Recent trends in the west Greenland salmon fishery, and implications for Thick-billed Murres

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1. Abstract

In the late 1960s and early 1970s, a high net-mortality of seabirds, particularly Thick-billed Murres (*Uria lomvia*), was associated with the west Greenland salmon fishery. Since 1972, the domestic fishery has been controlled by quotas and fishery opening dates and the non-Greenlandic offshore drift-net fishery was phased out in 1975. These restrictions probably resulted in a substantial decrease in murre net-mortality. However, the Greenlandic fishery has changed considerably since 1972 when seabird bycatch was last examined in detail. Fishing vessels now use monofilament nylon nets almost exclusively; fishing effort has redistributed closer to murre breeding colonies and intensive drift-netting occurs offshore on the continental shelf. These factors, combined with a change in 1981 to a later fishing season, have probably resulted in a renewal of significant murre net-mortality at west Greenland.

2. Résumé

Vers la fin des années 1960 et au début des années 1970, le taux élevé de mortalité d'oiseaux aquatiques dans des filets de pêche, en particulier de Marmettes de Brünnich (*Uria lomvia*) a été associé à la pêche au saumon à l'ouest du Groenland. Depuis 1972, la pêche locale est réglementée par la fixation de contingents et de dates d'ouverture tandis que la pêche hauturière nongroenlandaise aux filets dérivants a été abolie en 1975. Ces restrictions ont probablement entraîné une baisse considérable du taux de mortalité des marmettes dans les filets. Toutefois, la pêche groenlandaise a changé considérablement depuis 1972, année à laquelle les dernières captures d'oiseaux aquatiques ont été analysées en profondeur. Aujourd'hui, les navires de pêche utilisent presque exclusivement des filets en nylon monofilament; l'effort de pêche s'est redistribué près des colonies de marmettes nicheuses, et une pêche intensive aux filets dérivants a pris naissance au large, sur le plateau continental. Ces facteurs, associés au recul de la saison de pêche en 1981, ont probablement fait renaître les taux de mortalité élevés de marmettes dans les filets à l'ouest du Groenland.

