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Greenland Fishery for Shrimp (Pandalus borealis Kr.) in NAFO
Division 1A, (Greenland Management Areas NV1 and NV2) in 1986 and 1987

by

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INTRODUCTION.

Trial fishery for shrimp in West Greenland waters north of 70°52,5'N (NAFO Div. 1A, NV1 and NV2 - outside the territorial sea baseline) was carried into effect in 1985. The area was not included in the quota regulation of the Greenland shrimp fishery. However, trawlers had to be licensed to fish in the area.

Based on experience from 1985 the fishing fleet was imposed certain restrictions as of 1986, with the purpose of gaining more knowledge of the northernmost areas: Trawlers carrying processing facilities on board were obliged to fish north of 72°52,5'N before fishing south of this latitude. Also, a limit to catches was fixed at 400 tons per trip, and skippers had to report on different aspects of the fishery.

Nominal catches were 4.349 tons in 1985 and 11.045 tons in 1986.

For 1987, the Greenland Home Rule Administration fixed a TAC at 11.500 tons for the area between 71°00'N and 72°52.5'N (NAFO Div. 1A NV1), thereby delimiting trial fishery to the area north of 72°52.5'N (NAFO Div. 1A NV2).

Nominal catches were 10.626 tons in NAFO Div. 1A NV1 and NV2 in 1987.

MATERIALS AND METHODS.

Total catches and numbers of vessels participating in the fishery north of 71°00'N were compiled by area and year on the basis of compulsory reportings by all vessels to Greenland authorities.

Logbook data from 27 and 28 trawlers were analysed to show the overall distribution of trawling hours and mean catch rates in 1986 and 1987 respectively.

RESULTS AND DISCUSSION.

Based on distribution of effort in 1986 the following areas were defined as 'fishing areas' proper (i.e. statistical squares which were visited by more trawlers and in which total effort was 100 hours or above).

Fishery in 1986.

UUMMANNAQ (statistical squares MB005-010; figures 1 and 2B, tables 1A and 1B)

This area was discovered in mid October 1986 and fishing took place in five weeks only. Despite the short period, about one fourth of total fishing effort was expended in this area in 1986. Initial catch rates were very high - mean CPUE values on a weekly basis were more than 1000 kg/hour during the first two weeks of fishing. Catch rates declined fast through the period, though.

SVARTEN HUK (statistical square MG007; figures 1 and 2B, tables 1A and 1B).

Like Uummanaq this area was discovered in 1986. Trawling is only possible in a rather limited area; rough or soft bottom and diminishing depth prevent trawling west, north, and east of the area.

Catch rates were rather stable at about 600 kg/hour through the main four weeks of fishing (September). During October and November mean CPUE dropped to less than 300 kg/hour. However, effort was low during the last period.

SØNDRE UPERNAVIK (statistical squares ML003-006, MM001-004, MM438-440, MN001-004, MN438; figures 1 and 2B, tables 1A and 1B).

Søndre Upernavik fishing area was well-known from fishery in 1985. The area is characterized by large areas of relatively firm and even bottom. However, west of 58°W bottom tends to get more soft and uneven.

Overall catch rates declined slightly through the season, but within and between statistical squares catch rates were very variable. High catch rates (above 500 kg/hour) were almost exclusively obtained during the first period of fishing (June), though.

UPERNAVIK (statistical square MT004; figures 1 and 2A, tables 1A and 1B).

Effort was low and scattered over the year. The area is characterized by rough bottom and very variable depth.

TUGTORQORTOQ (statistical square ND438; figures 1 and 2A, tables 1A and 1B).

In this area fishing was limited to the ice-free period from the end of July to the end of September. Compared to statistical square MT004 effort was rather high. This was probably due to a combination of compulsory fishery north of 72°52.5'N and the fact that this area is one of the few suitable for fishing north of the latitude in question.

Mean CPUE was relatively low, but catch rates showed large fluctuations through the fishing season. Skippers reported that low catch rates (less than 100 kg/hour on a weekly basis) obtained during the last two weeks of fishing were typical of the area as such in that period.

Fishery in 1987.

Effort.

Distribution of fishing effort deviated markedly from the distribution in 1986, which is immediately shown by a comparison of the number of statistical squares in which fishery took place in the two years (figures 2A-D): In 1986 fishery took place in more than 100 squares; the comparable number for 1987 was 63.

Fishery moved south in 1987, but the pattern of 1986 was also apparent in 1987. Greatest effort was still expended in the 'fishing areas', as defined on the background of fishing effort in 1986. However, more statistical squares must be considered 'fishing areas' as of 1987 (tables 1A-D). It is characteristic, though, that this expansion of the fishery took place in areas adjoining the fishing areas of 1986, i.e. trawlers still concentrate on rather well-defined areas. The reason for this is without doubt that depths or bottom suitable for trawling are unavailable outside these areas.

Only a little more than 1% of fishing effort was expended north of 72°52.5'N, as compared with 13% in 1986. This was to be expected, because areas south of 72°52.5'N were included in the quota regulation of the Greenland shrimp fishery as of 1987. Also, large parts of the area north of this latitude are characterized by rough or very soft bottom, and it remained an area reserved for trial fishery.

Fishing effort was highest in Uummannaq fishing area (table 1C). This may be due to the combined effect of very promising CPUE levels of 1986 and the relative closeness of this area to shrimp processing plants and homeports of trawlers.

Søndre Upernavik fishing area is still by far the largest of the main fishing areas. As in Uummannaq fishing area, fishing effort in Søndre Upernavik fishing area was above the level of 1986 (tables 1A and 1C), but as a result of the substantial increase of activity in the Uummannaq area, the percentage of total fishing effort expended here was below the level of 1986. An area in the north-eastern corner of this fishing area (MP005-006) was

apparently discovered in 1987. 28% of the total effort expended in Søndre Upernavik fishing area and adjoining squares was expended here. The reason for this relative large concentration of effort is at present unknown

Fishery in the two smallest fishing areas in NAFO Div. 1A NV1, Svarten Huk and Upernavik, was characterized by very low effort (table 1C). The cause of this may be that shrimps are relatively small in Svarten Huk fishing area and that bottom is rough in Upernavik fishing area. Hours of fishing amounted to 493 in Svarten Huk fishing area and 393 in Upernavik fishing area - equivalent to 2% of total effort each.

