (Qasigiannugit to Upernavik) (Fig. 1).

The term "commercial" hunt indicates hunting for birds to be sold, whereas "non-commercial" or "private" hunt indicates hunting for private consumption. In practice, this distinction is not always clear, as commercial hunters consume many birds themselves and non-commercial hunters probably sell some birds to friends and relatives. "Winter" hunt means hunting in the period October-March between Ilulissat in the northern part of West Greenland and Nanortalik in southernmost West Greenland. "Spring" hunt means hunting in Northwest Greenland after 15 March.

#### Characteristics of Murre Hunting in West Greenland

To aid in the interpretation of field data and to understand the methods employed, the principal characteristics of the hunt and of hunting legislation in Greenland are summarized below.

Murres are traditionally hunted whenever available depending on the region (Bertelsen, 1921; Salomonsen, 1950, 1967, 1970; Kampp, 1988). Huge numbers of murres from the northeast Atlantic, arctic Canada and Greenland winter in the open-water regions of West Greenland from Sisimiut southwards (Fig. 1), together with many other alcids and seabirds (Salomonsen, 1950, 1967). In Northwest Greenland, seabirds are only available to hunters in spring and summer; the hunters here exploit local breeding birds as well as the migrants passing through on their way towards colonies in the High Arctic. In Avanersuaq (Thule) only small-scale summer hunting takes place near the large colonies (Salomonsen, 1970; Kampp, 1990). The only murre colonies in East Greenland — situated near Ittoqqortoormiit (Scoresby Sound) — are also exploited during the breeding season.

Selling of all legally killed birds (and other game) in Greenland is allowed (Greenland Home Rule, 1989). In the larger towns, professional hunters supply local outdoor markets with seal, fish, caribou, whale meat and a variety of birds throughout the year (Fig. 2). There is only a market for selling birds in the "large" towns, where there are many potential customers not shooting their own supply, whereas in small settlements everybody hunts or has ready access to birds from relatives. Several institutions, such as restaurants, hospitals, schools, etc., buy the birds directly from the hunters. In addition a number of processing companies have, until recently (see below), processed and distributed murres provided by the hunters.

Bird hunting is open to all Greenlanders (Inuit and permanently settled Danes), for whom no permits are required. However, in order to sell at markets and to processing companies, hunters must be registered as hunters/fishermen earning income from the fish and wildlife resources; they are issued a "full-time" or "part-time" hunting/fishing "licence," depending upon the extent to which they are active. Licences are not renewed regularly, and they create an inexact measure of the actual number of bird hunters. The number of licences, therefore, represents people "interested" in earning some form of income from the land and sea rather than the number actually engaged in hunting. A third type of licence, a "hobby permit,"

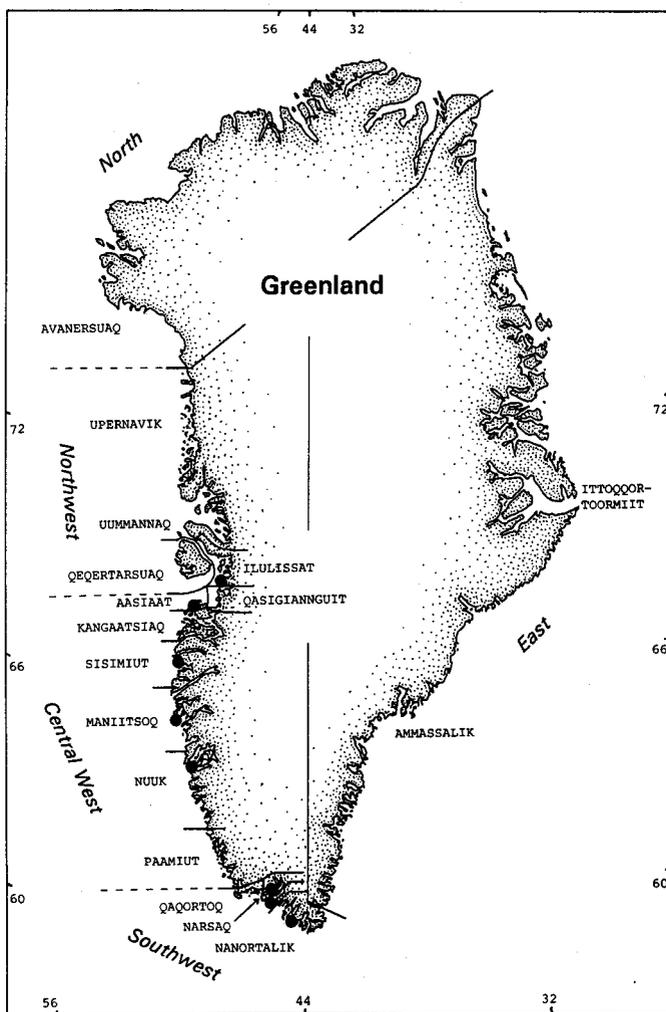


FIG. 1. Municipalities in Greenland and place names used in the text. Locations where the sales of murres at local markets were monitored are indicated (●).



FIG. 2. Selling of thick-billed murre at the local market in Qaqortoq, South Greenland.

is issued to tourists and non-residents — a group of hunters that probably does not account for a significant proportion of murre shot.

#### *Present Hunting Legislation*

In May 1988 stricter hunting regulations came into effect in Greenland (Greenland Home Rule, 1988). Three factors were important for the murre: First was the introduction of a closed season in the Uummanaq and Upernavik districts (1 June – 31 August) and a prolonged closed season from Ilulissat southwards (formerly 15 June – 15 August, now 1 June – 31 August and from Kangaatsiaq southwards 15 March – 15 October); there is no closed season for murre in North and East Greenland. Second was the termination of the selling of murre to processing companies. Commercial use of murre is at present confined to the local outdoor markets, although companies in small settlements may be granted exemptions from this regulation. And third was limited access to murre hunting; only holders of a full- or part-time hunter/fisherman licence may shoot murre (and black guillemots [*Cepphus grylle*]). This last regulation was in effect while we conducted the field research for the present study but was abolished in September 1989 (Greenland Home Rule, 1989). Since then non-professional hunters are allowed to shoot 10 murre per “hunting-trip.”

#### METHODS

##### *Survey of Commercial Hunting*

The survey was conducted during the murre hunting season from October 1988 to June 1989. The duration of the hunting season, peak seasons and the numbers of birds killed by the professional hunters in different regions were determined by counting the birds offered for sale at local markets at eight towns in West Greenland during the 1988/89 hunt (Fig. 1). Except in Nuuk, where we counted birds ourselves, volunteers recorded numbers of birds for sale in the remaining towns. Two months before the hunting season, volunteer observers were selected by mailing a request for assistance to all persons in Greenland listed in membership files provided by the Danish Ornithological Society. Through subsequent personal or telephone interviews of persons who responded to the mailed request, we made sure the volunteers had sufficient knowledge

to identify the killed bird species. We supplied all observers with an identification guide to Greenlandic birds (Boertmann and Fjeldsø, 1988). However, no tests of observers were performed, and we cannot rule out the possibility that some black guillemots have been recorded as murre. Due to identification difficulties, observers were not asked to distinguish common and thick-billed murre. Other alcids were too rarely shot (illegally) to cause any potential bias in the market surveys (pers. obs.).

