CAFSAC Res. Doc. 78/18

# STATUS OF THE COD STOCK IN SUBDIVISION 3Ps

by

C. A. Bishop and R. Wells

Research and Resource Services

Fisheries and Marine Service

Department of Fisheries and the Environment

3 Water Street

St. John's, Newfoundland

A1C 1A1

Nominal catches

Catches in 3Ps have declined from a high in recent years of 77,000 tons (1968) to a low of 32,376 in 1977. The catches and their corresponding TAC's are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|
| TAC ('000 tons) | 70,000 | 70,000 | 62,400 | 47,500 | 32,500 |
| Catch ('000 tons) | 52,641 | 44,877 | 35,373 | 37,133 | 32,376 |

The TAC for 1978 is 25,000 tons.

Abundance indices

The results of survey data obtained in 3Ps were tabulated on the basis of biomass estimates per strata for the years 1972-78. Where surveys were not complete for all strata, methods of estimation were used (Bishop, 1977; ICNAF Res. Doc. 77/VI/17). The results of methods 1-4 are shown in Tables 1-4. An additional method (5) is shown in Table 5. In this method, biomass estimates of strata in the same depth range were added and the average abundance per square mile was adjusted to the total area of the depth range. The summary Table 6 indicates that the cod biomass has stabilized at the low level of recent years.

Regressions of these estimates with catch per hour of Can N-OT5 for the corresponding years gave 'r' values ranging from .65 to .89.

Catch composition

Age compositions obtained from the 1977 catch are shown in Tables 2 and 3 of CAFSAC Working Paper 78/14. The catch composition for 1975 was re-evaluated and the adjusted figures are indicated in the VPA run in Table 7.

Fishing mortality

Several methods were used to obtain an estimate of F for 1977. Table 8 compares total effort from 6 sources of catch per unit effort. These were compared with average F values (6-10 years) from 1963 to 1973. The regressions calculated did not give an adequate 'r' value.

Other fishing mortality estimates for 1977 were calculated using methods indicated in Tables 9-11. The Paloheimo 'Z' estimate in Table 9 produced an estimate of 0.79, the ln of the average abundance (catch/hr) by year-class against year-class (Table 10) gave an estimate of 0.68, while the average of regressions of the ln of the catch at age for 1977 and 1976 (Table 11) gave an estimate of .66. An average of these gave an estimate of 0.70, the value subsequently used as terminal F in 1977.

Recruitment estimates

Estimates of recruitment are indicated in Tables 12 and 13. Table 12 and Fig. 1-3 indicate some regression values obtained by comparing year-class strength from surveys with those calculated in the VPA. The relatively high 'r' values obtained permitted the prediction of stock sizes (Table 13) at age 3 using the survey abundance estimates of 1-3 year-olds from the 1976 and 1977 surveys.

Stock abundance in 1977 and projection of catches

Using the terminal F of .70, the age composition of catch in 1977 and data from a previous VPA, the population size for 1977 was calculated (Table 7). This population size with the calculated recruitment level of 4800 (Table 13) was used to project catches up to 1986 (Table 14). Recruitment levels for 1978 and 1979 were calculated (Table 13) at 3600 and 4600. An average of 1977-80 recruitment (4500) was used for years 1980-86. F values for 1977 were calculated and the mean weight at age values were taken from 1977 catch data. The generated F for 1978, with catch based on quota, was .45. The projection was run at the $F_{opt}$ level 0.2 for subsequent years. The calculated catch level for 1979 was approximately 15,000 tons.

Using the same projection data at $F_{max}$ gave a catch value in 1979 of 21,000 tons (Table 15).

The projected catch in 1986 at $F_{opt}$ was 34,000 tons while that at $F_{max}$ was 38,000 tons.

General production model

In attempting to obtain the best estimate of effort for this stock, catch per unit effort data from 6 sources were considered (Tables 16-21). The best correlation (r = .86) was obtained using C/hr from Can(N) OT, T.C. 5 at a 3-year moving average (Table 16, Fig. 4). Regression values were calculated for all effort categories used (Tables 16-21) and MSY with effort MSY values were calculated for each. The MSY values fluctuated between 59 and 66,000 tons while E MSY ranged from 45 to 102,000 hours.

Using Can N-OT5 effort data, a yield curve was calculated (Fig. 5) using the 3-year moving average. The MSY for this curve was 62,000 tons and the MSY effort was 75,000 hours. The figure also indicates the values for 2/3 MSY. The calculated catch from this curve is approximately 15,000 tons at 2/3 MSY and 22,000 tons at MSY.

Table 1. Biomass estimates (weights in thousands of kgs) from stratified random cruises in Subdivision 3Ps using Method 1.

| STRATA # | AREA (SQ. MILES) | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | C.F. |
|---|---|---|---|---|---|---|---|---|---|
| 306 | 419 | 846 | 835 | 376 | 719 | 214 | 161 | 416 | .108 |
| 307 | 395 | 2918 | 6133 | 3919 | 884 | 1127 | 2097 | 3222 | - |
| 308 | 112 | 376 | 181 | 279 | 205 | 193 | 311 | 38 | .048 |
| 309 | 296 | 662 | 975 | 479 | 311 | 178 | 192 | 103 | - |
| 310 | 170 | 1008 | 191 | 377 | 2183 | 261 | 0 | 154 | .126 |
| 311 | 317 | 3885 | 590 | 2432 | 763 | 627 | 411 | 154 | - |
| 312 | 272 | 210 | 804 | 243 | 335 | 456 | 1047 | 343 | .104 |
| 313 | 165 | 371 | 29 | 144 | 242 | 142 | 41 | 50 | - |
| 314 | 974 | 0 | 1314 | 1328 | 374 | 2357 | 249 | 0 | .170 |
| 315 | 827 | 1480 | 0 | 592 | 431 | 1747 | 1550 | 692 | .196 |
| 316 | 189 | 271 | 937 | 63 | 58 | 77 | 17 | 169 | .048 |
| 317 | 193 | 101 | 286 | 589 | 164 | 551 | 491 | 261 | .074 |
| 318 | 123 | 173 | 11 | 4 | 15 | 0 | 6 | 25 | .007 |
| 319 | 984 | 4604 | 662 | 478 | 481 | 3102 | 2493 | 1412 | .400 |
| 321 | 1189 | 1917 | 0 | 1876 | 592 | 1742 | 737 | 2037 | .269 |
| 323 | 696 | 736 | 1344 | 1213 | 383 | 368 | 63 | 1652 | .174 |
| 705 | 195 | 63 | 62 | 66 | 18 | 0 | 60 | 1 | .008 |
| 707 | 93 | 157 | 155 | 5 | 44 | 0 | 228 | 71 | .020 |
| Ave. | | 1099 | 806 | 804 | 456 | 730 | 564 | 600 | |

Table 2. Biomass estimates (weights in thousands of kgs) from stratified random cruises in Division 3Ps using Method 2.

| STRATA # | AREA (SQ. MILES) | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---|---|---|---|---|---|---|---|---|
| 306 | 419 | 1131 | 844 | 376 | 719 | 214 | 161 | 416 |
| 307 | 395 | 2918 | 6133 | 3919 | 884 | 1127 | 2097 | 3222 |
| 308 | 112 | 302 | 181 | 279 | 205 | 193 | 311 | 38 |
| 309 | 296 | 662 | 975 | 479 | 311 | 178 | 192 | 103 |
| 310 | 170 | 1008 | 191 | 377 | 2183 | 294 | 0 | 154 |
| 311 | 317 | 3885 | 590 | 2432 | 763 | 627 | 411 | 154 |
| 312 | 272 | 210 | 548 | 243 | 335 | 456 | 1047 | 343 |
| 313 | 165 | 371 | 29 | 144 | 242 | 142 | 41 | 50 |
| 314 | 974 | 0 | 1963 | 1328 | 1760 | 2357 | 249 | 0 |
| 315 | 827 | 1480 | 0 | 592 | 1494 | 1747 | 1550 | 1299 |
| 316 | 189 | 271 | 937 | 63 | 58 | 77 | 17 | 297 |
| 317 | 193 | 101 | 286 | 589 | 164 | 551 | 491 | 303 |
| 318 | 123 | 173 | 11 | 4 | 222 | 0 | 6 | 193 |
| 319 | 984 | 4604 | 662 | 478 | 481 | 3102 | 2493 | 1546 |
| 321 | 1189 | 1917 | 0 | 2363 | 2148 | 1742 | 1744 | 2037 |
| 323 | 696 | 736 | 1403 | 1383 | 1257 | 368 | 63 | 1652 |
| 705 | 195 | 527 | 393 | 66 | 352 | 0 | 60 | 1 |
| 707 | 93 | 251 | 187 | 5 | 168 | 0 | 228 | 146 |
| Ave. | | 1142 | 852 | 840 | 764 | 732 | 620 | 664 |

Table 3. Biomass estimates (weights in thousands of kgs) from stratified random cruises in Subdivision 3Ps using Method 3.

| STRATA | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---|---|---|---|---|---|---|---|
| 307 | 2918 | 6133 | 3919 | 884 | 1127 | 2097 | 3222 |
| 309 | 662 | 975 | 479 | 311 | 178 | 192 | 103 |
| 311 | 3885 | 590 | 2432 | 763 | 627 | 411 | 154 |
| 313 | 371 | 29 | 144 | 242 | 142 | 41 | 50 |
| Total | 7836 | 7727 | 6974 | 2200 | 2074 | 2741 | 3529 |
| Ave | 1959 | 1932 | 1744 | 550 | 518 | 685 | 882 |

Table 4. Biomass estimates (weights in thousands of kgs) from stratified random cruises in Subdivision 3Ps using Method 4.

| STRATA # | AREA (SQ. MILES) | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | C.F. |
|---|---|---|---|---|---|---|---|---|---|
| 306 | 419 | | | 376 | 719 | 214 | 161 | 416 | .906 |
| 307 | 395 | 2918 | 6133 | 3919 | 884 | 1127 | 2097 | 3222 | 5.96 |
| 308 | 112 | | 181 | 279 | 205 | 193 | 311 | 38 | .33 |
| 309 | 296 | 662 | 975 | 479 | 311 | 178 | 192 | 103 | .55 |
| 310 | 170 | 1008 | 191 | 377 | 2183 | | 0 | 154 | .77 |
| 311 | 317 | 3885 | 590 | 2432 | 763 | 627 | 411 | 154 | 1.000 |
| 312 | 272 | 210 | | 243 | 335 | 456 | 1047 | 343 | 1.02 |
| 313 | 165 | 371 | 29 | 144 | 242 | 142 | 41 | 50 | .17 |
| 314 | 974 | 0 | | 1328 | | 2357 | 249 | 0 | .98 |
| 315 | 827 | 1480 | 0 | 592 | | 1747 | 1550 | | 1.44 |
| 316 | 189 | 271 | 937 | 63 | 58 | 77 | 17 | | .32 |
| 317 | 193 | 101 | 286 | 589 | 164 | 551 | 491 | | .51 |
| 318 | 123 | 173 | 11 | 4 | | 0 | 6 | | .02 |
| 319 | 984 | 4604 | 662 | 478 | 481 | 3102 | 2493 | | 2.36 |
| 321 | 1189 | 1917 | 0 | | | 1742 | | 2037 | 4.12 |
| 323 | 696 | 736 | | | | 368 | 63 | 1652 | 2.91 |
| 705 | 195 | | | 66 | | 0 | 60 | 1 | .04 |
| 707 | 93 | | | 5 | | 0 | 228 | | .19 |
| Ave. | | 3277 | 3325 | 1916 | 929 | 1699 | 1364 | 2790 | |

Table 5. Biomass estimates (weights in thousands of kgs) from stratified random cruises in Subdivision 3Ps using Method 5.