Catch rates.

Mean CPUE values (by year) were significantly below the level of 1986 in 21 of the 25 statistical squares that comprise the fishing areas (figure 4). Further, the marked northerly decline of mean CPUE of fishing areas, which was evident in 1986, did not show to nearly the same degree in 1987 (figure 3).

Bottom temperatures are low north of 71°N (Lund 1988). This may be of negative consequence to the shrimp stock, as suggested by a rather low fraction of berried females and a high incidence of dead eggs at an early stage of incubation (Lund 1988). Thus, low rates of reproduction may characterize the shrimp stock north of 71°N.

If the rate of reproduction is slow north of 71°N, as compared to the stock south of this latitude, it follows that regeneration of the northern stock will take comparatively long time. The virgin stock that was present in 1985 and 1986 may have been built up by a combination of intrinsic reproduction and shrimp (larvae) immigrating at a low rate (Lund 1988).

CONCLUSION.

The significant decline of mean CPUE from 1986 to 1987 (tables 1B and 1B, figures 3 and 4), in the two southernmost fishing areas, Uummannaq and Svarten Huk, especially, may suggest that fishery in 1986 removed a surplus of shrimp. If this is the case, future catch rates may stay at the level of 1987 or fall below if the combined rates of reproduction and immigration of shrimp are below the rate at which shrimp are removed by fishing.

Environmental conditions indicate that rates of reproduction may be low and that flow of shrimp larvae from more southern populations (of relatively high reproductive potential) may occur at a very low rate (Lund 1988). Thus, stock reproduction and immigration may not be able to counteract a sustained fishery at the level of 1986 and 1987.

References.

Lund, H. (1987): Trial Fishery for Shrimp (Pandalus borealis Kr.) in West Greenland Waters north of 70°52.5'N in 1986. NAFO SCR Doc. 87/07, Serial No. N1275.

Lund, H. (1988): On Environment and Reproduction of the West Greenland Shrimp Stock (Pandalus borealis Kr.) north of 71°N (NAFO Division 1A, NV1 and NV2). NAFO SCR Doc. 88/ .

table 1A

1986
EFFORT (hours) BY MONTH IN FISHING AREAS AND IN STATISTICAL UNITS OF FISHING AREAS.

| | Month | | | | | | |
|-------------------------|------------|-------------|-------------|------------|-------------|------------|----|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Uummannaq | | | | | | | |
| MB005 | - | - | - | - | 78 | 52 | - |
| MB006 | - | - | - | - | 394 | 38 | - |
| MB007 | - | - | - | - | 483 | 70 | - |
| MB008 | - | - | - | - | 683 | 102 | - |
| MB009 | - | - | - | - | 371 | 192 | - |
| MB010 | - | - | - | - | 96 | 118 | - |
| Total | | | | | 2105 | 572 | |
| Svarten Huk | | | | | | | |
| MG007 | - | 114 | 158 | 313 | 37 | 5 | - |
| Søndre Upernavik | | | | | | | |
| ML003 | 120 | 62 | 156 | 7 | - | - | - |
| ML004 | 114 | 39 | 192 | 67 | 8 | - | - |
| ML005 | 156 | 61 | 287 | 20 | 35 | - | - |
| ML006 | 33 | - | 123 | 19 | 8 | - | - |
| MM001 | 115 | 120 | 182 | 81 | 41 | - | - |
| MM002 | 119 | 171 | 139 | 68 | 93 | 35 | - |
| MM003 | 135 | 247 | 120 | 109 | 74 | 42 | - |
| MM004 | 27 | 63 | 207 | 22 | 10 | 7 | - |
| MM438 | 4 | - | 179 | 105 | 70 | - | - |
| MM439 | 4 | 4 | 114 | 4 | 72 | - | - |
| MM440 | 78 | 36 | 33 | 8 | 11 | 4 | - |
| MN001 | 4 | 69 | 40 | 7 | 5 | - | - |
| MN002 | 34 | 142 | 75 | 19 | 62 | - | - |
| MN003 | - | 89 | 84 | 12 | 4 | - | - |
| MN004 | 8 | 36 | 98 | - | 4 | - | - |
| MN438 | 3 | 3 | 203 | 51 | 8 | - | - |
| Total | 954 | 1142 | 2232 | 599 | 505 | 88 | |
| Upernavik | | | | | | | |
| MT004 | 59 | 93 | 31 | 82 | 22 | - | - |
| Tugtordortoq | | | | | | | |
| ND438 | - | 277 | 663 | 277 | - | - | - |

Table 1B

1986
 MEAN CATCH RATES (kg/hour) BY MONTH AND YEAR IN FISHING AREAS
 AND IN STATISTICAL UNITS OF FISHING AREAS.

| | Month | | | | | | | MEAN (year) |
|-------------------------|-------|-----|-----|-----|-----|-----|----|----------------|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Uummannaq | | | | | | | | |
| MB005 | - | - | - | - | 867 | 368 | - | 668 |
| MB006 | - | - | - | - | 894 | 485 | - | 858 |
| MB007 | - | - | - | - | 615 | 295 | - | 574 |
| MB008 | - | - | - | - | 633 | 271 | - | 586 |
| MB009 | - | - | - | - | 679 | 282 | - | 544 |
| MB010 | - | - | - | - | 504 | 326 | - | 406 |
| Mean | | | | | 689 | 312 | | 609 |
| Svarten Huk | | | | | | | | |
| MG007 | - | 605 | 590 | 559 | 289 | 179 | - | 556 |
| Søndre Upernavik | | | | | | | | |
| ML003 | 424 | 378 | 258 | 53 | - | - | - | 330 |
| ML004 | 394 | 374 | 322 | 100 | 225 | - | - | 309 |
| ML005 | 487 | 326 | 309 | 385 | 277 | - | - | 360 |
| ML006 | 317 | - | 289 | 336 | 420 | - | - | 305 |
| MM001 | 595 | 412 | 196 | 435 | 300 | - | - | 373 |
| MM002 | 616 | 390 | 257 | 367 | 357 | 170 | - | 382 |
| MM003 | 458 | 363 | 233 | 283 | 331 | 328 | - | 342 |
| MM004 | 465 | 384 | 223 | 357 | 281 | 220 | - | 283 |
| MM438 | 503 | - | 245 | 320 | 327 | - | - | 286 |
| MM439 | 570 | 223 | 234 | 196 | 415 | - | - | 305 |
| MM440 | 282 | 293 | 197 | 349 | 241 | 157 | - | 265 |
| MN001 | 644 | 474 | 159 | 257 | 435 | - | - | 365 |
| MN002 | 601 | 427 | 217 | 515 | 300 | - | - | 379 |
| MN003 | - | 392 | 281 | 362 | 293 | - | - | 339 |
| MN004 | 113 | 260 | 241 | - | 208 | - | - | 238 |
| MN438 | 295 | 473 | 285 | 406 | 292 | - | - | 310 |
| Mean | 471 | 384 | 258 | 323 | 332 | 250 | | 334 |
| Upernavik | | | | | | | | |
| MT004 | 372 | 255 | 193 | 588 | 301 | - | - | 365 |
| Tugtorqortoq | | | | | | | | |
| ND438 | - | 221 | 235 | 223 | - | - | - | 229 |