The mean number of birds present at the market depended on the time of day. From our own data sampling in Nuuk it was evident that the number of birds always peaked shortly after noon, usually at about 1400 h (Falk and Durinck, 1990). The observers were instructed to 1) record the numbers of murre at the market at least once a week and preferably once a day, 2) perform the count preferably between noon and 1400 h, and 3) each month return forms with notes on town name, date, time of observation and the number of murre observed for sale at the market. If birds were counted more than once a day, the highest number was used in subsequent analysis. Birds for sale at the market were usually lined up for customers to choose, making it easy to count the birds present. We thus assume that all volunteer observers recorded the market sale in respective towns with equal accuracy.

In Nanortalik, Qaqortoq and Nuuk the markets were inspected almost daily (see number of observer-days in Table 2) during the hunting season (15 October – 15 March). In Maniitsoq counts were performed on most working days and in Aasiaat at least three times a week. In Narsaq and Sisimiut the observations only covered a part of the hunting season. Observers were present in Uummanaq, Ilulissat and Qeqertarsuaq too, but except for 221 murre recorded in Ilulissat between 22 December and 4 January, no selling was noted in these towns within the season of 1988/89. We were unable to find volunteers to survey the markets in Paamiut and Qasigiannguit.

The observers made almost all their counts about noon as requested; however in Qaqortoq nearly all counts outside the peak season were performed between 1500 and 1600 h.

From our own countings of the sale in Nuuk we determined correction factors, which were then applied in extrapolations of market counts in all towns: First, in order to estimate how many birds were offered for sale on consecutive days, we classified all birds as “fresh” (identifiable by their not yet frozen body, fluffy plumage and fresh blood stains) or “repeat” birds. Over the winter, 9% of the birds observed on the market were repeat birds. Secondly, we estimated the proportion of birds recorded at the count time in relation to the total number passing through the market on a given day. One day twice a month we made counts every second hour, and on 27 December we counted the birds each hour from 0900 to 1700 h, keeping record of each individual hunter’s birds (Falk and Durinck, 1990). From these data we estimated that 70% of the birds occurring during the day could be recorded when numbers peaked.

The trade to institutions was recorded by asking canteen officers at 16 (7 in Qaqortoq, 6 in Nuuk, 3 in Aasiaat) school dining halls, restaurants, hospitals, old-peoples’ homes, etc., about annual consumption of murre and whether they obtained murre from the market, directly from the hunters, or from the processing companies (Falk and Durinck, 1990). Information on the number of schools and refectories in each town was provided by Greenland Home Rule and the remaining

institutions were counted or estimated by ourselves or by the volunteer observers.

#### *Commercial Kill Toll Estimates*

Kill tolls were estimated in the following way: The data on murren offered for sale were extrapolated to an estimate of the total number of birds traded via the market. Where the observation period in a town was shorter than the legal hunting season, or if the actual hunting period in an area due to factors such as weather conditions was shorter than the open season, extrapolations were performed only for the period that sale was monitored. Thus the number of birds sold at markets was calculated by the equation:

$$\frac{XD_h}{D_c 0.70 1.09}$$

where X = number of birds counted,  $D_h$  length of hunting or observation period (days), and  $D_c$  number of days with market counts.

The two processing companies in Qaqortoq district (Norsaq in the settlement Qassimiut, and Qarsorsaq in Eqaqarsuit), reported to the Greenland Home Rule the number of birds processed by the month, and those values were used.

The consumption of murren at institutions was crudely estimated from the sample, taking into account the number of each type of institution in each town.

Duration and peak of commercial hunting seasons in each district were identified by calculating a mean daily kill for each 10-day period.

#### *Non-Commercial Hunting*

By request from the Greenland Home Rule, all Greenlandic municipalities reported the number of full-time and part-time hunting licences issued. By observing the hunters returning to the towns, we recorded the species and number of birds shot per hunter per trip (all persons in a boat were included in calculation of the mean) for commercial as well as non-commercial hunters. Data were collected mainly in Qaqortoq ( $n = 105$  hunters) between 8-14 and 21 November, supplemented by some observations from Nuuk ( $n = 12$  hunters) between 27 November and 9 February. Figures obtained from Qaqortoq and Nuuk are assumed representative of the hunters from Sisimiut southwards, because all towns and settlements in the area are situated along the outer coast, where hunters have roughly the same access to murren in the main hunting season (October-January).

In calculating the extent of non-commercial hunting, we used the number of issued licences, representing the number of potential hunters (in the survey year only licence holders were allowed to hunt murren). Most hunters reported that hunting one or a few days usually was sufficient to supply their family with murren for the winter. For an educated guess on kill toll by non-commercial hunters we, therefore, assumed that all licence holders would each kill as many murren annually as each of the non-commercial hunters we observed had killed in a single hunting day. However, the mean daily kill per hunter was very low (20.5 birds/hunter). Under the assumption that hunters shooting fewer than 10 murren on a trip would have to hunt another day in order to meet the needs for his family, we made a "high estimate" of private kill toll, using the mean kill for hunters that had shot more than 10 birds in a day (30.9 murren/hunter).

The kill toll in the spring hunt in Qeqertarsuaq and Upernavik was roughly estimated from interviews with the hunters in the towns and most settlements and, in the case of Upernavik town, from observations of hunters returning from hunting trips (Lyngs, 1989).

#### *Limitations of Kill Toll Estimates*

The accuracy of market sale estimates is mainly affected by the applicability of the correction factors derived from the market in Nuuk and by the reliability of the market counts. Market counts were likely rarely made exactly when the numbers of birds peaked; this is especially evident in Qaqortoq, where counts usually were made in the late afternoon. Because the correction factor for counting efficiency was based on records of peak number of birds, it will minimize the estimate. However, the volunteer observers might tend to avoid counting at the market on days when they expected the hunting level to be low (bad weather). Such a bias will tend to inflate the total estimate — especially in towns where sale was not monitored daily — and to a certain degree counteract the effect of monitoring market sale outside the daily peak time. Due to incomplete survey periods, the total hunting estimates for Sisimiut and Narsaq are, of course, too low.