3. Introduction

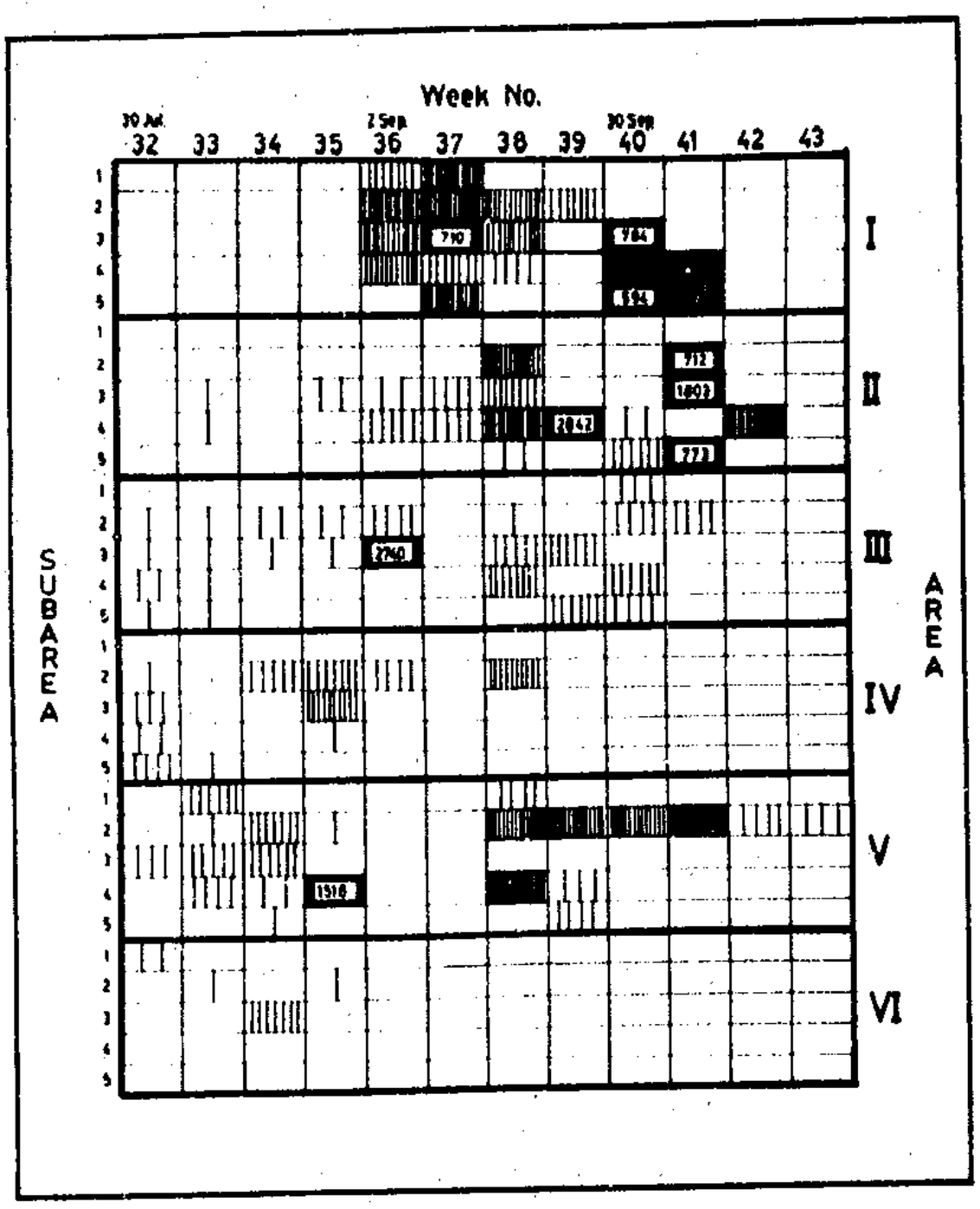
Each fall, millions of Thick-billed Murres (*Uria lomvia*) from Greenland and the eastern Canadian Arctic migrate south along the west coast of Greenland (Gaston 1980). During migration, large concentrations of these murres feed underwater on small fish, especially capelin (*Mallotus villosus*) which form dense post-spawning schools on offshore banks (Salomonsen 1967, Jangaard 1974). Migrating Atlantic salmon (*Salmo salar*) also feed intensively on capelin at west Greenland (Lear 1980) and an offshore drift-net salmon fishery has existed there since the 1960s (Reddin and Burfitt 1980). International attention was focused on west Greenland in the late 1960s and early 1970s when domestic and especially foreign fishing activity resulted in excessive salmon catches (Anon. 1980, Kreiberg 1980) and a large incidental bycatch of seabirds, particularly Thick-billed Murres (Tull *et al.* 1972, Christensen and Lear 1977). In 1976, Evans and Waterston suggested that the combined bird mortality from net-drowning, hunting, oil pollution, and colony disturbance exceeded annual recruitment for those Thick-billed Murre populations. This concern was supported by colony censuses which showed that both Greenlandic (Evans and Waterston 1976) and Canadian (Nettleship 1977) Thick-billed Murre populations had significantly declined over the previous 20 years.

4. Murre net-mortality: the 1970s

In order to evaluate recent murre bycatch in the west Greenland fishery with respect to the location and duration of fishing effort, we re-interpreted (Fig. 1) the data of Christensen and Lear (1977). They quantified murre bycatch (number of murres caught per 100 mile-hours of salmon drift-net fishing effort) on a weekly basis (from 30 July – 21 October) in 30 discrete zones (6 north/south areas and 5 east/west subareas) along the west coast of Greenland (Fig. 2). It is clear from the data (Fig. 1) that most murre bycatch in drift-nets occurred as murres staged on the Disko banks and the banks off Holsteinborg from early September (64%) to mid October (22%). While bycatch (43%) occurred in offshore zones (12–60 nautical miles [nm]), most bycatch (57%) occurred in neritic waters less than 12 nm from the coast. The extreme variability of murre bycatch is obvious (Fig. 1) and the cause of these fluctuations (e.g. weather, sea-state, etc.) are discussed by Christensen and Lear (1977). Periods of exceptionally high murre bycatch per fishing effort (Fig. 1) probably resulted from the combined concentration of murre and salmon feeding activity on capelin.