| DEPTH R. | STRATA | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---|---|---|---|---|---|---|---|---|
| 0-30 | 314 | 0 | | 1328 | | 2357 | 249 | 0 |
| | 320 | | 729 | | | 1335 | | |
| | Tot. | 0 | 729 | 1328 | | 3692 | 249 | |
| Tot. Str. | Area ($mi^2$) | 974 | 1320 | 974 | | 2294 | 974 | |
| 31-50 | 308 | | 181 | 279 | 205 | 193 | 311 | 38 |
| | 312 | 210 | | 243 | 335 | 456 | 1047 | 343 |
| | 315 | 1480 | 0 | 592 | | 1747 | 1550 | |
| | 321 | 1917 | 0 | | | 1742 | | 2037 |
| | 325 | | | | | 2 | | 180 |
| | 326 | | | | | | | 0 |
| | Tot. | 3607 | 181 | 1114 | 540 | 4140 | 2908 | 2598 |
| Tot. Str. | Area ($mi^2$) | 2288 | 2128 | 1211 | 384 | 3344 | 1211 | 2683 |
| 51-100 | 307 | 2918 | 6133 | 3919 | 884 | 1127 | 2097 | 3222 |
| | 311 | 3885 | 590 | 2432 | 763 | 627 | 411 | 154 |
| | 317 | 101 | 286 | 589 | 164 | 551 | 491 | |
| | 319 | 4604 | 662 | 478 | 481 | 3102 | 2493 | |
| | 322 | | | | | 5183 | | 491 |
| | 323 | 736 | | | | 368 | 63 | 1652 |
| | 324 | | | | | 8 | | |
| | Tot. | 12244 | 7671 | 7418 | 2292 | 10966 | 5555 | 5519 |
| Tot. Str. | Area ($mi^2$) | 2585 | 1889 | 1889 | 1889 | 4646 | 2585 | 2975 |
| 101-150 | 306 | | | 376 | 719 | 214 | 161 | 416 |
| | 309 | 662 | 975 | 479 | 311 | 178 | 192 | 103 |
| | 310 | 1008 | 191 | 377 | 2183 | | 0 | 154 |
| | 313 | 371 | 29 | 144 | 242 | 142 | 41 | 50 |
| | 316 | 271 | 937 | 63 | 58 | 77 | 17 | |
| | 318 | 173 | 11 | 4 | | 0 | 6 | |
| | Tot. | 2485 | 2143 | 1443 | 3513 | 611 | 417 | 723 |
| Tot. Str. | Area ($mi^2$) | 943 | 943 | 1362 | 1239 | 1192 | 1362 | 1050 |
| 151-200 | 705 | | | 66 | | 0 | 60 | 1 |
| | 706 | | | 23 | | | 76 | |
| | 707 | | | 5 | | 0 | 228 | |
| | 715 | | | | | 1 | 31 | 142 |
| | 716 | | | | | | 92 | 781 |
| | Tot. | | | 94 | | 1 | 487 | 924 |
| Tot. Str. | Area ($mi^2$) | | | 764 | | 420 | 1435 | 866 |
| | Tot. Area Per Depth Range | | | | | | | |
| 0-30 | 2294 | 0 | 1267 | 3128 | | 3692 | 586 | |
| 31-50 | 3510 | 5533 | 299 | 3229 | 4536 | 4346 | 8429 | 3399 |
| 51-100 | 4646 | 2700 | 18867 | 18245 | 5637 | 10966 | 9984 | 8619 |
| 101-150 | 1362 | 3589 | 3095 | 1443 | 3862 | 698 | 417 | 938 |
| 151-200 | 1435 | | | 177 | | 3 | 487 | 1531 |

Table 6. Comparison of cod biomass estimates (weights in thousands of tons) obtained from stratified random research cruises in 3Ps and values obtained from regressions of Can (N) OT (T.C. 5) c/hr on these estimates.

| YEAR | CAN (N) OT-R CPUE | METHOD 1 | METHOD 2 | METHOD 3 | METHOD 4 |
|---|---|---|---|---|---|
| 1972 | .548 | 1099 | 1142 | 1959 | 3277 |
| 1973 | .530 | 806 | 852 | 1932 | 3325 |
| 1974 | .535 | 804 | 840 | 1744 | 1916 |
| 1975 | .204 | 456 | 764 | 550 | 929 |
| 1976 | .415 | 730 | 732 | 518 | 1699 |
| 1977 | .314 | 564 | 620 | 685 | 1364 |
| 1978 | | 600 | 664 | 882 | 2790 |
| | M | .0564 | .0517 | .0171 | .0120 |
| | Int. | .0049 | -.0026 | .2133 | .1747 |
| | 'r' | .8928 | .6476 | .8683 | .8478 |

.338 (Estimated c/hr (1978) using Method 1)

Table 7. COD 3PS 1963-77 - VPA at Terminal F = .70.

NATURAL MORTALITY= 0.20

PARTIAL RECRUITMENT MULTIPLIER

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.0700 | 0.3900 | 0.7200 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

ASSUMED FISHING MORTALITY FOR LAST AGES

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3000 | 0.5000 | 0.4800 | 0.8000 | 0.5100 | 0.4600 | 0.4800 | 0.4200 | 0.4700 | 0.3100 | 0.2900 | 0.3000 | 0.3000 | 0.5500 | 0.7000 |

ESTIMATED POPULATION

| AGE YEAR | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 4197. | 7005. | 8560. | 8463. | 10014. | 7326. | 5515. | 3479. | 5636. | 3223. | 2776. | 3778. | 5310. | 5783. | 2121. |
| 4 | 3744. | 3349. | 5562. | 6799. | 6843. | 7939. | 5895. | 4446. | 2780. | 4354. | 2573. | 2183. | 2939. | 4181. | 4363. |
| 5 | 2738. | 2658. | 2219. | 3682. | 4331. | 4616. | 5360. | 4184. | 2906. | 1693. | 3118. | 1681. | 1289. | 1743. | 2324. |
| 6 | 1948. | 1600. | 1666. | 1292. | 1833. | 2379. | 2590. | 3340. | 2256. | 1604. | 971. | 1512. | 807. | 567. | 711. |
| 7 | 1126. | 1117. | 842. | 1037. | 640. | 922. | 1418. | 1471. | 1852. | 1190. | 992. | 433. | 803. | 250. | 204. |
| 8 | 925. | 693. | 648. | 395. | 386. | 311. | 432. | 749. | 628. | 772. | 558. | 459. | 137. | 127. | 87. |
| 9 | 382. | 484. | 397. | 344. | 179. | 193. | 136. | 194. | 391. | 231. | 393. | 258. | 159. | 47. | 58. |
| 10 | 108. | 231. | 225. | 215. | 116. | 93. | 108. | 40. | 93. | 204. | 114. | 141. | 30. | 21. | 26. |
| 11 | 128. | 62. | 131. | 91. | 82. | 66. | 38. | 23. | 14. | 27. | 126. | 48. | 25. | 15. | 13. |
| 12 | 42. | 92. | 20. | 77. | 27. | 33. | 34. | 26. | 3. | 4. | 4. | 85. | 21. | 5. | 11. |

KNOWN CATCHES

| AGE YEAR | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 96. | 191. | 231. | 95. | 287. | 114. | 77. | 76. | 288. | 73. | 100. | 170. | 184. | 411. | 92. |
| 4 | 450. | 578. | 964. | 1366. | 1091. | 1260. | 710. | 811. | 644. | 494. | 470. | 550. | 733. | 1214. | 949. |
| 5 | 709. | 564. | 580. | 1306. | 1290. | 1314. | 1158. | 1292. | 857. | 459. | 1150. | 630. | 540. | 792. | 841. |
| 6 | 528. | 518. | 361. | 462. | 639. | 585. | 718. | 976. | 727. | 355. | 400. | 480. | 454. | 288. | 328. |
| 7 | 253. | 294. | 325. | 512. | 235. | 357. | 455. | 637. | 822. | 460. | 390. | 240. | 587. | 130. | 94. |
| 8 | 303. | 188. | 206. | 159. | 136. | 131. | 176. | 246. | 313. | 264. | 220. | 240. | 72. | 50. | 40. |
| 9 | 90. | 189. | 122. | 183. | 60. | 55. | 79. | 73. | 128. | 83. | 200. | 200. | 120. | 14. | 27. |
| 10 | 29. | 65. | 103. | 104. | 32. | 42. | 72. | 21. | 54. | 46. | 50. | 100. | 10. | 5. | 12. |
| 11 | 14. | 34. | 33. | 52. | 38. | 22. | 6. | 18. | 8. | 20. | 20. | 20. | 17. | 2. | 6. |
| 12 | 10. | 33. | 7. | 39. | 10. | 11. | 12. | 8. | 1. | 1. | 1. | 20. | 5. | 2. | 5. |

ESTIMATE FISHING MORTALITY

| AGE YEAR | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.0256 | 0.0306 | 0.0303 | 0.0125 | 0.0322 | 0.0173 | 0.0155 | 0.0244 | 0.0581 | 0.0253 | 0.0406 | 0.0510 | 0.0391 | 0.0818 | 0.0 |
| 4 | 0.1425 | 0.2116 | 0.2126 | 0.2511 | 0.1938 | 0.1929 | 0.1428 | 0.2252 | 0.2958 | 0.1340 | 0.2255 | 0.3264 | 0.3224 | 0.3870 | 0.0 |
| 5 | 0.3371 | 0.2672 | 0.3408 | 0.4976 | 0.3993 | 0.3778 | 0.2728 | 0.4175 | 0.3944 | 0.3561 | 0.5237 | 0.5346 | 0.6215 | 0.6974 | 0.0 |
| 6 | 0.3561 | 0.4427 | 0.2738 | 0.5027 | 0.4867 | 0.3172 | 0.3658 | 0.3899 | 0.4402 | 0.2806 | 0.6076 | 0.4321 | 0.9732 | 0.8240 | 0.0 |
| 7 | 0.2854 | 0.3438 | 0.5565 | 0.7886 | 0.5206 | 0.5583 | 0.4379 | 0.6513 | 0.6745 | 0.5575 | 0.5702 | 0.9486 | 1.6471 | 0.8575 | 0.0 |
| 8 | 0.4492 | 0.3563 | 0.4325 | 0.5887 | 0.4933 | 0.6256 | 0.5982 | 0.4507 | 0.8007 | 0.4744 | 0.5726 | 0.8620 | 0.6669 | 0.5729 | 0.0 |
| 9 | 0.3015 | 0.5656 | 0.4144 | 0.8845 | 0.4612 | 0.3783 | 1.0226 | 0.5358 | 0.4493 | 0.5066 | 0.8250 | 1.9530 | 1.8039 | 0.3969 | 0.0 |
| 10 | 0.3523 | 0.3716 | 0.7056 | 0.7650 | 0.3619 | 0.6952 | 1.3290 | 0.8628 | 1.0229 | 0.2863 | 0.6643 | 1.5271 | 0.4612 | 0.2986 | 0.0 |
| 11 | 0.1293 | 0.9285 | 0.3273 | 0.9999 | 0.7191 | 0.4560 | 0.1926 | 1.8839 | 1.0144 | 1.6388 | 0.1936 | 0.6176 | 1.3803 | 0.1545 | 0.0 |
| 12 | 0.3000 | 0.5000 | 0.4800 | 0.8000 | 0.5100 | 0.4600 | 0.4800 | 0.4200 | 0.4700 | 0.3100 | 0.2900 | 0.3000 | 0.3000 | 0.5500 | 0.7000 |

POPULATION WTS AND NOS

| | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WT | 21385. | 22073. | 22624. | 24153. | 24226. | 25259. | 25654. | 24403. | 22256. | 17901. | 16675. | 13919. | 11415. | 10874. | 9841. |
| NO | 15339. | 17292. | 20271. | 22396. | 24452. | 23877. | 21527. | 17953. | 16558. | 13302. | 11625. | 10577. | 11521. | 12739. | 9918. |

POPULATION WTS AND NOS AGE 6 TO 12

| | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WT | 12971. | 12487. | 11249. | 10089. | 8435. | 9831. | 11644. | 14028. | 13488. | 10967. | 9345. | 8171. | 5220. | 2684. | 2686. |
| NO | 4659. | 4279. | 3929. | 3452. | 3264. | 3997. | 4757. | 5844. | 5237. | 4032. | 3158. | 2935. | 1982. | 1033. | 1109. |

Table 8. Comparisons of total effort data from different countries and tonnage classes and their relation to the average F values calculated from the VPA for cod in Subdivision 3Ps.