Assuming the number of issued hunting licences equals the number of non-commercial hunters certainly overestimates the number of hunters. But letting the recorded *daily* kill per hunter represent the *annual* kill toll by each hunter may be a serious underestimate of non-commercial hunters' annual murre kill. Lacking data to construct correction factors for either of the two parameters, we let them counterbalance each other to produce an estimate of the total non-commercial hunt.

#### *Age and Sex Distribution of the Kill*

Killed birds were classified as either "young" (first year) or "older" birds on the basis of whether the supra-orbital ridge was fully developed or not, which was estimated by feeling the "inter-eye width" (see Gaston, 1984, for details). The observers' ability to "age" murren by this method was subsequently tested on recovered birds of known age. A total of 6278 shot birds were aged this way, 3102 birds offered for sale at markets or observed in the hunters' boats and 3176 heads of birds supplied by the processing companies in Qaqortoq District. Aging by a bivariate plot of bill length (nostril to tip) against bill depth (Gaston, 1984) did not prove to be effective on the sample of birds from the Greenland winter hunt, possibly because they were collected through the entire winter, when the bills of the young are growing continuously.

A total of 427 freshly killed murren were bought from the hunters and dissected (see Jones *et al.*, 1982, and Anker-Nilssen *et al.*, 1988, for procedures). The presence and size of the cloacal bursa were used to distinguish between adults in breeding condition and immature non-breeders based on techniques described by Petersen (1976) and Anker-Nilssen *et al.* (1988) for the atlantic puffin (*Fratercula arctica*) and razorbill (*Alca torda*) respectively. Thus, birds classified as "older" by the skull development technique (see above) were further examined to determine the proportions of mature and immature from the development of the gonads and oviduct and the presence or absence of *bursa fabricius*. Females with broad, convoluted oviducts were classified as "old" birds (breeders), whereas thin and straight oviducts indicated immature females (*cf.* Petersen, 1976; Jones *et al.*, 1982). Although the oviduct

in adult birds may regress outside the breeding season (Gilbert, 1979; King and McLelland, 1984), there was a clear difference in the appearance of the reproductive organs in the dissected murre. In males, the juvenile birds (identified by skull development) had long, narrow testes less than 2.0 mm wide, but one older male with a large cloacal bursa had a testes width of 3.0 mm. Therefore, only males with broad "oval" testes, 3.5 mm or more in width, were classified as breeders, although this criterion may be conservative.

## RESULTS

### *Licences and Hunting Equipment*

In West Greenland, from Nanortalik to Upernavik, nearly 13 000 "professional" hunting/fishing licences have been issued since 1981, and of these more than 8000 were issued in Central West and Southwest Greenland, where the winter hunt takes place (Table 1). Nearly all of the licences are still valid. In all, about 26% of the total human population — or nearly every adult man — were legal, potential murre hunters in 1988/89.

Murre hunting is usually performed from 14-21 foot fiberglass dinghies or speedboats equipped with 30-115 HP outboard engines (Fig. 3). Single- and double-barrelled 12-gauge shotguns are very common; repeating pump-shotguns (more than 2 shots) are illegal for bird hunting, but they are occasionally observed in the hunters' boats and probably used in shooting murre.

### *Professional Hunting and Marketing*

We observed that only 10-20 hunters in each of the towns Qaqortoq, Nuuk and Maniitsoq supplied the markets with the

TABLE 1. Number of full-time or part-time hunting licences issued in each district in Greenland by the end of 1988

Region and district	Licences <sup>1</sup>				Total <sup>2</sup>
	Valid		Issued		
	part	full	part	full	
<b>West</b>					
Nanortalik			226	762	988
Qaqortoq	364	428			792
Narsaq	306	204	310	204	510
Paamiut	170	866			1 036
Nuuk	729	1 143	858	1 366	1 872
Maniitsoq	530	718			1 248
Sisimiut			164	1 011	1 175
Kangaatsiaq			78	408	486
Aasiaat	494	369	638	458	863
Qasigiannuit			237	370	607
Ilulissat					1 221
Qeqertarsuaq			177	209	386
Uummannaq			330	691	1 021
Upernavik			191	551	742
Total					12 947
<b>North and East</b>					
Avanersuaq			22	232	254
Ammassalik			169	424	593
Ittoqqortoormiit					124
Total					971
Grand total					13 918

<sup>1</sup>Some licences expire or are returned; the number of valid licences is therefore lower than the number issued. Some districts reported valid as well as issued number of licences, while others only reported total number issued since 1981.

<sup>2</sup>Sum of valid licences, if available.

bulk of the birds consumed, and we estimate that only 1-2% of the licence holders in each town (see above and Table 1) are to be considered true "professionals," in that they earn all their income from hunting. Commercial hunters usually hunt alone and are active as long as weather permits. Large numbers of birds may be shot. For example, one of the most active hunters in Nuuk killed 2127 thick-billed murre on 35 hunting days over two months (60.8 murre per hunt). A sample of 19 hunters returning in Qaqortoq averaged 32 murre per hunter each day.

In most towns of Central West and Southwest Greenland, the winter hunt begins in mid-October. It peaks later in the first half of November, although hunting activities can remain high throughout the winter if weather permits (Fig. 4). In Nuuk, the number of birds shot and sold increased gradually over a period of 5-6 weeks. However, the northernmost part of the survey area showed a very different pattern. In Aasiaat, there was a short hunting season in late October, followed by a 6-week period when no birds were available. In late December the birds suddenly reappeared in large numbers, forced in towards the coast by drift ice from the west. In Ilulissat, murre were only recorded from 22 December to 4 January (total 221 murre); a corresponding short season was recorded for the non-commercial hunt in Qeqertarsuaq.

Selling of birds at local markets levelled off after January and declined to almost zero by the end of the legal hunting season (15 March south of Kangaatsiaq). However, in Nanortalik, Qaqortoq and Narsaq, unusually severe ice conditions