table 1c

1987

EFFORT (hours) BY MONTH IN FISHING AREAS AND IN
STATISTICAL UNITS OF FISHING AREAS.

| | Month | | | | | | |
|-------------------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Uummannaq | | | | | | | |
| MB005 | - | 375 | 222 | 237 | 93 | 583 | - |
| MB006 | - | 291 | 45 | 527 | 380 | 474 | - |
| MB007 | 48 | 163 | 137 | 477 | 480 | 509 | 52 |
| MB008 | 34 | 145 | 99 | 187 | 346 | 403 | 179 |
| MB009 | 340 | 601 | 126 | 279 | 208 | 679 | 451 |
| MB010 | 124 | 686 | 421 | 337 | 38 | 141 | 347 |
| Total | 546 | 2261 | 1050 | 2044 | 1545 | 2789 | 1029 |
| Svarten Huk | | | | | | | |
| MG007 | - | 41 | 75 | 315 | 62 | - | - |
| Søndre Upernavik | | | | | | | |
| ML003 | - | - | - | - | 8 | - | - |
| ML004 | - | 21 | - | - | - | - | - |
| ML005 | 19 | 76 | 217 | 178 | 16 | - | - |
| ML006 | 22 | 33 | 18 | 85 | - | - | - |
| MM001 | 33 | 12 | 12 | 58 | 103 | 12 | - |
| MM002 | 46 | 18 | 121 | 400 | 337 | 385 | - |
| MM003 | 30 | 33 | 106 | 411 | 358 | 350 | - |
| MM004 | 10 | 96 | 236 | 111 | 97 | 21 | - |
| MM438 | - | - | 80 | 14 | 653 | - | - |
| MM439 | 16 | - | - | 16 | 265 | - | - |
| MM440 | - | - | 5 | - | 80 | - | - |
| MN001 | - | - | 35 | - | 100 | 18 | - |
| MN002 | 12 | 44 | 27 | 271 | 446 | 109 | - |
| MN003 | - | - | - | 132 | 525 | 120 | - |
| MN004 | - | - | 61 | 45 | 680 | 36 | 16 |
| MN438 | - | - | 12 | 331 | 59 | 11 | - |
| Total | 188 | 333 | 930 | 2052 | 3727 | 1062 | 16 |
| Upernavik | | | | | | | |
| MT004 | 78 | 175 | 65 | - | 75 | - | - |
| Tugtorqortoq | | | | | | | |
| ND438 | - | 155 | 147 | - | - | - | - |

Table 1D

1987

MEAN CATCH RATES (kg/hour) BY MONTH AND YEAR IN FISHING AREAS
AND IN STATISTICAL UNITS OF FISHING AREAS.

| | Month | | | | | | | MEAN (year) |
|-------------------------|-------|-----|-----|-----|-----|-----|-----|----------------|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Uummannaq | | | | | | | | |
| MB005 | - | 289 | 229 | 373 | 310 | 277 | - | 289 |
| MB006 | - | 256 | 172 | 447 | 305 | 274 | - | 328 |
| MB007 | 417 | 190 | 170 | 390 | 339 | 300 | 256 | 316 |
| MB008 | 383 | 223 | 205 | 347 | 352 | 240 | 204 | 276 |
| MB009 | 409 | 218 | 200 | 364 | 379 | 253 | 295 | 291 |
| MB010 | 382 | 218 | 227 | 438 | 283 | 258 | 291 | 281 |
| Mean | 401 | 233 | 212 | 404 | 337 | 269 | 275 | 297 |
| Svarten Huk | | | | | | | | |
| MG007 | - | 231 | 120 | 332 | 345 | - | - | 294 |
| Søndre Upernavik | | | | | | | | |
| ML003 | - | - | - | - | 48 | - | - | 48 |
| ML004 | - | 178 | - | - | - | - | - | 190 |
| ML005 | 112 | 237 | 200 | 249 | 57 | - | - | 213 |
| ML006 | 180 | 279 | 145 | 255 | - | - | - | 241 |
| MM001 | 360 | 150 | 93 | 205 | 151 | 162 | - | 196 |
| MM002 | 298 | 85 | 128 | 272 | 238 | 168 | - | 219 |
| MM003 | 180 | 155 | 164 | 258 | 267 | 142 | - | 216 |
| MM004 | 77 | 288 | 236 | 237 | 241 | 111 | - | 238 |
| MM438 | - | - | 102 | 351 | 410 | - | - | 336 |
| MM439 | 257 | - | - | 151 | 230 | - | - | 226 |
| MM440 | - | - | 124 | - | 282 | - | - | 282 |
| MN001 | - | - | 131 | - | 186 | 308 | - | 190 |
| MN002 | 155 | 244 | 208 | 258 | 259 | 171 | - | 246 |
| MN003 | - | - | - | 281 | 264 | 190 | - | 255 |
| MN004 | - | - | 176 | 336 | 289 | 108 | 201 | 274 |
| MN438 | - | - | 114 | 349 | 265 | 96 | - | 322 |
| Mean | 234 | 237 | 180 | 274 | 283 | 157 | 201 | 250 |
| Upernavik | | | | | | | | |
| MT004 | 219 | 233 | 107 | - | 200 | - | - | 204 |
| Tugtorqortoq | | | | | | | | |
| ND438 | - | 88 | 72 | - | - | - | - | 83 |