| Year | Can (N) OT 4 S.A. | Spain PT 4 S.A. | Can (N) OT 4 | Spain PT 4 | Can (N) OT 5 | Can (N) OT 5 Standard | $\bar{F}$ (6-10) |
|---|---|---|---|---|---|---|---|
| 1963 | 89.2 | 53.8 | 91.7 | 47.7 | | 86.6 | .35 |
| 1964 | 129.4 | 51.8 | 110.3 | 36.5 | | 104.2 | .42 |
| 1965 | 72.7 | 51.3 | 68.8 | 33.2 | 73.5 | 67.9 | .48 |
| 1966 | 93.0 | 50.3 | 80.8 | 42.1 | 75.2 | 75.7 | .71 |
| 1967 | 143.8 | 51.9 | 125.0 | 47.6 | 83.9 | 97.9 | .46 |
| 1968 | 112.4 | 53.2 | 115.8 | 44.1 | 106.8 | 108.0 | .51 |
| 1969 | 76.7 | 44.8 | 74.4 | 38.7 | 79.1 | 74.3 | .75 |
| 1970 | 169.2 | 64.2 | 152.6 | 56.0 | 121.9 | 132.0 | .58 |
| 1971 | 110.7 | 53.7 | 116.5 | 50.0 | 101.5 | 105.6 | .68 |
| 1972 | 58.9 | 48.5 | 57.6 | 42.6 | 80.9 | 65.0 | .42 |
| 1973 | 174.3 | 76.2 | 146.6 | 61.8 | 99.3 | 115.4 | .64 |
| Slope | .0004 | .0018 | .0005 | .0033 | .0003 | .0005 | |
| Inter-cept | .4997 | .4489 | .4927 | .3974 | .5574 | .4997 | |
| r | .1181 | .1136 | .1195 | .2040 | .0363 | .0827 | |

Table 9. 3Ps Cod - Paloheimo Z's.

| | Nos. in Catch | | | | | |
|---|---|---|---|---|---|---|
| AGE | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| 3 | 73 | 100 | 170 | 184 | 411 | 92 |
| 4 | 494 | 470 | 550 | 733 | 1,214 | 949 |
| 5 | 459 | 1,150 | 630 | 540 | 792 | 841 |
| 6 | 355 | 400 | 480 | 454 | 288 | 328 |
| 7 | 460 | 390 | 240 | 587 | 130 | 94 |
| 8 | 264 | 220 | 240 | 72 | 50 | 40 |
| 9 | 83 | 200 | 200 | 120 | 14 | 27 |
| 10 | 46 | 50 | 100 | 10 | 5 | 12 |
| 11 | 20 | 20 | 20 | 17 | 2 | 6 |
| Effort (Can N - OT 5) | 80,881 | 99,323 | 87,301 | 173,397 | 89,477 | 103,108 |
| 7-10 | 853 | 860 | 780 | 789 | 199 | 173 |
| 8-11 | | 490 | 560 | 219 | 71 | 85 |
| S | | .4678 | .7408 | .1414 | .1744 | .3707 |
| Z | | .76 | .30 | 1.9564 | 1.75 | .99 |
| F | | .56 | .10 | 1.76 | 1.55 | .79 |

Table 10. 3Ps Cod - Calculation of F using 1976 and 1977 catch per hour by year class.

| YEAR CLASS | 1976 C/Hr. ('000) | 1977 C/Hr. ('000) | AVERAGE ABUNDANCE | ln ABUNDANCE |
|---|---|---|---|---|
| 1973 | 4.59 | 9.20 | - | - |
| 1972 | 13.57 | 8.16 | 1086 | 6.99 |
| 1971 | 8.85 | 3.18 | 602 | 6.40 |
| 1970 | 3.22 | .91 | 206 | 5.33 |
| 1969 | 1.45 | .39 | .92 | 4.52 |
| 1968 | .56 | .26 | .41 | 3.71 |
| 1967 | .16 | .12 | .14 | 2.64 |
| 1966 | .06 | .06 | .06 | 1.79 |
| 1965 | .02 | - | - | - |
| 1964 | - | - | - | - |

SLOPE = -.88

INCERCEPT = 8.017

r = .9985

Z = .88

F = .68

Table 11. 3Ps Cod - Calculation of F using regressions of $\ln$ of catch composition at age against age.

| AGE | Catch Composition 1976 | Catch Composition 1977 | $\ln$ 1976 | $\ln$ 1977 |
|---|---|---|---|---|
| 3 | 411 | 92 | | |
| 4 | 1212 | 949 | 7.10 | 6.87 |
| 5 | 792 | 841 | 6.67 | 6.73 |
| 6 | 288 | 328 | 5.66 | 5.79 |
| 7 | 130 | 94 | 4.87 | 4.54 |
| 8 | 50 | 40 | 3.91 | 3.69 |
| 9 | 14 | 27 | 2.64 | 3.30 |
| 10 | 5 | 12 | 1.61 | 2.48 |
| 11 | 2 | 6 | .69 | 1.79 |
| | | Slope | -.95 | -.77 |
| | | r | .996 | .991 |
| | | F | .75 | .57 |

Average F = .66

Table 12. Numbers caught at age from surveys compared with numbers obtained from the V.P.A.

| YEAR CLASS | 1 YEAR | 2 YEAR | 3 YEAR | VPA 3 YEAR |
|---|---|---|---|---|
| 1973 | 579 | - | 7855 | 5783 |
| 1972 | 20 | 1753 | - | 5310 |
| 1971 | 18 | 834 | 1745 | 3778 |
| 1970 | - | 527 | 1057 | 2776 |
| 1969 | 287 | - | 822 | 3223 |
| 1968 | 18 | 5765 | - | 5636 |
| 1967 | 174 | 1746 | 3219 | 3479 |
| 1966 | 141 | 25634 | 9512 | 5515 |
| 1965 | - | 5551 | 11601 | 7326 |
| 1964 | 885 | - | 11512 | 10014 |
| 1963 | 408 | 5062 | - | 8463 |
| 1962 | 620 | 5527 | 23002 | 8560 |
| 1961 | 68 | 3781 | 8368 | 7005 |
| 1960 | - | 1383 | 4558 | 4197 |
| Slope | 5.1941 | .4090 | .3626 | |
| Intercept | 4550 | 2.3408 | 2.3734 | |
| r | .69 | .90 | .91 | |
| df | 9 | 8 | 9 | |
| Regression | AA | LL | LL | |

Table 13. Predicted stock sizes at ages 1-3 in 1977 and 1978 based on survey abundance estimates and calculated regressions.

| SURVEY YEAR | AGE | YEAR CLASS | SURVEY ABUNDANCE | PREDICTED STOCK SIZE |
|---|---|---|---|---|
| 1977 | 1 | 1976 | 6 | 4581 |
| | 2 | 1975 | 136 | 1634 |
| | 3 | 1974 | 2197 | 3847 |
| 1976 | 1 | 1975 | 203 | 5604 |
| | 2 | 1974 | 2855 | 5677 |
| | 3 | 1973 | 1855 | 3618 |
| AVERAGE RECRUITMENT AT 3 YEARS | | | | |
| | | 1976 | 4600 | |
| | | 1975 | 3600 | |
| | | 1974 | 4800 | |
| | | 1973 | 3600 | |

Table 14. 3PS COD PROJECTION OF CATCHES at $F_{opt}$ = 0.2

NATURAL MORTALITY# 0.2000 YEAR 1977

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4600. | 92. | 0.022 | 0.550 | 2640.0 | 50.6 | 3844.4 |
| 4 | 4363. | 949. | 0.273 | 0.680 | 2966.8 | 645.3 | 2718.7 |
| 5 | 2324. | 841. | 0.505 | 1.300 | 3021.2 | 1093.3 | 1148.3 |
| 6 | 711. | 328. | 0.700 | 1.860 | 1322.5 | 610.1 | 289.1 |
| 7 | 204. | 94. | 0.699 | 2.670 | 544.7 | 251.0 | 83.0 |
| 8 | 87. | 40. | 0.697 | 3.420 | 297.5 | 136.8 | 35.5 |
| 9 | 58. | 27. | 0.709 | 4.190 | 243.0 | 113.1 | 23.4 |
| 10 | 26. | 12. | 0.700 | 4.940 | 128.4 | 59.3 | 10.6 |
| 11 | 13. | 6. | 0.700 | 5.920 | 77.0 | 35.5 | 5.3 |
| 12 | 11. | 5. | 0.685 | 6.760 | 74.4 | 33.8 | 4.5 |
| TOTAL | 12597. | 2394. | | | 11315.5 | 3028.8 | 8162.8 |

NATURAL MORTALITY# 0.2000 YEAR 1978

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 3600. | 103. | 0.032 | 0.550 | 1980.0 | 56.5 | 2854.6 |
| 4 | 3844. | 564. | 0.176 | 0.680 | 2614.2 | 383.5 | 2639.6 |
| 5 | 2719. | 687. | 0.325 | 1.300 | 3534.3 | 893.6 | 1608.3 |
| 6 | 1148. | 381. | 0.451 | 1.860 | 2135.9 | 708.0 | 598.9 |
| 7 | 289. | 96. | 0.451 | 2.670 | 771.8 | 255.8 | 150.8 |
| 8 | 83. | 28. | 0.451 | 3.420 | 283.9 | 94.1 | 43.3 |
| 9 | 35. | 12. | 0.451 | 4.190 | 148.7 | 49.3 | 18.5 |
| 10 | 23. | 8. | 0.451 | 4.940 | 115.4 | 38.3 | 12.2 |
| 11 | 11. | 4. | 0.451 | 5.920 | 62.6 | 20.7 | 5.5 |
| 12 | 5. | 2. | 0.451 | 6.760 | 35.7 | 11.8 | 2.8 |
| TOTAL | 11758. | 1883. | | | 11682.6 | 2511.8 | 7934.3 |

NATURAL MORTALITY# 0.2000 YEAR 1979

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4600. | 58. | 0.014 | 0.550 | 2530.0 | 31.9 | 3713.8 |
| 4 | 2855. | 194. | 0.078 | 0.680 | 1941.1 | 132.2 | 2161.8 |
| 5 | 2640. | 322. | 0.144 | 1.300 | 3431.4 | 418.1 | 1871.3 |
| 6 | 1608. | 265. | 0.200 | 1.860 | 2991.4 | 493.1 | 1078.1 |
| 7 | 599. | 99. | 0.200 | 2.670 | 1599.0 | 263.6 | 401.4 |
| 8 | 151. | 25. | 0.200 | 3.420 | 515.6 | 85.0 | 101.1 |
| 9 | 43. | 7. | 0.200 | 4.190 | 181.4 | 29.9 | 29.0 |
| 10 | 19. | 3. | 0.200 | 4.940 | 91.4 | 15.1 | 12.4 |
| 11 | 12. | 2. | 0.200 | 5.920 | 72.2 | 11.9 | 8.2 |
| 12 | 6. | 1. | 0.200 | 6.760 | 37.3 | 6.1 | 3.7 |
| TOTAL | 12532. | 976. | | | 13390.8 | 1486.8 | 9380.7 |

NATURAL MORTALITY# 0.2000 YEAR 1980

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3714. | 253. | 0.078 | 0.680 | 2525.4 | 172.0 | 2812.5 |
| 5 | 2162. | 263. | 0.144 | 1.300 | 2810.3 | 342.4 | 1532.6 |
| 6 | 1671. | 308. | 0.200 | 1.860 | 3480.6 | 573.7 | 1254.3 |
| 7 | 1078. | 178. | 0.200 | 2.670 | 2878.4 | 474.5 | 722.6 |
| 8 | 401. | 66. | 0.200 | 3.420 | 1372.9 | 226.3 | 269.1 |
| 9 | 101. | 17. | 0.200 | 4.190 | 423.4 | 69.8 | 67.7 |
| 10 | 29. | 5. | 0.200 | 4.940 | 143.4 | 23.6 | 19.5 |
| 11 | 12. | 2. | 0.200 | 5.920 | 73.4 | 12.1 | 8.3 |
| 12 | 8. | 1. | 0.200 | 6.760 | 55.2 | 9.1 | 5.5 |
| TOTAL | 13877. | 1150. | | | 16238.0 | 1934.7 | 10325.1 |