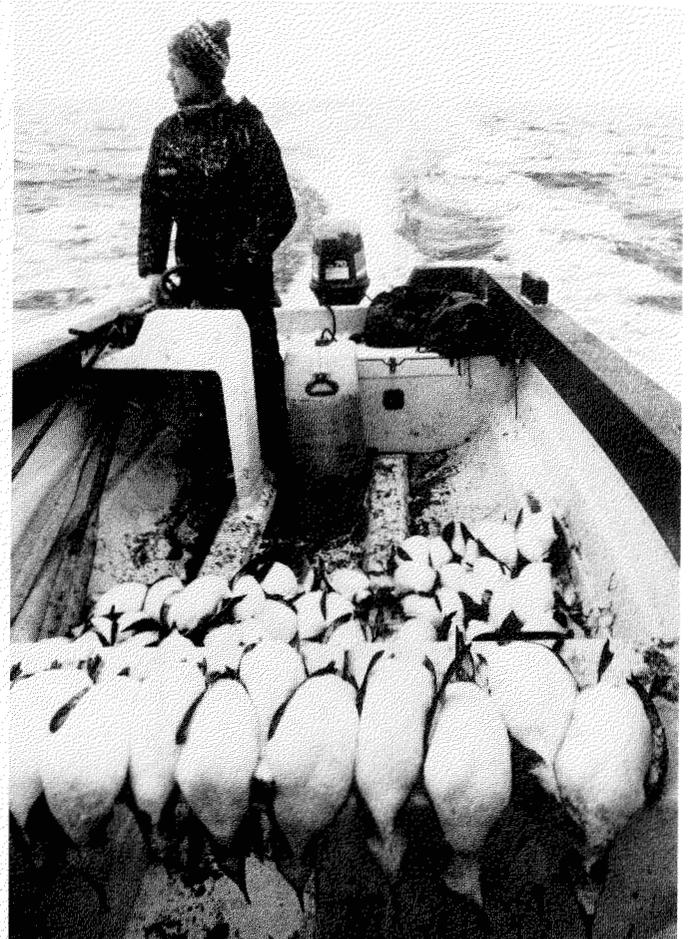
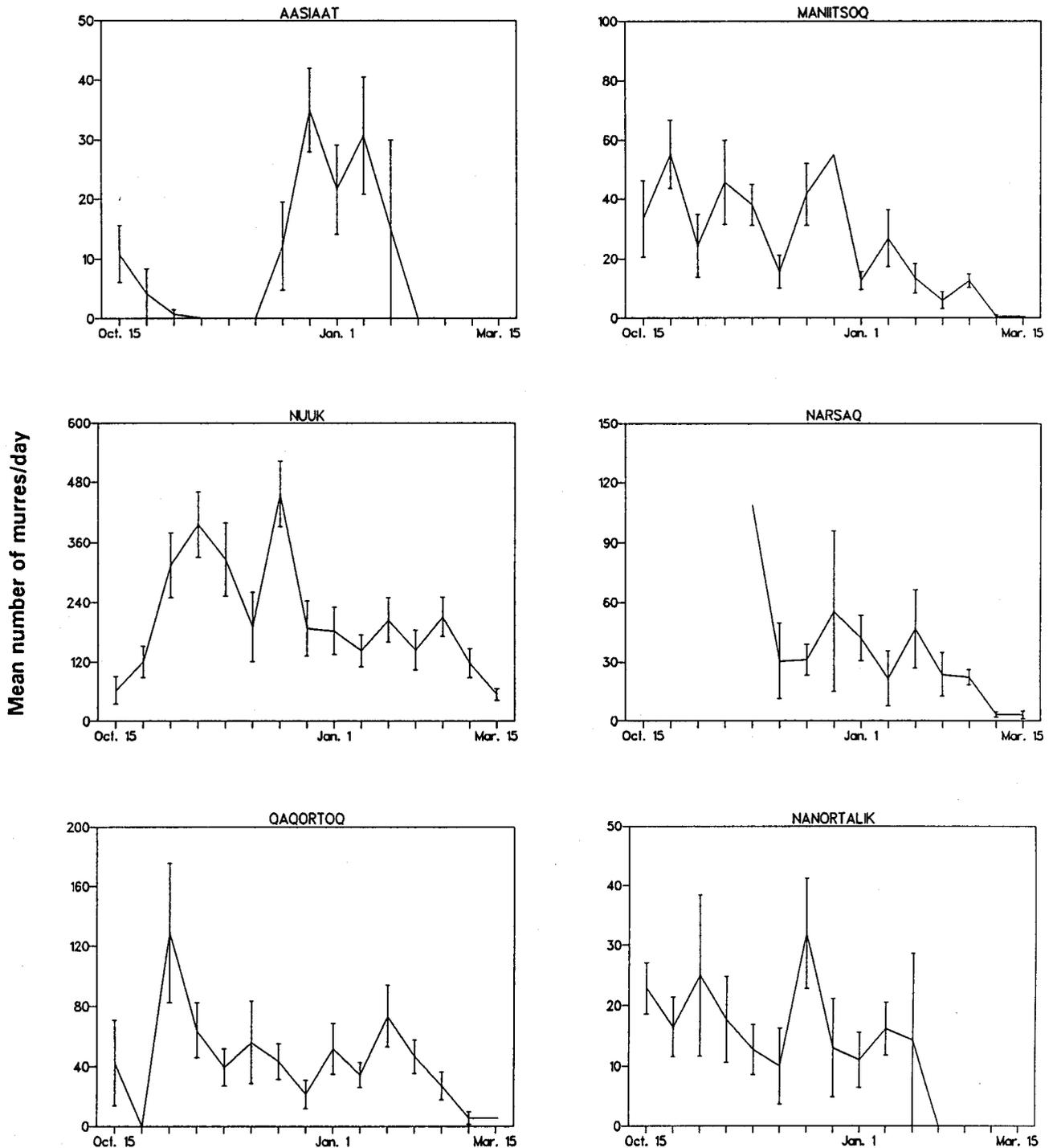


FIG. 3. Fast boats give access to hunting areas far from human settlements. A hunter returns to Nuuk after a successful hunt about 35 km from the town.



#### Hunting season in 10-day periods

FIG. 4. Trade of murre at the local outdoor markets in six Greenlandic towns. Mean number of murre/day ( $\pm$  S.E.) counted in each 10-day period during the winter hunt is shown. Note different scales.

prevented almost all hunting from mid-February, and in Maniitsoq ice hindered hunting from late December to the end of the season (Fig. 4). Hunting was concentrated in the first half of the hunting season. In Nuuk, the mean number of murre per observer-day was significantly reduced from 223.1 birds/day for the period 15 October – 31 December to 146.0 birds/day for 1 January – 15 March ( $X^2_1 = 15.55$  [Yates-corr.],

$P < 0.0005$ , two-tailed). The corresponding figures for Maniitsoq were 36.8 and 8.6 murre/day respectively ( $X^2_1 = 15.72$ ,  $P < 0.0005$ ). However, in Qaqortoq a decrease from 48.0 to 34.4 murre/day was insignificant ( $X^2_1 = 1.96$ ,  $P > 0.1$ ).

At the markets the birds were available on most days, but only in substantial numbers on days when hunting conditions were good. High winds ( $> 10$  m/s) prevented hunting, and the

number of birds at the market in Nuuk ( $\log_{10}N$ ) showed a strongly negative correlation with wind speed ( $P < 0.0001$ ,  $r = -0.4346$ ,  $df = 146$ ). Thus, the ranges in observed numbers of murre per day are large (Fig. 4).