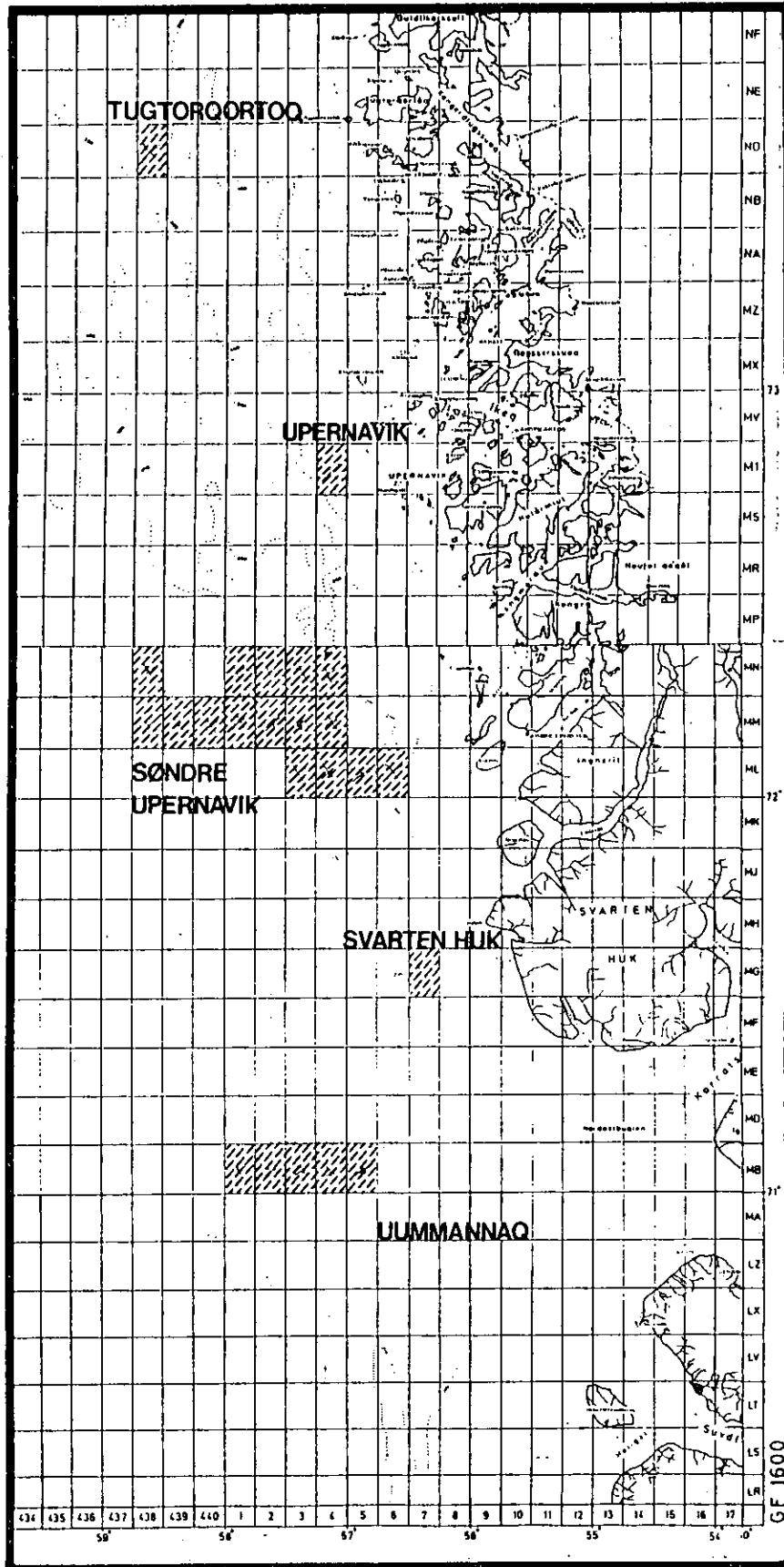


Figure 1. FISHING AREAS IN GREENLAND WATERS NORTH OF 71°N (defined as statistical units in which fishing effort was 100 hours and above in 1986: hatched squares).