NATURAL MORTALITY# 0.2000 YEAR 1981

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2812. | 343. | 0.144 | 1.300 | 3656.2 | 445.5 | 1993.8 |
| 6 | 1533. | 253. | 0.200 | 1.860 | 2850.5 | 469.9 | 1027.3 |
| 7 | 1254. | 207. | 0.200 | 2.670 | 3349.1 | 552.1 | 840.8 |
| 8 | 723. | 119. | 0.200 | 3.420 | 2471.4 | 407.4 | 484.4 |
| 9 | 269. | 44. | 0.200 | 4.190 | 1127.5 | 185.9 | 180.4 |
| 10 | 68. | 11. | 0.200 | 4.940 | 334.6 | 55.2 | 45.4 |
| 11 | 19. | 3. | 0.200 | 5.920 | 115.2 | 19.0 | 13.0 |
| 12 | 8. | 1. | 0.200 | 6.760 | 56.2 | 9.3 | 5.6 |
| TOTAL | 14820. | 1285. | | | 18906.3 | 2343.5 | 10975.1 |

NATURAL MORTALITY# 0.2000 YEAR 1982

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1994. | 329. | 0.200 | 1.860 | 3708.5 | 611.3 | 1336.5 |
| 7 | 1027. | 169. | 0.200 | 2.670 | 2742.9 | 452.1 | 688.6 |
| 8 | 841. | 139. | 0.200 | 3.420 | 2875.6 | 474.0 | 563.6 |
| 9 | 484. | 80. | 0.200 | 4.190 | 2029.6 | 334.6 | 324.7 |
| 10 | 180. | 30. | 0.200 | 4.940 | 891.1 | 146.9 | 120.9 |
| 11 | 45. | 7. | 0.200 | 5.920 | 268.8 | 44.3 | 30.4 |
| 12 | 13. | 2. | 0.200 | 6.760 | 88.2 | 14.5 | 8.7 |
| TOTAL | 15470. | 1395. | | | 21126.9 | 2713.0 | 11408.4 |

Table 14
Cont'd.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1983

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1337. | 220. | 0.200 | 2.670 | 3568.5 | 588.2 | 895.9 |
| 8 | 689. | 114. | 0.200 | 3.420 | 2355.1 | 388.2 | 461.6 |
| 9 | 564. | 93. | 0.200 | 4.190 | 2361.5 | 389.3 | 377.8 |
| 10 | 325. | 54. | 0.200 | 4.940 | 1604.0 | 264.4 | 217.7 |
| 11 | 121. | 20. | 0.200 | 5.920 | 715.8 | 118.0 | 61.0 |
| 12 | 30. | 5. | 0.200 | 6.760 | 205.8 | 33.9 | 20.4 |
| TOTAL | 15900. | 1466. | | | 22960.8 | 3015.3 | 11696.7 |

NATURAL MORTALITY# 0.2000 YEAR 1984

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 896. | 148. | 0.200 | 3.420 | 3063.9 | 505.1 | 600.5 |
| 9 | 462. | 76. | 0.200 | 4.190 | 1934.1 | 318.8 | 309.4 |
| 10 | 378. | 62. | 0.200 | 4.940 | 1866.3 | 307.6 | 253.2 |
| 11 | 218. | 36. | 0.200 | 5.920 | 1288.5 | 212.4 | 145.9 |
| 12 | 81. | 13. | 0.200 | 6.760 | 547.9 | 90.3 | 54.3 |
| TOTAL | 16176. | 1512. | | | 24341.7 | 3242.9 | 11882.1 |

NATURAL MORTALITY# 0.2000 YEAR 1985

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 876. | 144. | 0.200 | 3.420 | 2997.3 | 494.1 | 587.5 |
| 9 | 601. | 99. | 0.200 | 4.190 | 2516.2 | 414.8 | 402.5 |
| 10 | 309. | 51. | 0.200 | 4.940 | 1528.5 | 252.0 | 207.4 |
| 11 | 253. | 42. | 0.200 | 5.920 | 1499.2 | 247.1 | 169.8 |
| 12 | 146. | 24. | 0.200 | 6.760 | 986.3 | 162.6 | 97.8 |
| TOTAL | 16328. | 1537. | | | 25168.5 | 3379.2 | 11983.7 |

NATURAL MORTALITY# 0.2000 YEAR 1986

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 876. | 144. | 0.200 | 3.420 | 2997.3 | 494.1 | 587.5 |
| 9 | 587. | 97. | 0.200 | 4.190 | 2461.5 | 405.8 | 393.8 |
| 10 | 403. | 66. | 0.200 | 4.940 | 1988.6 | 327.8 | 269.8 |
| 11 | 207. | 34. | 0.200 | 5.920 | 1227.9 | 202.4 | 139.0 |
| 12 | 170. | 28. | 0.200 | 6.760 | 1147.6 | 189.2 | 113.8 |
| TOTAL | 16386. | 1546. | | | 25463.8 | 3427.9 | 12022.6 |

Table 15.3PS COD PROJECTION OF CATCHES at $F_{max}$ = 0.30.

NATURAL MORTALITY# 0.2000 YEAR 1977

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4800. | 92. | 0.022 | 0.550 | 2640.0 | 50.6 | 3844.4 |
| 4 | 4363. | 949. | 0.273 | 0.680 | 2966.8 | 645.3 | 2718.7 |
| 5 | 2324. | 841. | 0.505 | 1.300 | 3021.2 | 1093.3 | 1148.3 |
| 6 | 711. | 328. | 0.700 | 1.860 | 1322.5 | 610.1 | 289.1 |
| 7 | 204. | 94. | 0.699 | 2.670 | 544.7 | 251.0 | 83.0 |
| 8 | 87. | 40. | 0.697 | 3.420 | 297.5 | 136.8 | 35.5 |
| 9 | 58. | 27. | 0.709 | 4.190 | 243.0 | 113.1 | 23.4 |
| 10 | 26. | 12. | 0.700 | 4.940 | 128.4 | 59.3 | 10.6 |
| 11 | 13. | 6. | 0.700 | 5.920 | 77.0 | 35.5 | 5.3 |
| 12 | 11. | 5. | 0.685 | 6.760 | 74.4 | 33.8 | 4.5 |
| TOTAL | 12597. | 2394. | | | 11315.5 | 3028.8 | 8162.8 |

NATURAL MORTALITY# 0.2000 YEAR 1978

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 3600. | 103. | 0.032 | 0.550 | 1980.0 | 56.5 | 2854.6 |
| 4 | 3844. | 564. | 0.176 | 0.680 | 2614.2 | 383.5 | 2639.6 |
| 5 | 2719. | 687. | 0.325 | 1.300 | 3534.3 | 893.6 | 1608.3 |
| 6 | 1148. | 381. | 0.451 | 1.860 | 2135.9 | 708.0 | 598.9 |
| 7 | 289. | 96. | 0.451 | 2.670 | 771.8 | 255.8 | 150.8 |
| 8 | 83. | 28. | 0.451 | 3.420 | 283.9 | 94.1 | 43.3 |
| 9 | 35. | 12. | 0.451 | 4.190 | 148.7 | 49.3 | 18.5 |
| 10 | 23. | 8. | 0.451 | 4.940 | 115.4 | 38.3 | 12.2 |
| 11 | 11. | 4. | 0.451 | 5.920 | 62.6 | 20.7 | 5.5 |
| 12 | 5. | 2. | 0.451 | 6.760 | 35.7 | 11.8 | 2.8 |
| TOTAL | 11758. | 1883. | | | 11682.6 | 2511.8 | 7934.3 |

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1979

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4600. | 87. | 0.021 | 0.550 | 2530.0 | 47.7 | 3687.9 |
| 4 | 2855. | 286. | 0.117 | 0.680 | 1941.1 | 194.6 | 2079.1 |
| 5 | 2640. | 466. | 0.216 | 1.300 | 3431.4 | 606.4 | 1741.3 |
| 6 | 1608. | 380. | 0.300 | 1.860 | 2991.4 | 706.2 | 975.5 |
| 7 | 599. | 141. | 0.300 | 2.670 | 1599.0 | 377.5 | 363.2 |
| 8 | 151. | 36. | 0.300 | 3.420 | 515.6 | 121.7 | 91.4 |
| 9 | 43. | 10. | 0.300 | 4.190 | 181.4 | 42.8 | 26.3 |
| 10 | 19. | 4. | 0.300 | 4.940 | 91.4 | 21.6 | 11.2 |
| 11 | 12. | 3. | 0.300 | 5.920 | 72.2 | 17.0 | 7.4 |
| 12 | 6. | 1. | 0.300 | 6.760 | 37.3 | 8.8 | 3.3 |
| TOTAL | 12532. | 1415. | | | 13390.8 | 2144.3 | 8986.6 |

NATURAL MORTALITY# 0.2000 YEAR 1980

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3688. | 370. | 0.117 | 0.680 | 2507.8 | 251.5 | 2686.0 |
| 5 | 2079. | 367. | 0.216 | 1.300 | 2702.8 | 477.6 | 1371.5 |
| 6 | 1741. | 411. | 0.300 | 1.860 | 3238.8 | 764.6 | 1056.1 |
| 7 | 975. | 230. | 0.300 | 2.670 | 2604.5 | 614.9 | 591.7 |
| 8 | 363. | 86. | 0.300 | 3.420 | 1242.3 | 293.3 | 220.3 |
| 9 | 91. | 22. | 0.300 | 4.190 | 383.1 | 90.5 | 55.5 |
| 10 | 26. | 6. | 0.300 | 4.940 | 129.7 | 30.6 | 15.9 |
| 11 | 11. | 3. | 0.300 | 5.920 | 66.4 | 15.7 | 6.8 |
| 12 | 7. | 2. | 0.300 | 6.760 | 50.0 | 11.8 | 4.5 |
| TOTAL | 13483. | 1561. | | | 15400.4 | 2597.0 | 9616.0 |

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1981

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2686. | 475. | 0.216 | 1.300 | 3491.8 | 617.0 | 1771.9 |
| 6 | 1372. | 324. | 0.300 | 1.860 | 2551.1 | 602.3 | 831.9 |
| 7 | 1056. | 249. | 0.300 | 2.670 | 2819.9 | 665.7 | 640.6 |
| 8 | 592. | 140. | 0.300 | 3.420 | 2023.4 | 477.7 | 358.9 |
| 9 | 220. | 52. | 0.300 | 4.190 | 923.1 | 217.9 | 133.6 |
| 10 | 55. | 13. | 0.300 | 4.940 | 274.0 | 64.7 | 33.6 |
| 11 | 16. | 4. | 0.300 | 5.920 | 94.3 | 22.3 | 9.7 |
| 12 | 7. | 2. | 0.300 | 6.760 | 46.0 | 10.9 | 4.1 |
| TOTAL | 14112. | 1704. | | | 17151.8 | 2971.1 | 10019.6 |

NATURAL MORTALITY# 0.2000 YEAR 1982

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2626. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1772. | 418. | 0.300 | 1.860 | 3295.7 | 778.1 | 1074.7 |
| 7 | 832. | 196. | 0.300 | 2.670 | 2221.1 | 524.4 | 504.6 |
| 8 | 641. | 151. | 0.300 | 3.420 | 2190.8 | 517.2 | 388.5 |
| 9 | 359. | 85. | 0.300 | 4.190 | 1503.6 | 355.0 | 217.7 |
| 10 | 134. | 32. | 0.300 | 4.940 | 660.1 | 155.8 | 81.0 |
| 11 | 34. | 8. | 0.300 | 5.920 | 199.1 | 47.0 | 20.4 |
| 12 | 10. | 2. | 0.300 | 6.760 | 65.3 | 15.4 | 5.9 |
| TOTAL | 14515. | 1803. | | | 18479.9 | 3289.1 | 10261.5 |

Table 15
Cont'd.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1983

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1075. | 254. | 0.300 | 2.670 | 2869.5 | 677.4 | 651.8 |
| 8 | 505. | 119. | 0.300 | 3.420 | 1725.6 | 407.4 | 306.0 |
| 9 | 389. | 92. | 0.300 | 4.190 | 1627.9 | 384.3 | 235.7 |
| 10 | 218. | 51. | 0.300 | 4.940 | 1075.2 | 253.8 | 132.0 |
| 11 | 81. | 19. | 0.300 | 5.920 | 479.8 | 113.3 | 49.2 |
| 12 | 20. | 5. | 0.300 | 6.760 | 137.9 | 32.6 | 12.4 |
| TOTAL | 14756. | 1860. | | | 19484.2 | 3526.2 | 10407.2 |