A total of 42 089 murre were counted at the markets, which means that a minimum of 62 000 murre were sold in the towns surveyed (Table 2). The market in Paamiut was not surveyed, but based on the average sale in neighbouring towns and the size of the human population, the market sale can be estimated at 5900 murre. Thus, the sale of murre at local markets between Aasiaat and Nanortalik totalled 70 000 birds for the 1988/89 season.

Hunters sold almost 11 000 birds to the processing companies in 1988/89, all from one district (Table 3). In previous years, the numbers of birds processed were much higher, totalling at least 93 000 murre in 1986-87 and 33 800 in 1987-88 (Table 3); one company in Nuuk alone processed about 60 000 murre in 1986-87. Data on industrial processing of murre are figures reported to the Greenland Home Rule by the companies involved, and so the actual number of traded birds may have been higher.

The hunters met the requirements for the different institutions as well. From a sample of 16 institutions a total of 6456-7221 murre were reported consumed per year. Nine of these institutions bought all their birds directly from the hunters,

TABLE 2. Observed and estimated sale of murre at the local markets in seven Greenlandic towns<sup>1</sup>

Town	Observer days <sup>2</sup>	Hunting period <sup>3</sup> (days)	Number of murre	
			Counted	Estimated <sup>4</sup>
NAN	91	98	1 574	2 222
QAQ	105	126	5 071	7 975
NSQ <sup>5</sup>	39	91	1 243	3 801
NUK	143	147	30 213	40 705
MAN	88	126	2 542	4 770
SIS <sup>5</sup>	34	42	901	1 459
AAS	55	84	545	1 091
Total	—	—	42 089	62 023

<sup>1</sup>Market in Ilulissat also observed but extrapolation not performed; see Table 4.

<sup>2</sup>Observer days<sup>2</sup> is the number of days when murre were counted.

<sup>3</sup>Length of hunting period as recorded by observations at the markets. Official hunting season dates not used for extrapolations.

<sup>4</sup>Estimates extrapolated from actual hunting period (in days) by the conversion factors for "repeat" birds (1/1.09) and the proportion of total sale observed (1/0.70) (see Methods).

<sup>5</sup>Minimum estimates due to incomplete survey periods (NSQ: 2 Dec. - 15 Mar.; SIS: 9 Nov. - 15 Dec.).

TABLE 3. Numbers of murre<sup>1</sup> bought by commercial bird-processing companies in West Greenland, 1985-89

Municipality or town	Season			
	1985/86	1986/87	1987/88	1988/89
Qaqortoq	608	3 790	15 648	10 627
Nuuk	53 699*	70 367*	6 170	0
Maniitsoq	711	12 038	12 000	0
Sisimiut	147	4 549	— <sup>2</sup>	0
Uummannaq	—	2 781	—	0
Total	55 165	93 525	33 818	10 627

<sup>1</sup>Data from official reports to the Greenland Home Rule; however data marked with asterisks include information direct from one processing company.

<sup>2</sup>No data available.

who often received orders before they went out hunting. Only in Qaqortoq did the institutions buy the largest proportion (> 75%) of their birds from the local markets or bird-processing companies in the district. Based on the number of birds not being handled via the markets and on the number and different kinds of institutions in each town, a minimum estimate of 14 000 murre were delivered directly to institutions and therefore not included in counts made at the outdoor markets (Table 4).

The markets also sold other bird species, though murre were by far the most numerous bird sold within the survey period; for example, 89.1% of all birds identified and counted in Nuuk were thick-billed murre (K. Falk and J. Durinck, unpubl. data). In Greenland both *Uria* species occur and are shot by hunters. However, of 6278 murre examined, only 7 (0.1%) were common murre (*Uria aalge*).

### Non-Commercial Hunting

Many people hunt murre for food. The actual number of non-commercial hunters is unknown, but from living in the communities we got the impression that most people with access to a boat go murre hunting. In contrast to the professionals, most of the non-commercial hunters only go out during the autumn and early winter, and the majority of these hunters remove their boats from the water before December. Non-commercial hunters normally hunted in teams composed of a "driver" and one or more "gunners." Their daily kill toll averaged 20.5 murre per hunter (all drivers and gunners included), a take lower than that of commercial hunters (32 murre/hunter, see above).

Based on the mean number of birds per non-commercial hunter per day (20.5 or 30.9) times the total number of hunting

TABLE 4. Estimate of the total kill of murre in West Greenland

District	Commercial hunt <sup>2</sup>	Non-commercial hunt <sup>1</sup>	
		Low	High
Nanortalik	2 222	20 000	31 000
Qaqortoq	7 975	16 000	24 000
Narsaq	3 801	10 000	16 000
Paamiut	5 900 <sup>3</sup>	21 000	32 000
Nuuk	40 705	38 000	58 000
Maniitsoq	4 770	26 000	39 000
Sisimiut	1 459	24 000	36 000
Kangaatsiaq <sup>4</sup>	—	10 000	15 000
Aasiaat	1 091	18 000	27 000
Qasigianniguit	—	—	—
Ilulissat <sup>5</sup>	221	—	—
Qeqertarsuaq <sup>6</sup>	—	1 600	—
Uummannaq <sup>6</sup>	—	200	—
Upernavik <sup>7</sup>	—	5 200	15 000
Processing companies	10 627	—	—
Institutions	14 000	—	—
Total	92 771	190 000	293 000

<sup>1</sup>The low and high values for the non-commercial were derived by using different values for number of murre shot per hunting licence: 20.5 and 30.9 birds/hunter/day (see Methods).

<sup>2</sup>Extrapolated values from Table 2.

<sup>3</sup>Estimate based on number of inhabitants and mean values for sales in neighbouring towns.

<sup>4</sup>No local market.

<sup>5</sup>Data from winter hunt only; no information from spring.

<sup>6</sup>No selling owing to late ice breakup; small numbers only killed in one small settlement.

<sup>7</sup>Estimates from interviews with hunters; minimum value for 1989 (late ice breakup); maximum applies to normal years (Lyngs, 1989).

permits for full-time or part-time hunters in Central West and Southwest Greenland (Table 1), the non-commercial kill toll for the winter hunt is estimated to fall within the range of 190 000 to 293 000 murrens annually (Table 4). The low and high values derive from mean personal kill tolls of 20.5 and 30.9 murrens/day respectively (see Methods).

#### Spring Hunting in Northern Regions

In addition to the murrens killed in the winter hunt, a number of birds are shot in April to June, when ice breaks up in the areas from Qeqertarsuaq northwards. Hunting at colonies during the breeding season is now prohibited (Greenland Home Rule, 1988). Interviews with hunters revealed information from which the general hunting level can be estimated. About 800 birds were shot during April and May 1989 in Qeqertarsuaq (about the same number as recorded during the winter), whereas in Uummannaq only inhabitants in one small settlement near the mouth of the fiord shot murrens, totalling 200 birds. The hunters of the Upernavik district only managed to kill an estimated 5000 murrens between late April and mid-June 1989, partly due to late ice breakup and poor hunting conditions and to the termination of summer hunting by regulation. In "normal" years prior to the revised Game Act, the total kill is estimated at 15 000 murrens (Lyngs, 1989).