The total salmon catch and fishing effort in west Greenland waters has decreased since 1973 in accordance with the International Commission for the Northwest Atlantic Fisheries (ICNAF) recommendations of 1972 (Reddin and Burfitt 1980). The domestic Greenland fleet has maintained a quota since 1973, usually caught by early September, of 1190 t per year up to 1980. The foreign offshore

Figure 1
Murres caught in salmon drift nets at west Greenland, 1972, per 100 mile-hours of nets. Each vertical line represents 20 murres caught; maximum number per block is 20 lines or 400 murres. Blocks containing numbers with black borders represent exceptionally high murre bycatch and the number displayed is the actual bycatch for that week (not prorated). Blank blocks result from zero fishing effort, not absence of bycatch. Adapted from Christensen and Lear (1977)



drift-net fishery, which took about 850 t annually, was phased out completely by 31 December 1975 (Reddin and Burfitt 1980). Regulation of the salmon fishery by a quota and opening date set by the Danish government (Anonymous 1980) has led to increasingly earlier fishing seasons from 1975 (20 August – 12 September) to 1979 (1–28 August). This effectively shifted fishing effort away from the time period during which birds were most likely to be caught in nets (Fig. 1) and during which a greater fishing effort was required to catch salmon (Christensen and Lear 1977).

Based on this time shift of fishing effort, reduced offshore fishing activity, and the data of Christensen and Lear (1977), we calculated that, from 1976–80, murre bycatch in salmon nets was reduced to about 10–20% of that calculated by Tull *et al.* (1972) for 1969–71 (500 000 ± 50%) or Christensen and Lear (1977) for 1972 (207 000 by non-Greenlandic vessels). However, changes in the operation and type of fishing gear used by Greenlandic fleets (Table 1) and the imposition of later fishery opening dates beginning in 1981, may have resulted in a renewal of significant murre net-mortality at west Greenland.

5. The recent domestic Greenland salmon fishery

In 1972, Greenlandic drift-net vessels were usually small, fished close to shore during daylight hours, and used a higher proportion of more visible multifilament nylon

Table 1
Comparison of the domestic West Greenland salmon fishery in 1972 and 1981

1972	1981
Mostly stationary multifilament gill nets set in fiords and near shore.	Almost exclusively monofilament drift nets, set inshore and off shore.
Mostly small "open boat" fishing vessels.	Many mid-size longliners and some large ocean-going fishing vessels.
Drift nets fished in daylight hours only.	Drift nets fished day and night.
Fishing effort widely distributed along coast.	Fishing effort concentrated on northern banks.

nets than did the non-Greenlandic fleet (Christensen and Lear 1977). In recent years (1976–80), the majority of the salmon quota (959 t in 1980) has been taken in larger vessels which venture farther off shore, with the balance of the quota (231 t) taken in small boats near shore.

At present, the standard fishing gear (Kreiberg 1980) is a light-coloured monofilament nylon gill net (130–140 mm mesh, 38 m in length). Mainly fished as drift-nets, a fleet is composed of many (up to 100) of these nets joined together (typically 2–3 km). Although these nets are checked in daylight (Kreiberg 1980), they are usually left in the water overnight, and poor weather may result in gear being unattended for several days and nights (Kreiberg 1980). These are important factors since Christensen and Lear (1977) found that 97% of murre net-entrapment occurred in nets set overnight.