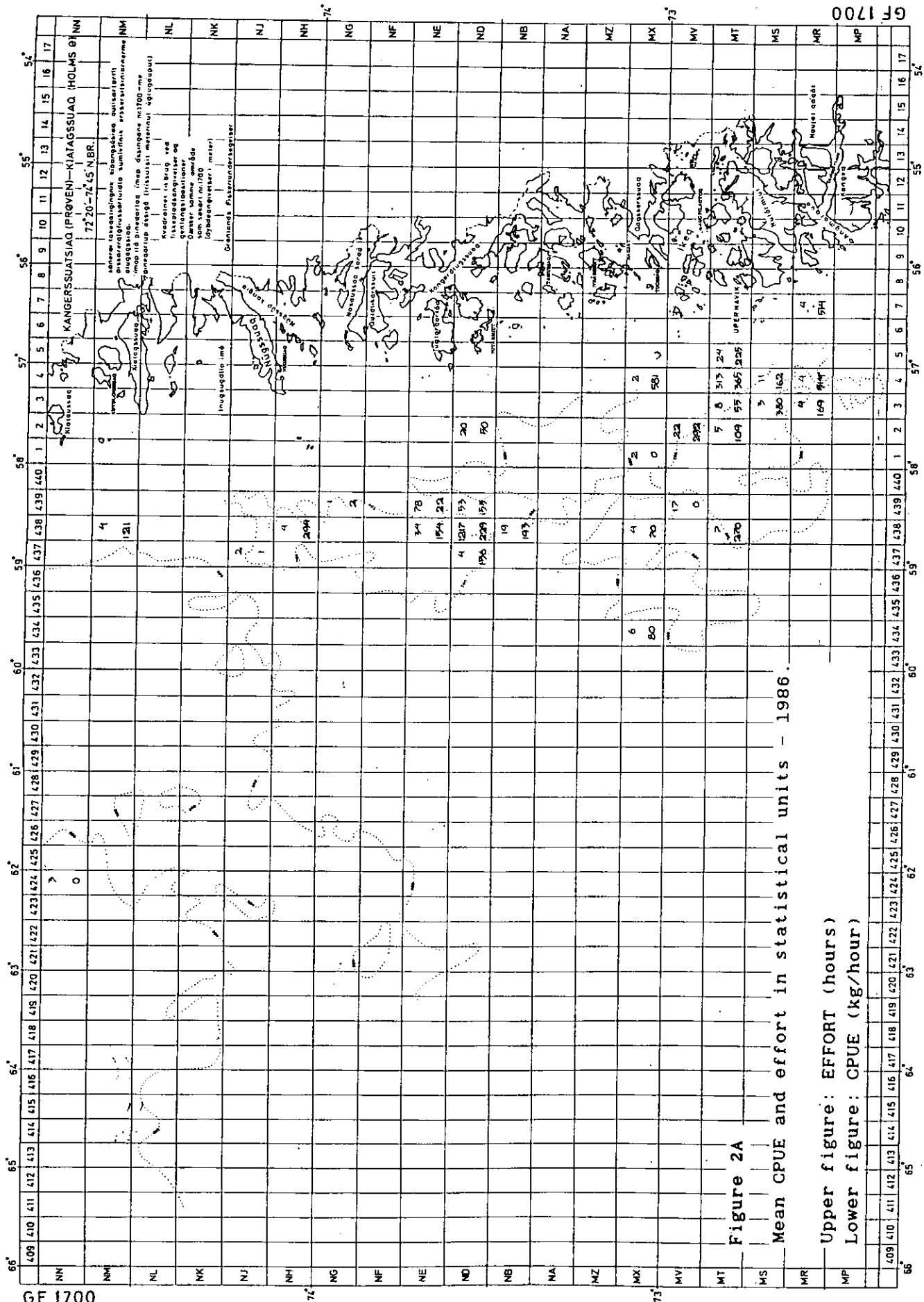


Figure 2A

Mean CPUE and effort in statistical units - 1986.

Upper figure: EFFORT (hours)

Lower figure: CPUE (kg/hour)

GF 1700

GF 1700

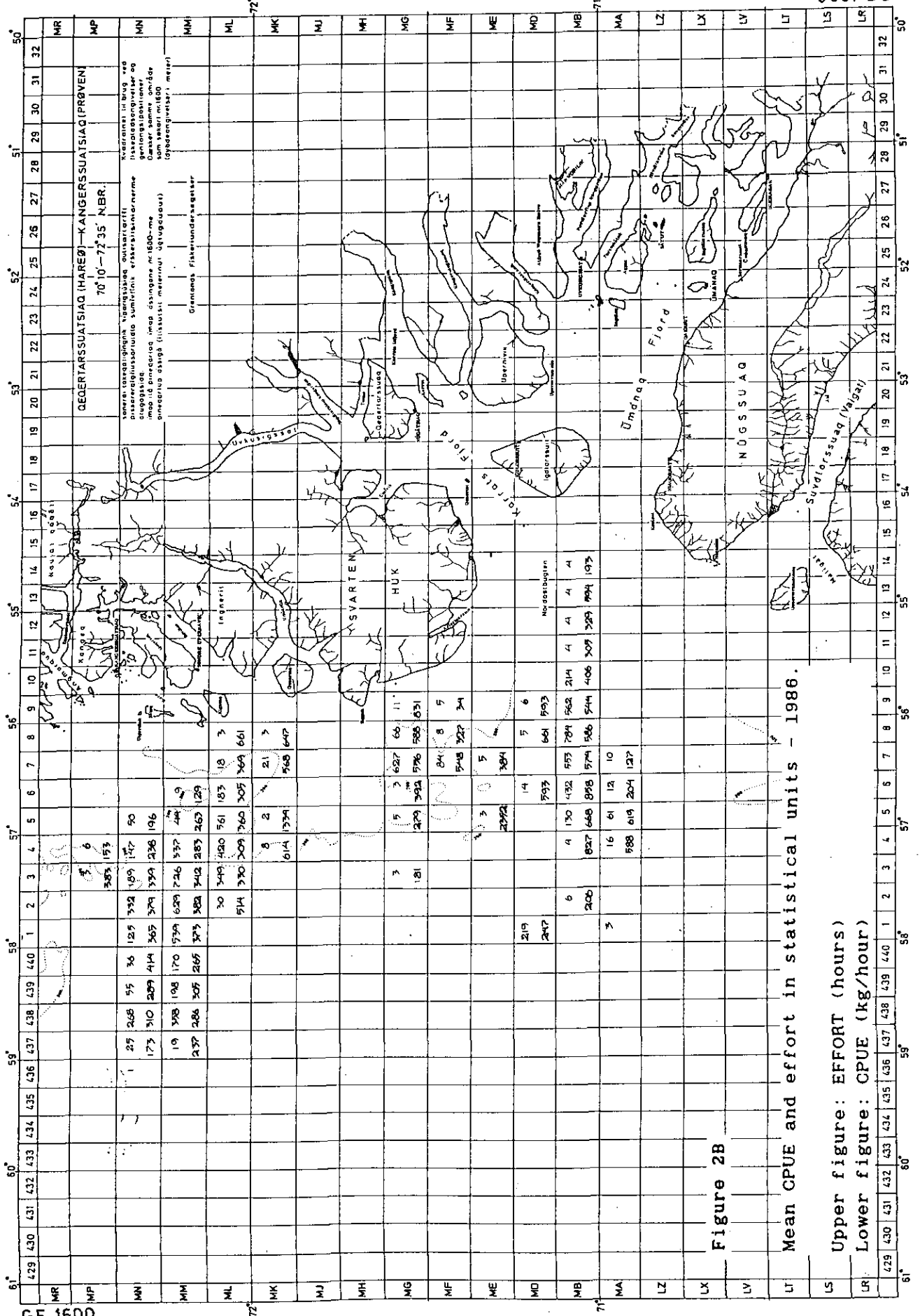


Figure 2B

Mean CPUE and effort in statistical units - 1986.