#### Total Kill Toll

Since non-commercial hunting is only roughly estimated, we can only estimate the total murre kill for West Greenland; it amounts to 280 000 to 390 000 birds per year (Table 4). Although spatial and temporal differences cannot be determined for the entire region, monthly totals for the commercial hunt during the entire winter hunting season are available for the Nuuk-Maniitsoq area in Central West Greenland and Qaqortoq-Nanortalik in Southwest Greenland; results are depicted in Figure 5.

#### Age and Sex Distribution of the Kill

Birds-of-the-year predominated in the kill in October to December in all districts. The proportion of older birds (not birds-of-the-year) shot in South Greenland never exceeded 8.7%, and although the proportion of old birds showed a significant uneven distribution during the winter ( $X^2_4 = 71.63$ ,  $P < 0.0005$ , two-tailed), no steady increase was apparent (Fig. 6). But in Nuuk and Maniitsoq the proportion of older birds killed rapidly increased as winter progressed. In Nuuk, where birds were aged every month during the hunting season ( $n = 1866$ ), the proportion of old birds increased steadily from 27.5% ( $n = 160$ ) in October to 75.8% ( $n = 33$ ) in March; the proportions of older birds differed highly significantly from an uneven distribution ( $X^2_5 = 104.22$ ,  $P < 0.0005$ ). Birds shot in December and January in Maniitsoq had an age distribution similar to those from Nuuk during the same period, whereas in October a relatively high proportion of old birds was recorded in Maniitsoq (36.3%). The proportion of adults shot in the spring hunt in Upernavik was very high (88.2%,  $n = 102$ ; Fig. 6).

Although the proportion of old birds shot increased during the hunting season, the peak in hunting effort before January "levels out" the total kill of older birds; the number of older murrens killed in the commercial hunt in Nuuk and Maniitsoq districts before and after 1 January respectively were almost

equal (c. 9200 versus 10 000; Fig. 5). In Southwest Greenland, the total kill of older murrens in the commercial hunt (including birds handled at processing companies) was about 1200.

Among the winter murrens classified as old on the basis of skull development ( $n = 128$ ), 60% were sexually mature. The proportion of mature murrens among older birds shot in April to late May in Qeqertarsuaq and Upernavik was 95% ( $n = 22$ ). These proportions are based on inspections of the gonads. The corresponding proportions based solely on the presence or absence of cloacal bursa were 76% and 95% respectively.

More male than female murrens were shot (Table 5). However, the difference derives mainly from a larger proportion of males among the old birds sampled in Central West Greenland, where the uneven distribution among sexes was highly significant, but the differences elsewhere were not.

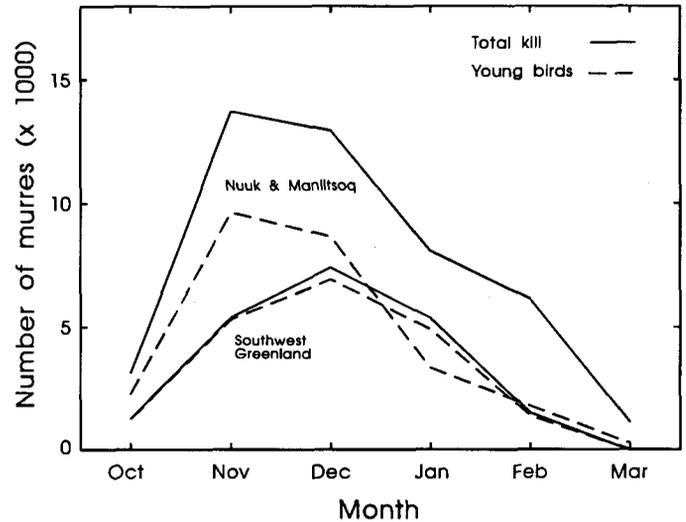


FIG. 5. Mean number of total and first-year murrens harvested by the professional hunters in Central West (Nuuk and Maniitsoq) and Southwest (Nanortalik and Qaqortoq) Greenland during the winter hunt 1988-89. Numbers estimated from trade at local markets and processing companies and proportions of young murrens for Nuuk and South Greenland respectively (Figs. 4 and 6).

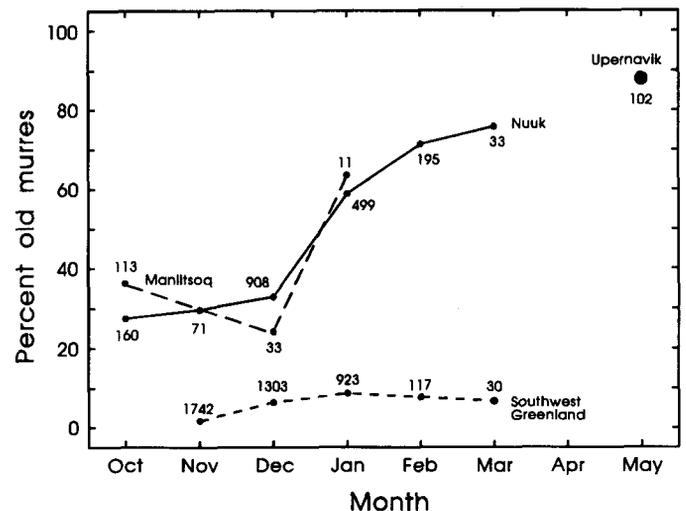


FIG. 6. Age distribution of the murre harvest in different regions of West Greenland. Birds are aged on skull development. Sample size indicated at each data point.

TABLE 5. Sex and age class<sup>1</sup> of 427 thick-billed murre shot in West Greenland, 1988-89

Region	Juvenile		Older		Combined	
	♂	♀	♂	♀	♂	♀
SW Greenland	27	30	4	7	31	37
CW Greenland	66	58	73	40 <sup>2</sup>	139	98 <sup>3</sup>
NW Greenland	15	13	55	39	70	52
Total	108	101	132	86 <sup>4</sup>	240	187 <sup>5</sup>

<sup>1</sup>Determined by skull development (see Methods).

<sup>2</sup> $P < 0.005$  ( $X^2_1 = 9.06$ , Yates correction, two-tailed).

<sup>3</sup> $P < 0.01$  ( $X^2_1 = 6.75$ ).

<sup>4</sup> $P < 0.005$  ( $X^2_1 = 9.29$ ).

<sup>5</sup> $P < 0.025$  ( $X^2_1 = 6.33$ ).