NATURAL MORTALITY# 0.2000 YEAR 1984

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 652. | 154. | 0.300 | 3.420 | 2229.3 | 526.3 | 395.4 |
| 9 | 306. | 72. | 0.300 | 4.190 | 1282.3 | 302.7 | 185.6 |
| 10 | 236. | 56. | 0.300 | 4.940 | 1164.1 | 274.6 | 142.9 |
| 11 | 132. | 31. | 0.300 | 5.920 | 781.5 | 184.5 | 80.1 |
| 12 | 49. | 12. | 0.300 | 6.760 | 332.3 | 78.5 | 29.8 |
| TOTAL | 14895. | 1893. | | | 20164.9 | 3686.9 | 10491.5 |

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1985

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 638. | 151. | 0.300 | 3.420 | 2180.9 | 514.9 | 386.8 |
| 9 | 395. | 93. | 0.300 | 4.190 | 1656.6 | 391.1 | 239.8 |
| 10 | 186. | 44. | 0.300 | 4.940 | 917.0 | 216.5 | 112.6 |
| 11 | 143. | 34. | 0.300 | 5.920 | 846.2 | 199.8 | 86.7 |
| 12 | 80. | 19. | 0.300 | 6.760 | 541.3 | 127.8 | 48.6 |
| TOTAL | 14962. | 1909. | | | 20517.2 | 3770.1 | 10532.2 |

NATURAL MORTALITY# 0.2000 YEAR 1986

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 638. | 151. | 0.300 | 3.420 | 2180.9 | 514.9 | 386.8 |
| 9 | 387. | 91. | 0.300 | 4.190 | 1620.6 | 382.6 | 234.6 |
| 10 | 240. | 57. | 0.300 | 4.940 | 1184.6 | 279.7 | 145.4 |
| 11 | 113. | 27. | 0.300 | 5.920 | 666.5 | 157.3 | 68.3 |
| 12 | 87. | 20. | 0.300 | 6.760 | 586.0 | 138.4 | 52.6 |
| TOTAL | 14984. | 1914. | | | 20613.9 | 3792.9 | 10545.4 |

Table 16. Catch per hour (Can.(N) OT, 501-900 t), total catch and total effort expended in the 3Ps cod fishery.

| Year | Catch/Hour | Catch | Effort ('000s hrs) | Effort (Moving Average) 2-year | 3-year |
|---|---|---|---|---|---|
| 1965 | .699 | 51,400 | 73.5 | | |
| 1966 | .874 | 65,749 | 75.2 | 74.4 | |
| 1967 | .744 | 62,393 | 83.9 | 79.6 | 77.5 |
| 1968 | .723 | 77,217 | 106.8 | 95.4 | 88.6 |
| 1969 | .798 | 63,103 | 79.1 | 93.0 | 89.9 |
| 1970 | .625 | 76,161 | 121.9 | 100.5 | 102.6 |
| 1971 | .630 | 63,967 | 101.5 | 111.7 | 100.8 |
| 1972 | .548 | 44,323 | 80.9 | 91.2 | 101.4 |
| 1973 | .530 | 52,641 | 99.3 | 90.1 | 93.9 |
| 1974 | .535 | 44,877 | 87.3 | 93.3 | 89.2 |
| 1975 | .204 | 35,373 | 173.4 | 130.4 | 120.0 |
| 1976 | .415 | 37,133 | 89.5 | 131.4 | 116.7 |
| 1977 | .314 | 32,376 | 103.1 | 96.3 | 122.0 |

| | | |
|---|---|---|
| Slope | -.0079 | -.0110 |
| Intercept | 1.3624 | 1.6527 |
| r | -.7051 | -.8618 |
| MSY | 59 | 62 |
| E MSY | 86 | 75 |

Table 17. Catch per hour (Can (N) OT-5, standard), total catch and total effort expended in the 3Ps cod fishery.

| Year | CPUE | Catch | Effort | YEARS 2 | YEARS 3 |
|---|---|---|---|---|---|
| 1960 | .827 | 77,775 | 94.0 | | |
| 1961 | .859 | 86,211 | 100.4 | 97.2 | |
| 1962 | .412 | 55,266 | 134.1 | 117.2 | 109.5 |
| 1963 | .578 | 50,051 | 86.6 | 110.4 | 107.0 |
| 1964 | .518 | 53,956 | 104.2 | 95.4 | 108.3 |
| 1965 | .792 | 51,400 | 68.9 | 86.6 | 86.6 |
| 1966 | .863 | 65,749 | 75.7 | 72.3 | 82.9 |
| 1967 | .529 | 62,393 | 97.9 | 86.8 | 80.8 |
| 1968 | .707 | 77,217 | 108.0 | 103.0 | 93.9 |
| 1969 | .899 | 63,103 | 74.3 | 91.2 | 93.4 |
| 1970 | .529 | 76,161 | 132.0 | 103.2 | 104.8 |
| 1971 | .582 | 63,967 | 105.6 | 118.8 | 104.0 |
| 1972 | .815 | 44,323 | 65.0 | 85.3 | 100.9 |
| 1973 | .381 | 52,641 | 115.4 | 90.2 | 95.3 |
| 1974 | .438 | 44,877 | 92.2 | 103.8 | 90.9 |
| 1975 | .439 | 35,373 | 109.9 | 101.0 | 105.8 |
| 1976 | .398 | 37,133 | 91.2 | 100.6 | 97.8 |
| 1977 | .275 | 32,376 | 109.7 | 100.4 | 103.6 |

| | | |
|---|---|---|
| M | -.0080 | -.0090 |
| Intercept | 1.3728 | 1.4548 |
| r | -.4838 | -.4342 |
| MSY | 59 | 59 |
| E MSY | 86 | 81 |

Table 18. Catch per hour [Can (N) OT-4 (monthly adjusted)], catch and total effort expended in the 3Ps cod fishery.

| YEAR | CPUE | CATCH | EFFORT | 2 | 3 |
|---|---|---|---|---|---|
| 1960 | .750 | 77775 | 103.7 | - | - |
| 61 | .779 | 85211 | 110.7 | 107.2 | - |
| 62 | .789 | 55266 | 70.0 | 90.4 | 94.8 |
| 63 | .561 | 50051 | 89.2 | 79.6 | 90.0 |
| 64 | .417 | 53956 | 129.4 | 109.3 | 96.2 |
| 65 | .707 | 51400 | 72.7 | 101.0 | 97.1 |
| 66 | .707 | 65749 | 93.0 | 82.8 | 98.4 |
| 67 | .434 | 62393 | 143.8 | 118.4 | 103.2 |
| 68 | .687 | 77217 | 112.4 | 128.1 | 116.4 |
| 69 | .823 | 63103 | 76.7 | 94.6 | 111.0 |
| 1970 | .450 | 76161 | 169.2 | 123.0 | 119.4 |
| 71 | .578 | 63967 | 110.7 | 140.0 | 118.9 |
| 72 | .753 | 44323 | 58.9 | 84.8 | 112.9 |
| 73 | .302 | 52641 | 174.3 | 116.6 | 114.6 |
| 74 | .353 | 44877 | 127.1 | 150.7 | 120.1 |
| 75 | .429 | 35373 | 82.5 | 104.8 | 128.0 |
| 76 | .310 | 37133 | 119.8 | 101.1 | 109.8 |
| 77 | .179 | 32376 | 180.9 | 150.4 | 127.7 |
| | | | M | -.0052 | -.0074 |
| | | | INTERCEPT | 1.1236 | 1.3431 |
| | | | r | -.5788 | -.4476 |
| | | | MSY | 61 | 61 |
| | | | EMSY | 108 | 91 |

Table 19. Catch per hour [Can (N) OT-4], catch and total effort expended in the 3Ps cod fishery.

| YEAR | CPUE | CATCH | EFFORT | 2 | 3 |
|---|---|---|---|---|---|
| 1960 | .780 | 77775 | 99.7 | - | - |
| 61 | .810 | 86211 | 106.4 | 103.0 | - |
| 62 | .389 | 55266 | 142.1 | 124.2 | 116.1 |
| 63 | .546 | 55051 | 91.7 | 116.9 | 113.4 |
| 64 | .489 | 53956 | 110.3 | 101.0 | 114.7 |
| 65 | .747 | 51400 | 68.8 | 89.6 | 90.3 |
| 66 | .814 | 65749 | 80.8 | 74.8 | 86.6 |
| 67 | .499 | 62393 | 125.0 | 102.9 | 91.5 |
| 68 | .667 | 77217 | 115.8 | 102.4 | 107.2 |
| 69 | .848 | 63103 | 74.4 | 95.1 | 105.1 |
| 1970 | .499 | 76161 | 152.6 | 113.5 | 114.3 |
| 71 | .549 | 63967 | 116.5 | 134.6 | 114.5 |
| 72 | .769 | 44323 | 57.6 | 87.0 | 108.9 |
| 73 | .359 | 52641 | 146.6 | 102.1 | 106.9 |
| 74 | .413 | 44877 | 113.1 | 129.8 | 105.8 |
| 75 | .414 | 35373 | 90.3 | 101.7 | 116.7 |
| 76 | .375 | 37133 | 99.0 | 94.6 | 100.8 |
| 77 | .259 | 32376 | 125.0 | 112.0 | 104.8 |
| | | | M | -.0056 | -.0073 |
| | | | INTERCEPT | 1.1451 | 1.3123 |
| | | | r | -.4777 | -.3872 |
| | | | MSY | 59 | 59 |
| | | | EMSY | 102 | 90 |

Table 20. Catch per hour (Spanish PT, 151-500 tons), total catch and total effort expended in the 3Ps cod fishery.

| Year | Catch/hour | Catch | Effort | Effort (Moving Average) 2-year | 3-year |
|---|---|---|---|---|---|
| 1960 | 1.06 | 77,775 | 73,373 | | |
| 1961 | 0.980 | 86,211 | 87,970 | 80,672 | |
| 1962 | 1.01 | 55,266 | 54,719 | 71,345 | 72,021 |
| 1963 | 1.05 | 50,051 | 47,668 | 51,194 | 63,452 |
| 1964 | 1.48 | 53,956 | 36,457 | 42,063 | 46,281 |
| 1965 | 1.55 | 51,400 | 33,161 | 34,809 | 39,095 |
| 1966 | 1.56 | 65,749 | 42,147 | 37,654 | 37,255 |
| 1967 | 1.31 | 62,393 | 47,628 | 44,888 | 40,979 |
| 1968 | 1.75 | 77,217 | 44,124 | 45,876 | 44,633 |
| 1969 | 1.63 | 63,103 | 38,713 | 41,419 | 43,488 |
| 1970 | 1.36 | 76,161 | 56,001 | 47,357 | 46,279 |
| 1971 | 1.28 | 63,967 | 49,974 | 52,988 | 48,229 |
| 1972 | 1.04 | 44,323 | 42,618 | 46,296 | 49,531 |
| 1973 | 0.852 | 52,641 | 61,785 | 52,202 | 51,459 |
| 1974 | 0.504 | 46,706 | 92,671 | 77,228 | 65,691 |
| 1975 | 0.783 | 35,373 | 45,176 | 68,924 | 66,544 |
| 1976 | 1.21 | 37,133 | 30,688 | 37,932 | 56,178 |
| 1977 | | 32,376 | | | |
| | | | MSY | 64 | 63 |
| | | | E MSY | 60 | 50 |
| | | | Slope | -.0180 | -.0252 |
| | | | Intercept | 2.1463 | 2.5193 |
| | | | r | .76 | .78 |

Table 21. Catch per hour (Spain PT 151-500, monthly adjusted), catch and total effort expended in the 3Ps cod fishery.