Upper figure: EFFORT (hours)
Lower figure: CPUE (kg/hour)

Upper figure: EFFORT (hours)
Lower figure: CPUE (kg/hour)

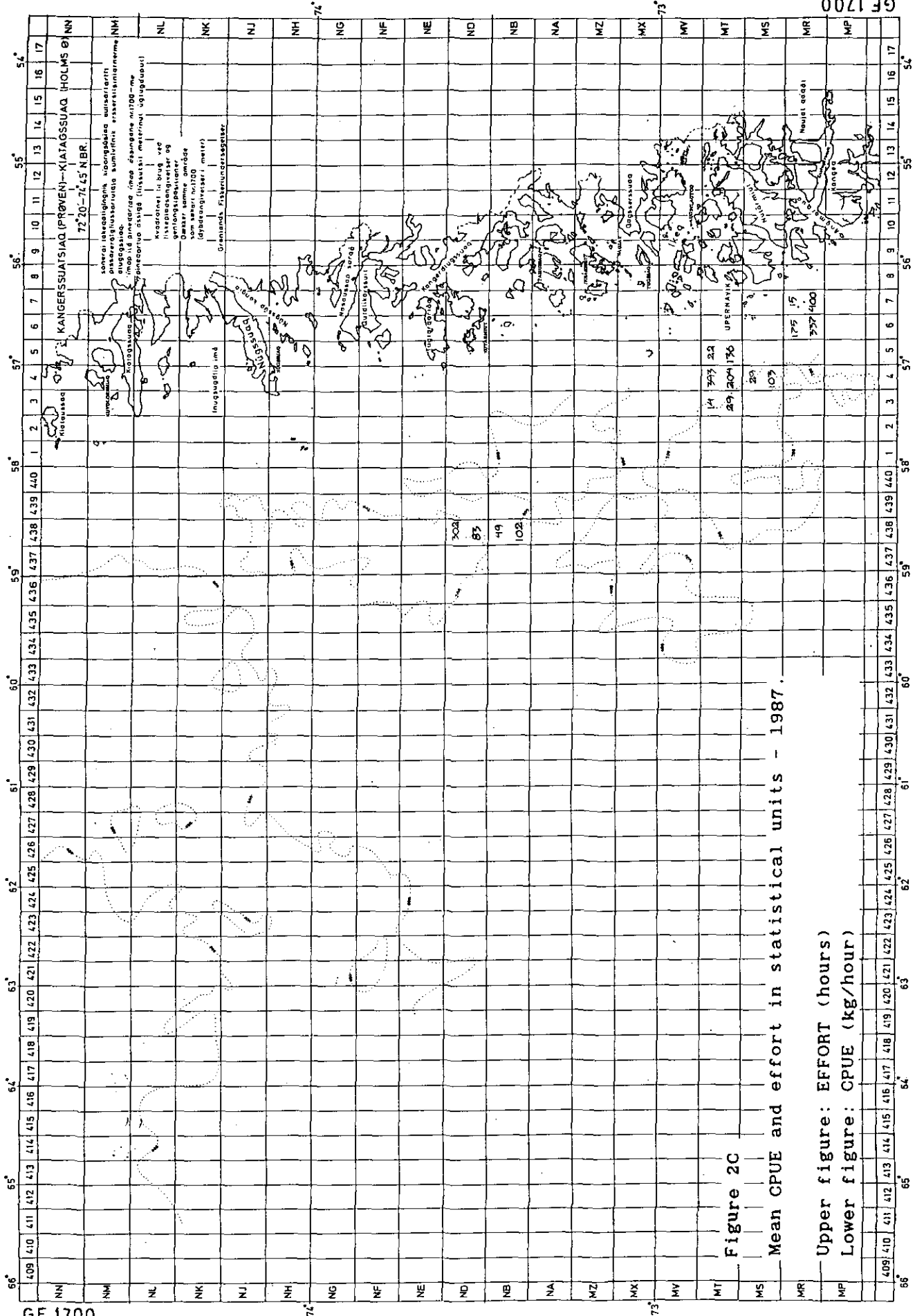


Figure 2C

Mean CPUE and effort in statistical units - 1987.

Upper figure: EFFORT (hours)

Lower figure: CPUE (kg/hour)