## DISCUSSION

### Accuracy of Estimates

The survey covered most municipalities in the region where intensive winter hunting occurred, and the sale of murre by professional hunters was, on the whole, accurately determined in the towns surveyed. Overall, the number of murre killed for commercial purposes in 1988/89 may exceed 100 000 in the entire West Greenland. However, as stated in the Methods section, several factors may bias the estimate of the commercial kill toll. The most important factors that tend to minimize the estimate are 1) the applied correction factors, which may not be valid for other towns than Nuuk and may underestimate sales if counts were not done when the daily peak in numbers of murre occurred, 2) incomplete survey periods in Sisimiut and Narsaq (a total of about 7000 people) and lack of survey in Paamiut, and 3) our being conservative in our selection of institutions to include in the extrapolation of field data on sale to restaurants, hospitals, etc. The only factor that will tend to bias the estimate upwards is if the volunteer observers in some towns have been selective in the days they chose to count at the markets. This could have been the case in Aasiaat, Maniitsoq and Narsaq, but in the remaining towns the markets were counted virtually daily, thus reducing the risk of observers avoiding days with few murre for sale. Half of the total number of murre were recorded by daily counts in Nuuk, where we did most of the counts ourselves, so the effect of other observers' potentially biased counts cannot significantly affect the total estimate.

The survey was carried out in a year with severe winter conditions, which to a certain extent restrained hunting activities in some areas. According to the commercial hunters it is, though, normal that the murre hunt gradually decreases in January to March, and the ice conditions in Southwest and Central West Greenland in 1988/89 were probably more important in reducing the kill of eiders (*Somateria* spp.), which become important hunting prey from January onwards (K. Falk and J. Durinck, unpubl. data). Therefore, we do not believe that the winter conditions have caused the commercial kill toll estimate for the winter hunt of 1988/89 to be very atypical.

With the lack of rigid data on numbers of non-commercial hunters and their annual take, the non-commercial kill toll is far more difficult to assess than the commercial. The annual kill of 190 000 to 293 000 murre in the non-commercial winter hunt is, therefore, only an educated guess. Those estimates do, however, suggest that the kill of murre for private con-

sumption is larger than that taken for commercial purposes (see Table 4). The estimate of kill toll during the spring hunt in Northwest Greenland based on observations of hunting intensity and on interviews with hunters gave a minimum figure, due to the unusual winter conditions in the spring of 1989. In Upernavik, the kill between late April and mid-June was estimated at 5000 murre, but in years with more normal weather conditions, the kill toll is estimated at 15 000 murre (Lyngs, 1989), which is considerably lower, but in the same order of magnitude, as the "upper limit" of 50 000 estimated by Evans and Kampp (1991).

In round figures the total murre kill may be 300 000 to 400 000. But other information supports this rough estimate. From 1954 to 1958 C. Vibe carried out a survey of Inuit hunting that indicated that at least 200 000 murre were killed annually in the winter hunt between Qeqertarsuaq and Nanortalik (Kampp *et al.*, in press). Since the mid-1950s, the human population has doubled in the region and hunters have become more efficient owing to improved boat and gun technologies. It therefore seems likely that more birds are shot and consumed today than earlier.

In Newfoundland, where hunting conditions are comparable to those in West Greenland but where a larger human population creates more potential consumers (however, selling being illegal), intensive research has revealed that 300 000 to 725 000 murre were shot by permit holders each winter during the mid-1980s. As 40-50% of the hunters did not obtain permits, the overall harvest levels could be 600 000 to 1 500 000 murre (Elliot *et al.*, 1991). That research confirmed rough estimates made earlier by Wendt and Cooch (1984).

### Age Structure of the Kill, Origin of Murre and Implications for Populations

The increasing proportion of old murre shot during the season in Nuuk and Maniitsoq is very similar to patterns found in the total kill in Newfoundland (Elliot *et al.*, 1991). Great differences in age distribution were also observed between regions of Newfoundland, but nowhere was the proportion of adults as low during the entire season as that recorded for Southwest Greenland in 1988/89. However, the unusual age structure of the 1988/89 kill in Southwest Greenland may be a special case. Preliminary data for the 1989/90 season suggest that 18.6% ( $n = 4086$ ) of the murre killed in November and December 1989 in Qaqortoq district were older birds (K. Falk and J. Durinck, unpubl. data). Band recoveries further demonstrate the dominance of birds-of-the-year in the kill (Kampp, 1983, 1988, 1991). This applies to the entire hunt outside the breeding areas, but also to Northwest Greenland murre as well as high arctic Canadian and Spitsbergen murre. Kampp (1991) estimated the proportions of first-year birds, older immatures and adults shot in the winter to be 71:19:10 respectively; in our survey where the birds were aged by physical characters, the corresponding values were 56:18:26 for birds sampled in Nuuk.

When age distribution data from the Newfoundland hunt were applied to estimates of actual kill numbers, a peak of first-year birds in November was noted, as was the very high proportion and number of adult murre shot during late winter (Elliot *et al.*, 1991). In Greenland, however, the hunting pressure decreases during the winter, and so a high kill rate of older murre seems not to occur (Fig. 5). In our estimates of the numbers of first-year and older birds killed, only data from

the commercial hunt are included. Since non-commercial hunting occurs mainly in the fall, the proportion of juvenile birds in the total kill must be even higher.

All else being equal, it appears self-evident that killing young murres is less detrimental to the populations involved than killing the old breeders, although the importance of age-distribution of the kill is not well known. The spring hunt (and the summer hunt that was legal until 1988) in Northwest Greenland takes a very high proportion of adult murres, of which nearly all are breeders. This hunt, therefore, poses a major threat to local breeding populations, as has long been suspected (Salomonsen, 1967; Evans and Waterston, 1976; Evans, 1984) and recently demonstrated (Evans and Kampp, 1991; Kampp, 1991).

The presence of common murres at the local market at Maniitsoq in October suggests that murres shot at the beginning of the hunting season may be of local origin, since the only Greenlandic breeding sites for the species are situated near Maniitsoq and Qaqortoq. From band recoveries it is well known that murres shot in southernmost West Greenland (Nanortalik to Paamiut) are almost exclusively winter visitors from Spitsbergen and probably other eastern populations, whereas few Canadian and Greenlandic murres have been recovered in that area (Salomonsen, 1967; Gaston, 1980; Kampp, 1988). Farther north in West Greenland murres from West Greenland and high arctic Canada occur, and even some from Spitsbergen; birds from Spitsbergen are shot as far north as Ilulissat (K. Kampp, pers. comm. 1991). Considering the large murre population and small banding total in Spitsbergen, these birds may in fact make up a significant proportion — even the majority — of the murres killed during the winter hunt in West Greenland (*cf.* data in Kampp, 1988). Iceland may hold as much as 29% of the Atlantic population of thick-billed murres (Nettleship and Evans, 1985), but the birds' wintering areas are largely unknown (Brown, 1985). However, from the small number of birds banded in Iceland there are two recoveries from Newfoundland (Elliot, 1991; J.W. Chardine, pers. comm. 1991) and none from Greenland (K. Kampp, pers. comm. 1991). Though it is not much to build on, it suggests that Icelandic murres rarely visit Greenland but *may* contribute significantly to the populations hunted in Newfoundland.