| Year | Spain 151-500 CPUE | Catch | Effort | YEARS 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 1960 | .978 | 77,775 | 79,525 | | | | |
| 1961 | 1.044 | 86,211 | 82,578 | 81,052 | | | |
| 1962 | .920 | 55,266 | 60,072 | 71,325 | 74,058 | | |
| 1963 | .930 | 50,051 | 53,818 | 56,946 | 65,489 | 68,998 | |
| 1964 | 1.042 | 53,956 | 51,781 | 52,800 | 55,224 | 62,062 | 65,555 |
| 1965 | 1.001 | 51,400 | 51,349 | 51,565 | 52,316 | 54,255 | 59,920 |
| 1966 | 1.307 | 65,749 | 50,305 | 50,827 | 51,145 | 51,813 | 53,465 |
| 1967 | 1.203 | 62,393 | 51,865 | 51,085 | 51,173 | 51,325 | 51,824 |
| 1968 | 1.451 | 77,217 | 53,216 | 52,540 | 51,795 | 51,684 | 51,703 |
| 1969 | 1.408 | 63,103 | 44,817 | 49,016 | 49,966 | 50,051 | 50,310 |
| 1970 | 1.186 | 76,161 | 64,217 | 54,517 | 54,083 | 53,529 | 52,884 |
| 1971 | 1.192 | 63,967 | 53,664 | 58,940 | 54,233 | 53,979 | 53,556 |
| 1972 | .913 | 44,323 | 48,547 | 51,106 | 55,476 | 52,811 | 52,892 |
| 1973 | .691 | 52,641 | 76,181 | 62,364 | 59,464 | 60,652 | 57,485 |
| 1974 | .434 | 46,706 | 107,618 | 91,900 | 77,449 | 71,503 | 70,045 |
| 1975 | .541 | 35,373 | 65,384 | 86,501 | 83,061 | 74,433 | 70,279 |
| 1976 | .963 | 37,133 | 38,560 | 51,972 | 70,521 | 71,936 | 67,258 |
| 1977 | | 32,376 | | | | | |
| | | | M | -.0150 | -.0219 | -.0270 | -.0333 |
| | | | b | 1.9254 | 2.3362 | 2.6198 | 2.9674 |
| | | | r | -.7322 | -.8100 | -.7888 | -.7868 |
| | | | df | 14 | 13 | 12 | 11 |
| | | | MSY | 62 | 62 | 64 | 66 |
| | | | E MSY | 64 | 53 | 49 | 45 |

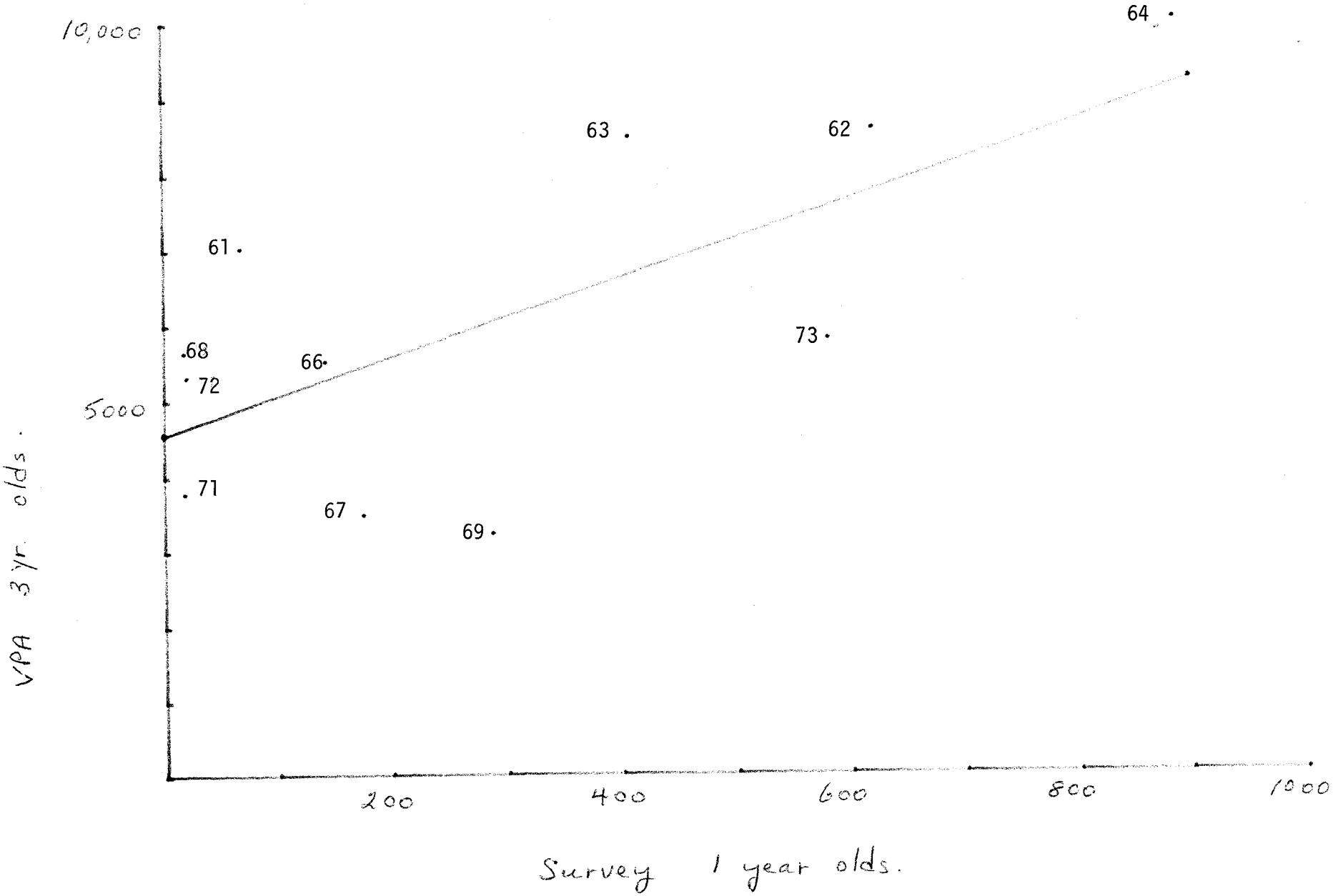


Fig. 1. Relationship of VPA 3-yr-olds to survey 1-yr-olds for cod in Subdivision 3Ps, 1961-73.

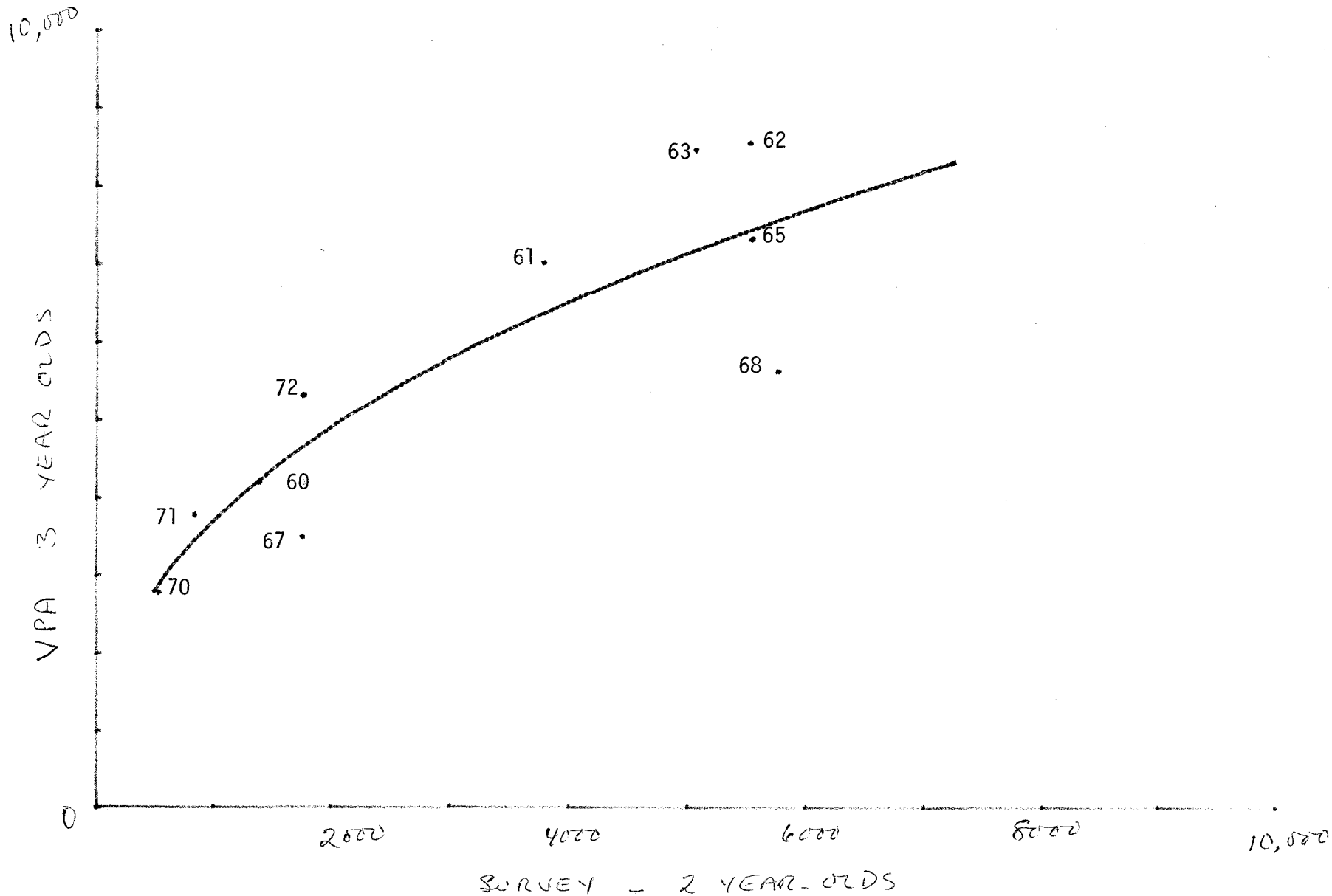


Fig. 2. Relationship of VPA 3-yr-olds to survey 2 yr-olds for cod in Subdivision 3Ps, 1961-73.

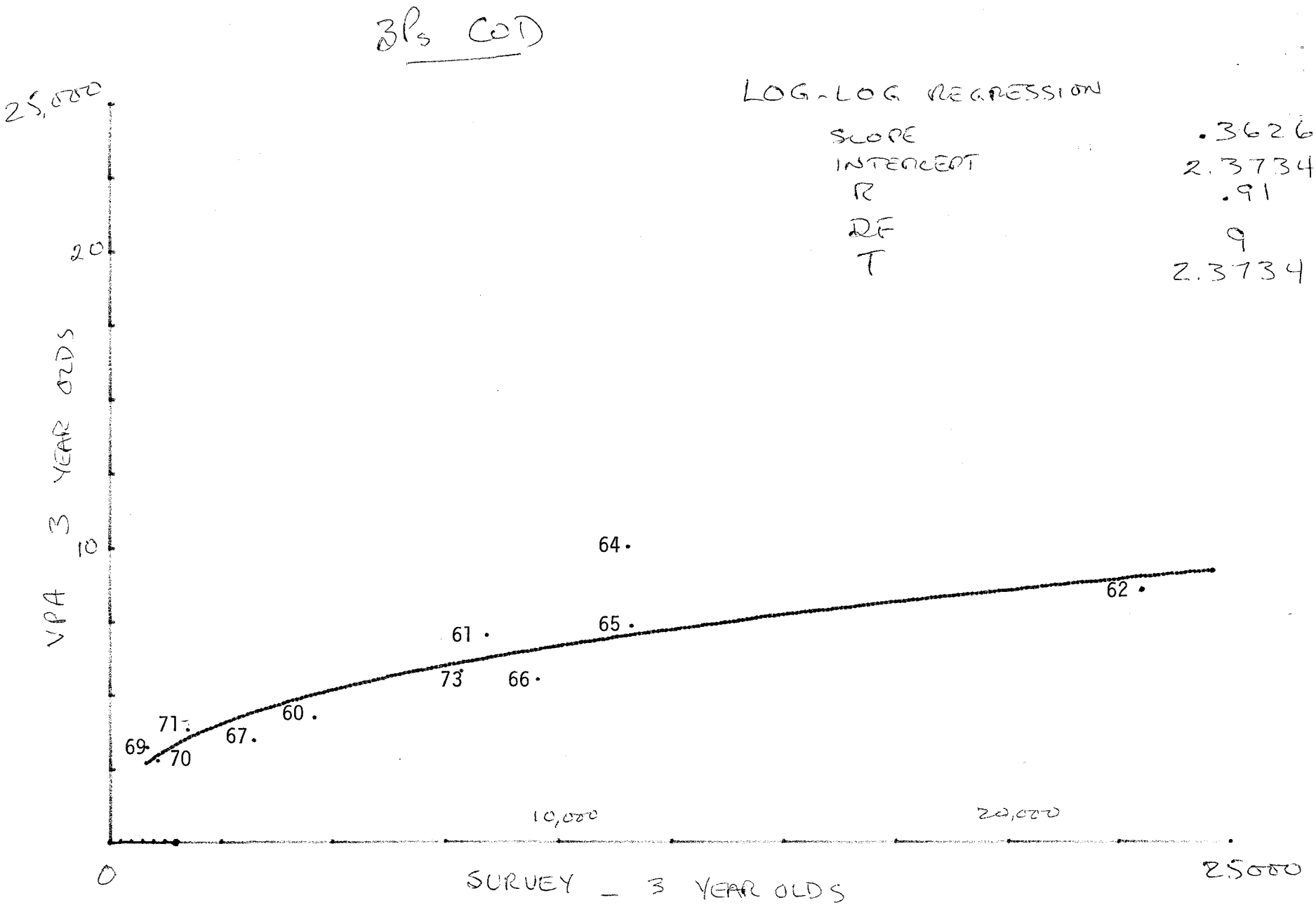


Fig. 3. Relationship of VPA 3-yr-olds to survey 3-yr-olds in Subdivision 3Ps Cod, 1961-73.