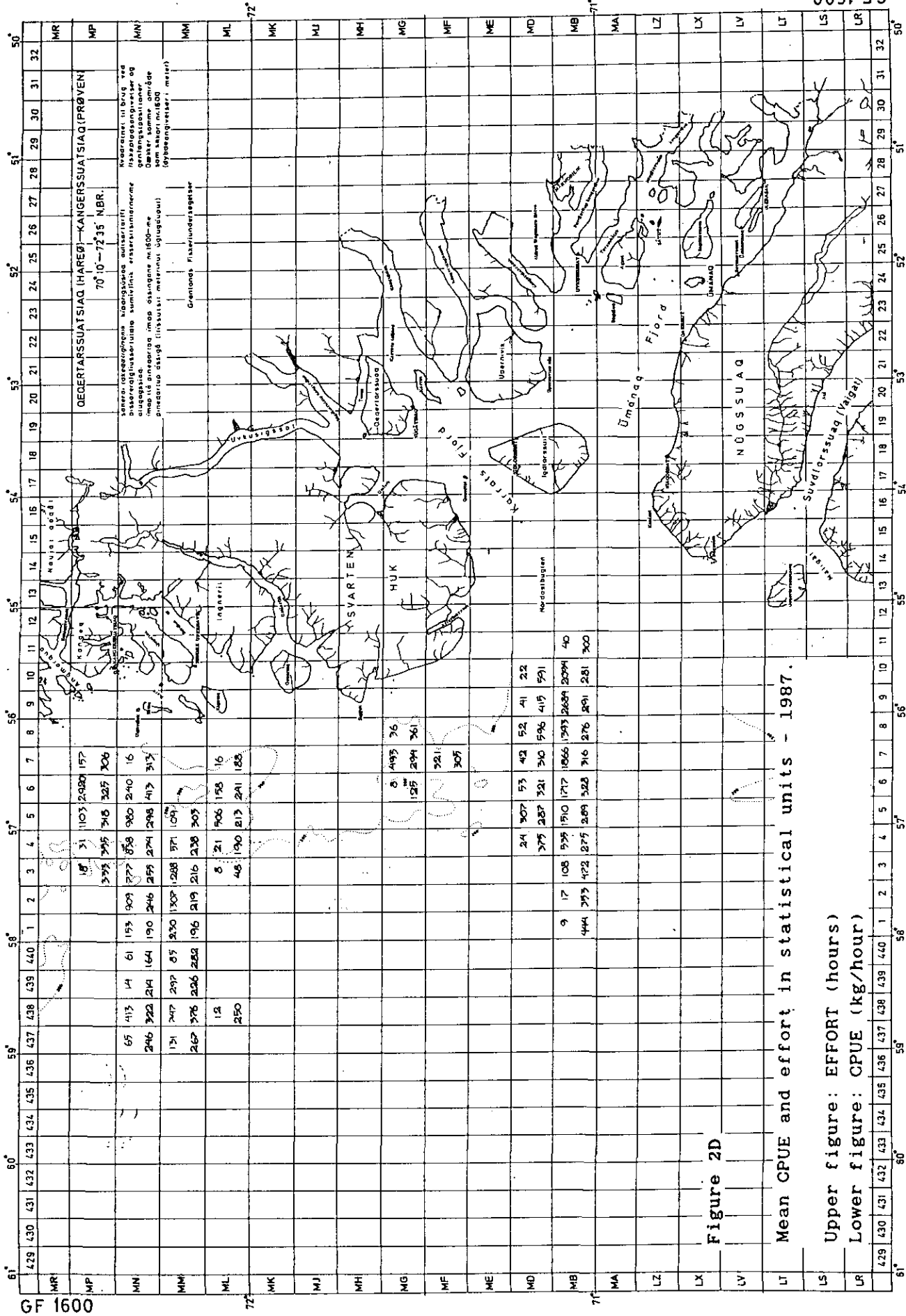


Figure 2D

Mean CPUE and effort in statistical units - 1987.

Upper figure: EFFORT (hours)

Lower figure: CPUE (kg/hour)

GEOGRAPHICAL VARIATION IN MEAN CATCH RATE IN 1986 AND 1987

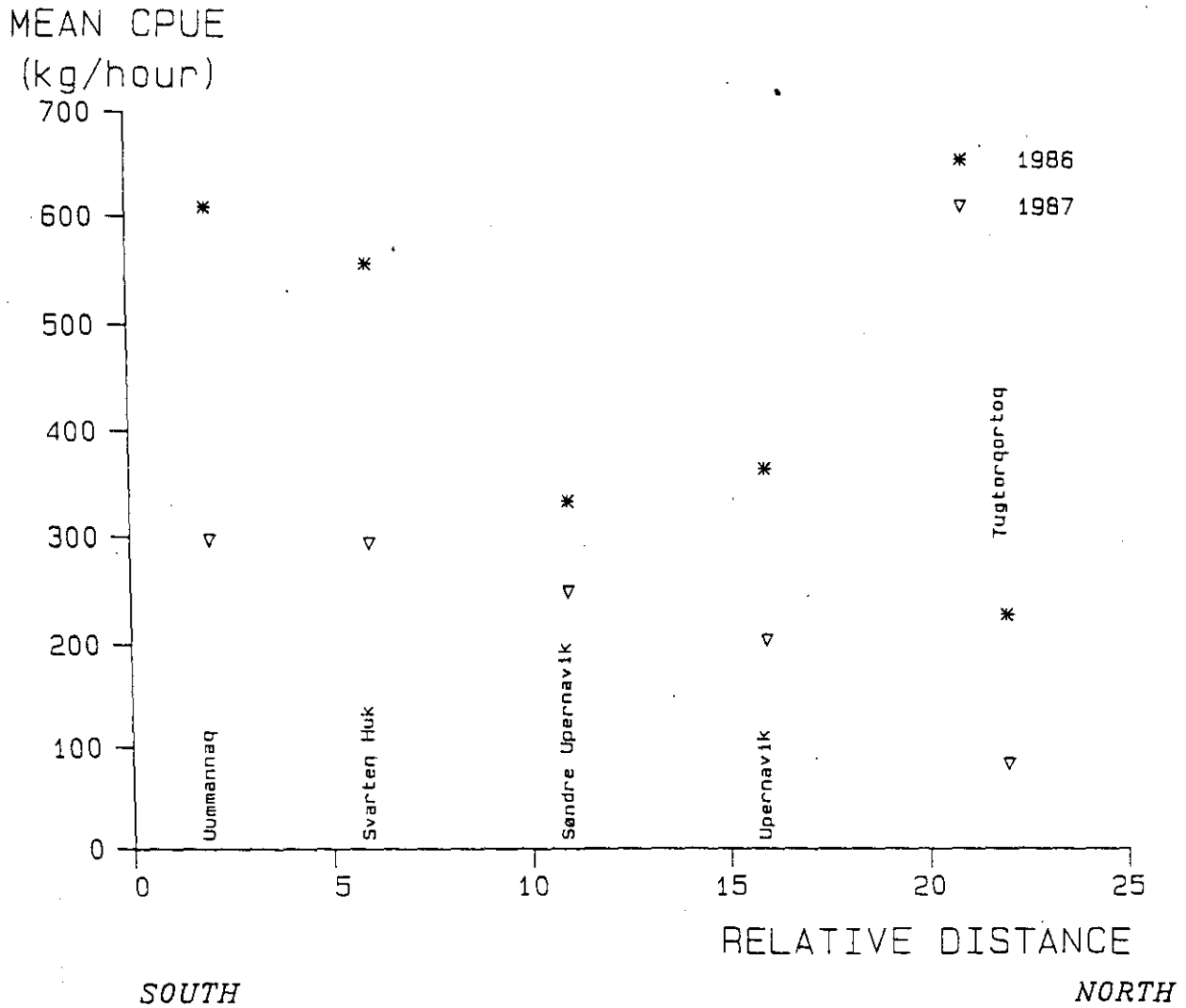
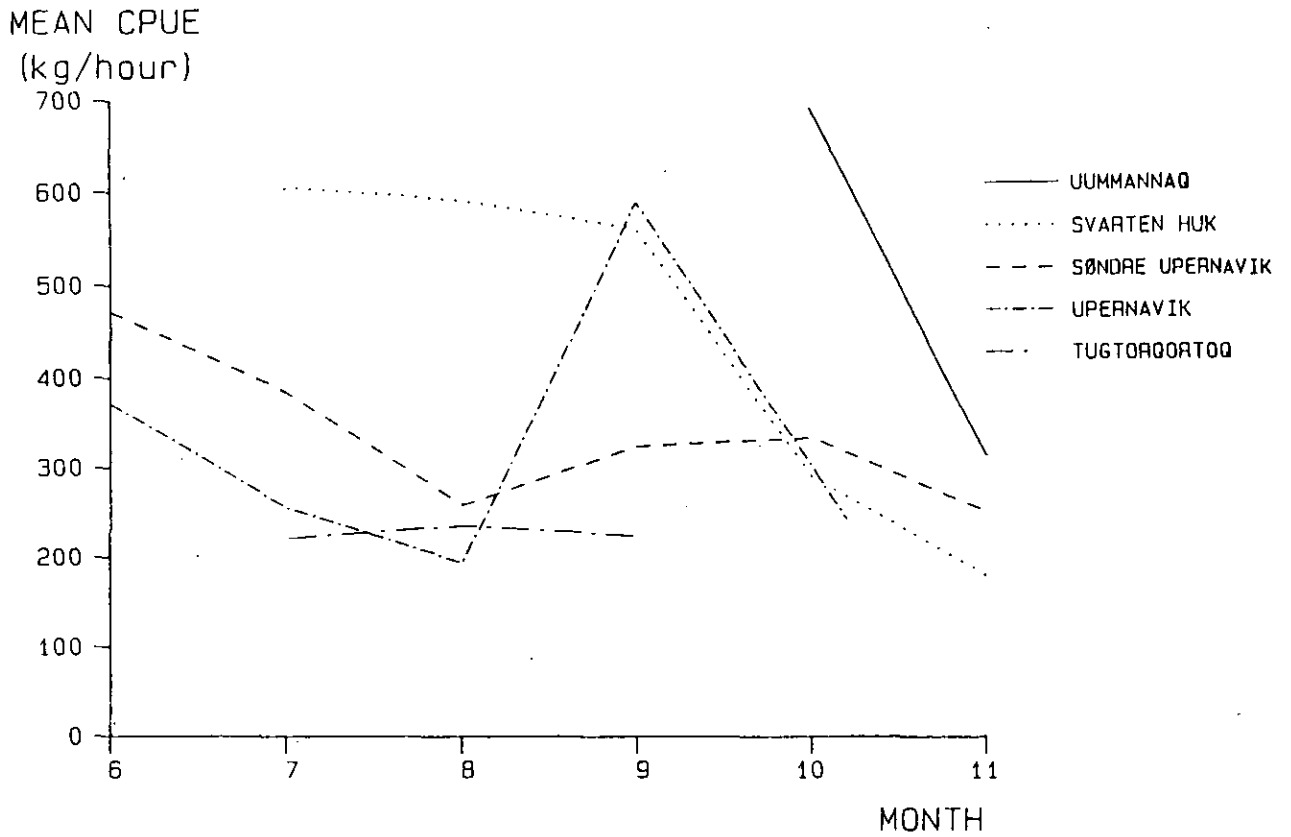