In summary, from this survey and previous studies on the thick-billed murre populations and hunting it is known that: 1) murres in most or all of West Greenland have been declining, and the colonies in Uummannaq have been wiped out while the populations in Ilulissat Bay and southern Upernavik districts are also nearly depleted (Evans, 1984; Nettleship and Evans, 1985; Evans and Kampp, 1991; Kampp, 1991); 2) immense numbers of murres are shot each winter in West Greenland and Newfoundland (Elliot, 1991) and that these include birds from Greenland, Canada, Spitsbergen and Murmansk, with insignificant contributions from Novaya Zemlya (Kampp, 1988, 1991); 3) a much lower, but still substantial, number is shot in the Northwest Greenland breeding areas (Evans and Kampp, 1991; Kampp, 1991); 4) the kill in the breeding area mainly comprises the adult breeders, whereas the winter hunt in Greenland and Newfoundland to a large extent includes first-year birds (Elliot *et al.*, 1991; Kampp, 1991); 5) population declines have been most serious in the areas where summer hunting pressure has been the greatest (Evans and Kampp, 1991; Kampp, 1991); and 6) all murres breeding in West Greenland share the same, or almost the same, wintering area.

We therefore conclude that the summer hunt is the most acute threat to Greenland's murre populations and that probable negative effects of the huge winter hunt are swamped by the population changes caused by the summer hunt. Although it has not yet been possible to link the winter hunt with population declines, we suspect, for sheer numbers of birds shot alone, that the winter hunt in Greenland and in Newfoundland must have detrimental effects on some or all involved populations, at least by limiting the rate at which reduced populations can recover (Nettleship and Evans, 1985; Elliot, 1991).

### *Hunting Regulations*

A revised Game Act was approved by the Greenland Home Rule Authority in May 1988 (Greenland Home Rule, 1988). As summarized in the Introduction, the act improved the legal status of the murres. However, several factors diminish the intended effect of the improved regulations. Every year since the revised Game Act was introduced (1989, 1990 and 1991) the hunters in some of the districts in Northwest Greenland have been granted exemptions from the act and obtained a prolonged hunting season after 31 May. Permission to continue hunting into the recently introduced closed season is reducing the hunters' understanding of the need for cautious use of the murres. Accordingly, they may get the impression that the regulations are not meant seriously, a conception furthered by a lack of law enforcement of hunting regulations. For example, hunters in Upernavik and Ilulissat have recently returned bands from birds they reported shot in the middle of the closed season (K. Kampp, pers. comm. 1991). Such episodes show the need for public education on murre population biology.

The open season in Central West and Southwest Greenland corresponds with the period when birds are available. Thus hunters there have the same length of time to hunt murres now as previously, even though the official hunting season has been shortened, and the kill toll has probably remained the same.

The legal reduction in industrial use of murres may have prompted some compensating sale at the local markets. But fewer processed birds are available for sale in off-seasons, and despite the exemptions from the Game Act to the processing companies in Qaqortoq District, we believe that the halt in large-scale industrial processing of murres is the only measure likely to have caused a decrease in the total kill in the winter hunt. After all, in 1988/89 hunters in Nuuk and Maniitsoq complained that they could not sell as many murres as previously and that they were able to shoot more birds than they could sell at the outdoor markets. Unfortunately, hunters and local authorities already exert increasing pressure on the Home Rule for loosening the restrictions on industrial use of murres, and even for opening hunting in the breeding season in Northwest Greenland, where breeding populations are most jeopardized.

From the currently available information on hunting and on murre biology, the following recommendations for future management of the thick-billed murre in Greenland are offered: 1) Public education on the need for conservation and protection of wildlife, particularly murres, is essential. Hunters must learn why, despite its local abundance, the thick-billed murre is a wildlife resource that cannot sustain an uncontrolled harvest. 2) The number of murre hunters should be reduced by restricting murre hunting to full-time professional hunters who obtain most of their income from the selling of birds at the

local markets only. A new hunting licence system is needed to distinguish between professional and non-commercial hunters. 3) Winter hunting of murre should be limited to October–December, when first-year birds constitute most of the kill. 4) Commercial selling to processing companies should be kept at a minimum and only a few settlements without other means of income in the winter should be granted exemptions from the existing restrictions on commercial processing. Finally, 5) hunting regulations should be subject to effective law enforcement.

#### Future Research

Considering the magnitude of the murre hunt, further information is required to comprehend its effects on the murre populations involved. Data are too few to provide accurate estimates of the kill, and nothing is known about annual variation in kill tolls in different regions. Therefore, one cannot quantify the overall impact of the hunting activities on murre populations in Greenland and elsewhere. As long as the origin of the birds shot remains uncertain, effects on regional populations cannot be determined and evaluated. Three recommendations for future research stand out: 1) comprehensive survey of the magnitude and annual variation of the non-commercial hunt is needed, as is a long-term monitoring program of the commercial hunt; 2) population levels of thick-billed murre breeding in Greenland should be monitored carefully in order to detect changes in population size and status and initiate/recommend actions where necessary; and 3) intensive banding programs and "DNA-fingerprinting" should be undertaken to determine more precisely the wintering grounds of thick-billed murre breeding in the Atlantic. These techniques should permit calculation of the percent contributions of the different populations to the kill toll of murre in Greenland and Newfoundland.

APPENDIX. Greenlandic and English/Danish place names and their abbreviations used in the text and tables

Greenlandic name	Abbreviation	English/Danish name
Nanortalik	NAN	Nanortalik
Qaqortoq	QAQ	Julianehåb
Narsaq	NSQ	Narsaq
Paamiut	PAM	Frederikshåb
Nuuk	NUK	Godthåb
Maniitsoq	MAN	Sukkertoppen
Kangaatsiaq	KAN	Kangåtsiaq
Sisimiut	SIS	Holsteinsborg
Aasiaat	AAS	Egedesminde
Qasigianniguit	QAS	Christianshåb
Ilulissat	ILU	Jakobshavn
Qeqertarsuaq	QEQ	Godhavn
Uummannaq	UMQ	Umanaq
Upernavik	UPV	Upernavik
Avanersuaq		Thule
Ammassalik		Angmagssalik
Ittoqqortoormiit		Scoresby Sound

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