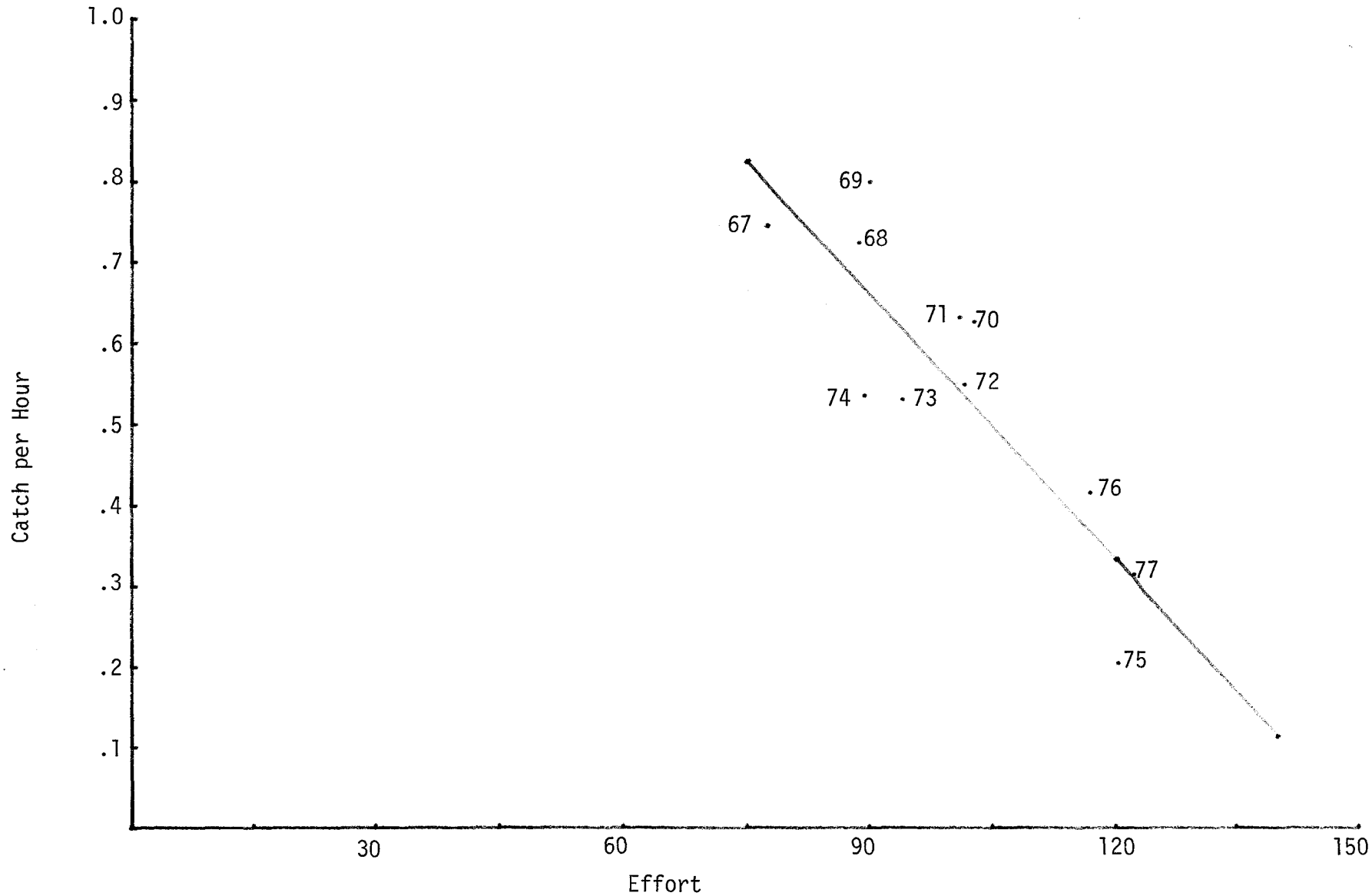


Fig. 4. Relationship of catch per hour and effort (3-year moving average) expended in the cod fishery in ICNAF Subdivision 3Ps (Can (N) OT-5).

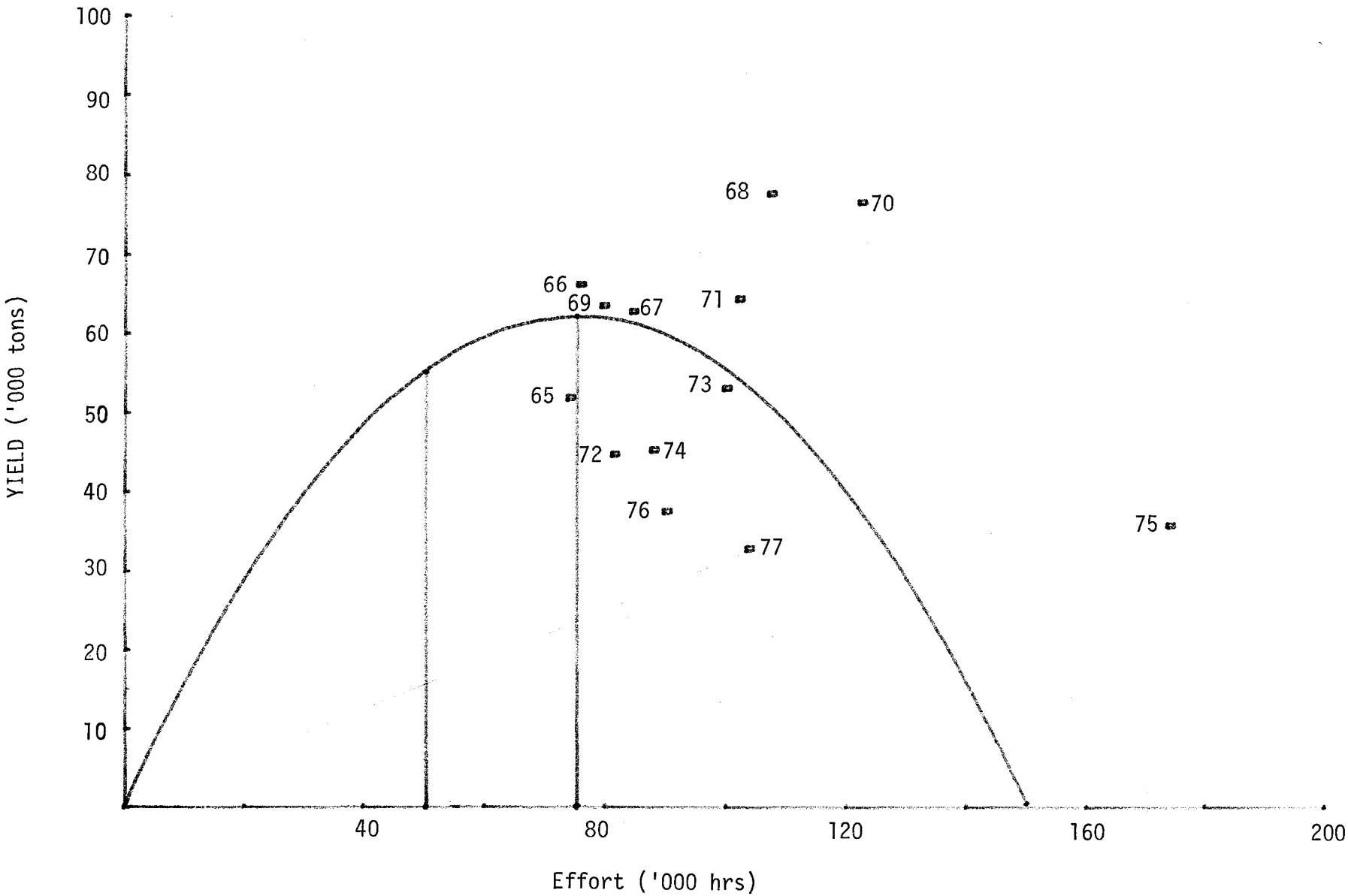


Fig. 5. Yield curve - Subdivision 3Ps cod.

ADDENDUM 1

CAFSAC Res. Doc. 78/18

# Additional and revised data pertaining to the 3Ps cod stock

by

C.A. Bishop
Department of Fisheries and Environment
Fisheries and Marine Service
Research and Resource Services
St. John's, Newfoundland

International Commission for the Northwest Atlantic Fisheries

Serial No. 5037
(D.c.3)

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# Cod stock evaluation - Div. 3NO

by

C.A. Bishop
Department of Fisheries and Environment
Fisheries and Marine Service
Research and Resource Services
St. John's, Newfoundland

Sampling data for cod from subdivision 3NO during 1976 proved very scanty. Otter trawl samples were available for the 2nd and 3rd quarters from Can. (N) in Subdivision 3Ø. With catches for those two quarters totalling only 1057 tons from a fishery directed toward species other than cod, there was little material available to provide a determination of total numbers at age.

Several methods involving evaluation of trends in the fishery were attempted to provide some indication of stock abundance changes. These methods essentially involved comparisons of different biomass estimates from stratified-random research cruises in Subdivision 3N (1971-76) with catch-per-unit-effort data from the Spanish pair trawler fishery (tons class 4; 151-500 tons) for the period 1971-75. The different methods used are as follows:

## Method 1

For the years 1971-76 biomass estimates in numbers of fish were compared in strata with at least 3 years of data (Table 1). Strata which had continuous data(361,362) (for each of the 6 years) were used to obtain estimates for strata which had not been fished in a particular year. These estimates were obtained by; totalling the numbers in each stratum for which there was continuous data (Table 1.), totalling numbers from each incomplete stratum (eg. 845 + 639 + 4709 in stratum 359, Table 1 ) and dividing by the corresponding years total in the continuous data years (i.e. 18121 + 1870 + 1744) to obtain a ratio (eg. .285 in stratum 359). This ratio was applied to the total per year obtained from strata with contimuous data (eg. 9326 in 1971) to provide an estimate in that year for the stratum which had no data (i.e. 9326 X .285 = 2657, an estimate of biomass for stratum 359 in 1971). Estimates were thus obtained for all strata which had incomplete survey data (Table 2). An average number of fish per year for all these strata was obtained and this was compared with seasonally adjusted Spanish PT, catch-per-unit-effort from 1971-75 (Table 2; Fig. 1.)

## Method 2

Using the same raw data as presented in Table 1, estimates of numbers present in strata where no fishing had been done were accomplished by using the areas (in sq. miles) involved with each strata (Table 3). For each year the totals for strata which had data (eg. 34606 in 1971; Table 1) were divided by the total area for the same strata. The ratios of numbers per unit area were used to obtain estimates for strata with missing data by multiplying the ratio by the stratum area for the particular year. (eg. ratio 1971=3.097; estimates for strata 359, 360, etc. = 1304, 9265 etc.) Estimates were thus obtained for all strata with missing data (Table 3.) Average numbers per year were obtained and this was compared with a seasonally adjusted Spanish PT. CPUE from 1971-75 (Fig. 2).

Method 3

Average numbers of fish per year were obtained from strata which provided a contimuous series of data from 1971-75. In this case only strata 361 and 362 could be used. These averages were plotted against Spanish PT - CPUE from 1971-75 (Fig. 3).

Method 4

In this method all biomass estimates as shown in Table 1 were adjusted to a standard - that of strata 362. As such, determining values for strata with no data available in some years was not considered. Conversion factors obtained per stratum and the average values that resulted per year are shown in Table 2. Similarly these average values were plotted against Spanish PT - CPUE from 1971-75 (Fig. 4).