Figure 3.

MEAN CPUE BY MONTH IN FISHING AREAS 1986



MEAN CPUE BY MONTH IN FISHING AREAS 1987

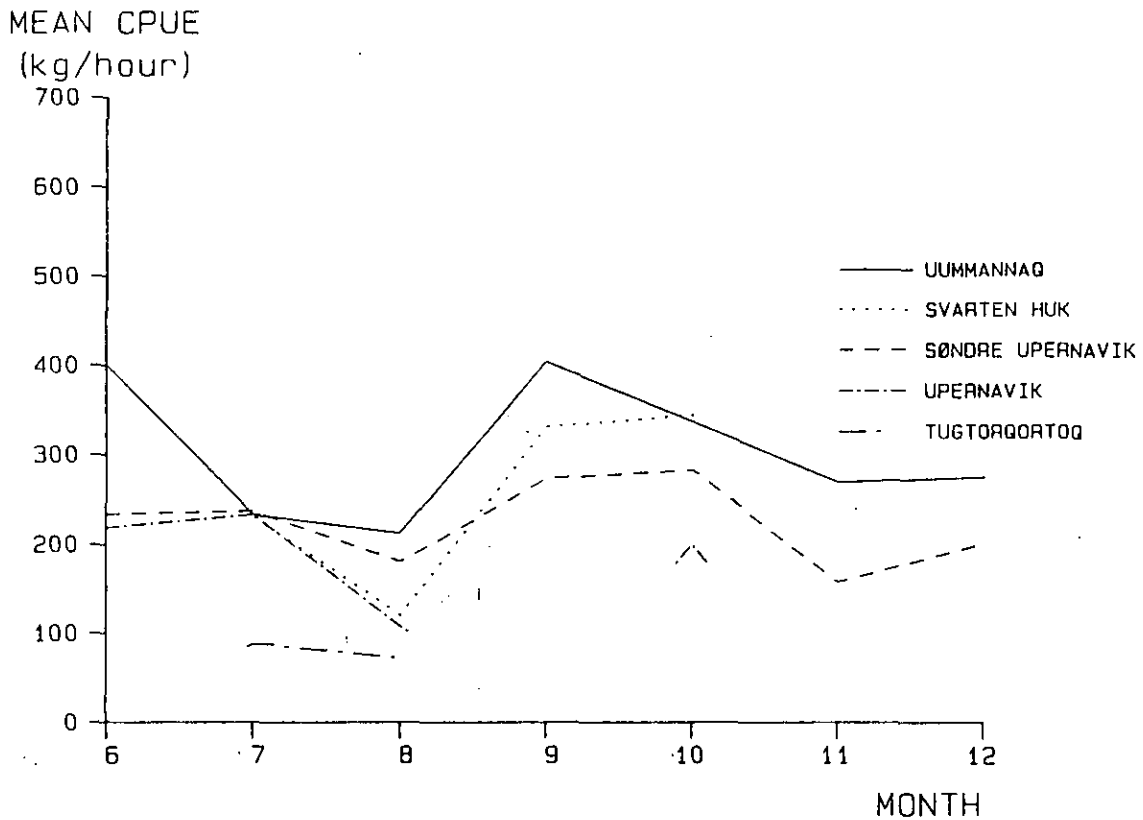


Figure 4.