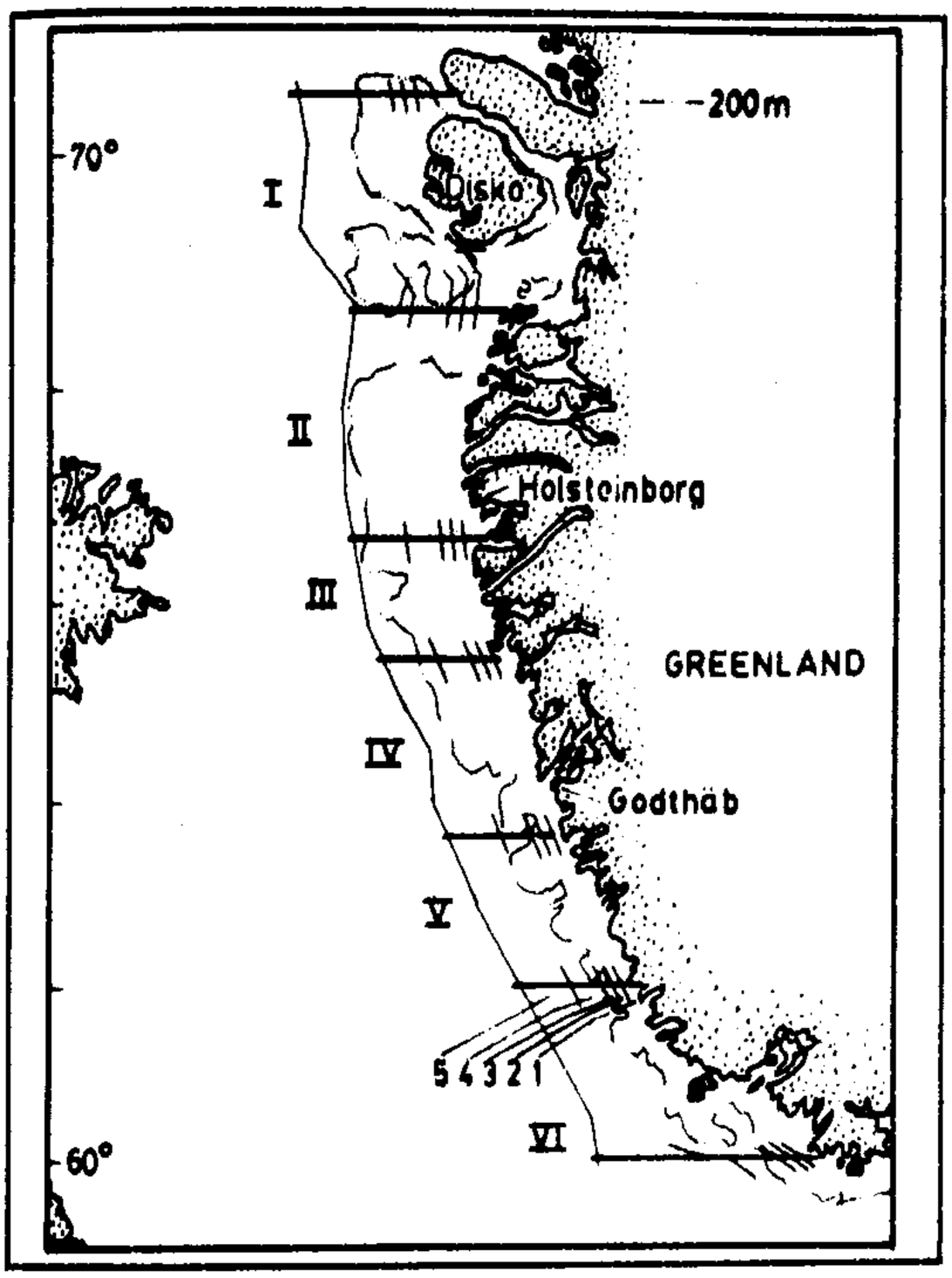
The distribution of salmon fishing effort has shifted considerably from the early 1970s when most (67% in 1973, Anon. 1980) salmon were taken south of Godthaab to the late 1970s when most (71% in 1979, Anon. 1980) salmon were taken north of Godthaab. This is significant in terms of murre mortality since Christensen and Lear (1977) found that, in 1972, 84% of all murre net-mortality occurred north of Godthaab (Figs. 1 and 2).

In 1981, the fishery was opened on 25 August. The large vessel quota was caught by 10 September and the small boat quota was reached sometime in mid October. Of all the changes in the domestic Greenland fishery discussed above, the timing of the quota is probably the most significant in terms of murre net-mortality.

6. Conclusions

Recent net-mortality studies have shown (Piatt *et al.* this volume, Ainley *et al.* 1981) that the bycatch of seabirds in fishing gear is highly variable and depends on many factors including the abundance and distribution of prey, mesh size and type of nets involved, fish and seabird migration patterns, and the proximity of fishing effort to colony sites. Because the Greenlandic salmon fishery now utilizes monofilament nylon nets, nets are usually left in the water overnight, fishing effort has redistributed to more northerly locations, intensive drift-netting occurs within a 25-km distance from the coast, and the recent trend is to open the salmon fishery later in the year; we predict that there has been an increase in Thick-billed Murre and other seabird net-mortality at west Greenland. In view of the fact that Greenlandic and eastern Canadian arctic Thick-billed

Figure 2
Area map of west Greenland showing fishing areas I–VI and subareas 1–5. Subareas (1–5) extend over whole coastline but are segmented here for clarity. The subareas are defined as: 1, inside the baseline; 2, baseline - 6 nm; 3, 6–12 nm; 4, 12–30 nm; 5, 30–60 nm. Adapted from Christensen and Lear (1977)



Murre populations have already suffered substantial reductions in numbers (Nettleship 1977), a re-investigation of net-mortality at west Greenland should proceed in the future to establish whether the salmon fishery is once again significantly affecting arctic murre populations.

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