Table 1. The relationship of VPA biomass estimates to survey biomass estimates.

| Year | VPA Biomass 3-12 | Survey Biomass (Methods 1-4) |
|---|---|---|
| 1972 | 17,901 | 217 |
| 1973 | 16,675 | 190 |
| 1974 | 13,919 | 161 |
| 1975 | 11,815 | 88 |
| 1976 | 10,874 | 112 |
| 1977 | 11,370 | 98 |
| 1978 | (13,104) | 132 |

| | |
|---|---|
| Slope | .0536 |
| Intercept | 6.0289 |
| r | .96 |
| df | 4 |

Table 2. Relationship of Can (N) OT-5 CPUE and VPA biomass estimates (3-12) along with the relationship of weighted F to total effort (based on Can (N) OT-5).

| Year | Can (N) OT-5 CPUE | VPA Biomass 3 - 12 | Weighted F | Total Effort (Can (N) OT-5) |
|---|---|---|---|---|
| 1965 | .699 | 22,624 | .46 | 73.5 |
| 1966 | .874 | 24,153 | .67 | 75.2 |
| 1967 | .744 | 24,226 | .51 | 83.9 |
| 1968 | .723 | 25,259 | .48 | 106.8 |
| 1969 | .798 | 25,654 | .55 | 79.1 |
| 1970 | .625 | 24,403 | .70 | 121.9 |
| 1971 | .630 | 22,256 | .73 | 101.5 |
| 1972 | .548 | 17,901 | .55 | 80.9 |
| 1973 | .530 | 16,675 | .60 | 99.3 |
| 1974 | .535 | 13,919 | .96 | 87.3 |
| 1975 | .204 | 11,815 | 1.04 | 173.4 |
| 1976 | .415 | 10,874 | .69 | 89.5 |
| 1977 | .314 | 11,370 | | |
| Slope | .0301 | | .0042 | |
| Inter cept | .0052 | | .2540 | |
| r | .90 | | .64 | |
| df | 11 | | 10 | |
| regression | AA | | AA | |

Table 3. 3Ps cod catch and population projections (1979-86) assuming TAC's of 25,000 tons in 1979-82 and a $F_{opt}$ (0.2) fishing mortality from 1983-86.

NATURAL MORTALITY=0.200

| AGE | MEAN WT. | SELECTION | POPULATION NUMBERS |
|---|---|---|---|
| 3 | 0.550 | 0.070 | 4900.000 |
| 4 | 0.680 | 0.390 | 4363.000 |
| 5 | 1.300 | 0.720 | 2324.000 |
| 6 | 1.860 | 1.000 | 711.000 |
| 7 | 2.670 | 1.000 | 204.000 |
| 8 | 3.420 | 1.000 | 87.000 |
| 9 | 4.190 | 1.000 | 58.000 |
| 10 | 4.940 | 1.000 | 26.000 |
| 11 | 5.920 | 1.000 | 13.000 |
| 12 | 6.760 | 1.000 | 11.000 |

RESULTS FOR YEAR 1977

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4900.0 | 2695.0 | 0.0489 | 212.0 | 116.6 | 3820.5 | 2101.2 |
| 4 | 4363.0 | 2966.8 | 0.2730 | 949.0 | 645.3 | 2718.7 | 1848.7 |
| 5 | 2324.0 | 3021.2 | 0.5034 | 840.1 | 1092.1 | 1150.2 | 1495.2 |
| 6 | 711.0 | 1322.5 | 0.6995 | 328.0 | 610.1 | 289.2 | 537.9 |
| 7 | 204.0 | 544.7 | 0.6983 | 94.0 | 251.0 | 83.1 | 221.8 |
| 8 | 87.0 | 297.5 | 0.6961 | 40.0 | 136.8 | 35.5 | 121.4 |
| 9 | 58.0 | 243.0 | 0.6717 | 26.0 | 108.9 | 24.3 | 101.6 |
| 10 | 26.0 | 128.4 | 0.7000 | 12.0 | 59.3 | 10.6 | 52.2 |
| 11 | 13.0 | 77.0 | 0.7000 | 6.0 | 35.5 | 5.3 | 31.3 |
| 12 | 11.0 | 74.4 | 0.6849 | 5.0 | 33.8 | 4.5 | 30.7 |
| TOTAL | 12697. | 11370. | | 2512. | 3089. | 8142. | 6542. |

RESULTS FOR YEAR 1978

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4300.0 | 2365.0 | 0.0311 | 119.4 | 65.7 | 3412.7 | 1877.0 |
| 4 | 3820.5 | 2597.9 | 0.1733 | 552.5 | 375.7 | 2630.3 | 1788.6 |
| 5 | 2718.7 | 3534.4 | 0.3199 | 678.2 | 881.7 | 1616.5 | 2101.5 |
| 6 | 1150.2 | 2139.8 | 0.4443 | 376.7 | 700.7 | 683.9 | 1123.2 |
| 7 | 289.2 | 772.2 | 0.4443 | 94.7 | 252.9 | 151.8 | 405.4 |
| 8 | 83.1 | 284.1 | 0.4443 | 27.2 | 93.1 | 43.6 | 149.2 |
| 9 | 35.5 | 148.8 | 0.4443 | 11.6 | 48.7 | 18.6 | 78.1 |
| 10 | 24.3 | 119.8 | 0.4443 | 7.9 | 39.3 | 12.7 | 62.9 |
| 11 | 10.6 | 62.6 | 0.4443 | 3.5 | 20.5 | 5.6 | 32.9 |
| 12 | 9.8 | 66.4 | 0.4443 | 3.2 | 21.8 | 5.2 | 34.9 |
| TOTAL | 12442. | 12091. | | 1875. | 2500. | 8501. | 7654. |

Table 3. (cont'd)



RESULTS FOR YEAR 1979

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4200.0 | 2310.0 | 0.0244 | 91.7 | 50.5 | 3355.8 | 1845.7 |
| 4 | 3412.7 | 2320.7 | 0.1359 | 393.9 | 267.8 | 2439.1 | 1658.6 |
| 5 | 2630.3 | 3419.4 | 0.2508 | 531.1 | 690.4 | 1675.7 | 2178.4 |
| 6 | 1616.5 | 3006.7 | 0.3484 | 433.5 | 806.3 | 934.1 | 1737.5 |
| 7 | 603.9 | 1612.3 | 0.3484 | 161.9 | 432.4 | 349.0 | 931.7 |
| 8 | 151.8 | 519.3 | 0.3484 | 40.7 | 139.3 | 87.7 | 300.1 |
| 9 | 43.6 | 182.8 | 0.3484 | 11.7 | 49.0 | 25.2 | 105.6 |
| 10 | 18.6 | 92.1 | 0.3484 | 5.0 | 24.7 | 10.8 | 53.2 |
| 11 | 12.7 | 75.4 | 0.3484 | 3.4 | 20.2 | 7.4 | 43.6 |
| 12 | 10.7 | 72.4 | 0.3484 | 2.9 | 19.4 | 6.2 | 41.8 |
| TOTAL | 12701. | 13611. | | 1676. | 2500. | 8891. | 8896. |

RESULTS FOR YEAR 1980

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0201 | 81.3 | 44.7 | 3610.9 | 1986.0 |
| 4 | 3355.8 | 2282.0 | 0.1122 | 323.3 | 219.8 | 2456.0 | 1670.1 |
| 5 | 2439.1 | 3170.9 | 0.2071 | 414.9 | 539.4 | 1623.5 | 2110.5 |
| 6 | 1675.7 | 3116.9 | 0.2876 | 381.4 | 709.4 | 1029.1 | 1914.1 |
| 7 | 934.1 | 2494.2 | 0.2876 | 212.6 | 567.7 | 573.7 | 1531.7 |
| 8 | 349.0 | 1193.4 | 0.2876 | 79.4 | 271.6 | 214.3 | 732.9 |
| 9 | 87.7 | 367.7 | 0.2876 | 20.0 | 83.7 | 53.9 | 225.8 |
| 10 | 25.2 | 124.5 | 0.2876 | 5.7 | 28.3 | 15.5 | 76.5 |
| 11 | 10.8 | 63.8 | 0.2876 | 2.5 | 14.5 | 6.6 | 39.2 |
| 12 | 13.5 | 91.6 | 0.2876 | 3.1 | 20.8 | 8.3 | 56.2 |
| TOTAL | 13391. | 15380. | | 1524. | 2500. | 9592. | 10343. |

RESULTS FOR YEAR 1981

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0171 | 69.1 | 38.0 | 3621.8 | 1992.0 |
| 4 | 3610.9 | 2455.4 | 0.0952 | 297.8 | 202.5 | 2687.8 | 1827.7 |
| 5 | 2456.0 | 3192.8 | 0.1758 | 360.0 | 467.9 | 1686.6 | 2192.6 |
| 6 | 1623.5 | 3019.7 | 0.2442 | 320.1 | 595.4 | 1041.2 | 1936.7 |
| 7 | 1029.1 | 2747.6 | 0.2442 | 202.9 | 541.8 | 660.0 | 1762.2 |
| 8 | 573.7 | 1961.9 | 0.2442 | 113.1 | 386.8 | 367.9 | 1258.3 |
| 9 | 214.3 | 897.9 | 0.2442 | 42.3 | 177.0 | 137.4 | 575.9 |
| 10 | 53.9 | 266.2 | 0.2442 | 10.6 | 52.5 | 34.6 | 170.7 |
| 11 | 15.5 | 91.6 | 0.2442 | 3.1 | 18.1 | 9.9 | 58.8 |
| 12 | 14.9 | 101.0 | 0.2442 | 2.9 | 19.9 | 9.6 | 64.8 |
| TOTAL | 14092. | 17209. | | 1422. | 2500. | 10257. | 11839. |

Table 3. (cont'd)



RESULTS FOR YEAR 1982

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0147 | 59.5 | 32.7 | 3630.6 | 1996.8 |
| 4 | 3621.8 | 2462.9 | 0.0818 | 258.2 | 175.6 | 2732.4 | 1858.0 |
| 5 | 2687.8 | 3494.1 | 0.1510 | 342.3 | 445.0 | 1892.1 | 2459.7 |
| 6 | 1686.6 | 3137.1 | 0.2097 | 290.2 | 539.9 | 1119.6 | 2082.5 |
| 7 | 1041.2 | 2780.0 | 0.2097 | 179.2 | 478.4 | 691.2 | 1845.4 |
| 8 | 660.0 | 2257.2 | 0.2097 | 113.6 | 388.4 | 438.1 | 1498.3 |
| 9 | 367.9 | 1541.6 | 0.2097 | 63.3 | 265.3 | 244.2 | 1023.3 |
| 10 | 137.4 | 678.9 | 0.2097 | 23.7 | 116.8 | 91.2 | 450.7 |
| 11 | 34.6 | 204.6 | 0.2097 | 5.9 | 35.2 | 22.9 | 135.8 |
| 12 | 19.5 | 131.9 | 0.2097 | 3.4 | 22.7 | 12.9 | 87.5 |
| TOTAL | 14757. | 19163. | | 1339. | 2500. | 10875. | 13438. |

RESULTS FOR YEAR 1983

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0140 | 56.7 | 31.2 | 3633.1 | 1998.2 |
| 4 | 3630.6 | 2468.8 | 0.0780 | 247.2 | 168.1 | 2749.4 | 1869.6 |
| 5 | 2732.4 | 3552.1 | 0.1440 | 332.9 | 432.8 | 1937.1 | 2518.2 |
| 6 | 1892.1 | 3519.3 | 0.2000 | 311.9 | 580.1 | 1268.3 | 2359.1 |
| 7 | 1119.6 | 2989.3 | 0.2000 | 184.6 | 492.8 | 750.5 | 2003.8 |
| 8 | 691.2 | 2363.8 | 0.2000 | 113.9 | 389.7 | 463.3 | 1584.5 |
| 9 | 438.1 | 1835.7 | 0.2000 | 72.2 | 302.6 | 293.7 | 1230.5 |
| 10 | 244.2 | 1206.5 | 0.2000 | 40.3 | 198.9 | 163.7 | 808.7 |
| 11 | 91.2 | 540.1 | 0.2000 | 15.0 | 89.0 | 61.2 | 362.0 |
| 12 | 36.9 | 242.6 | 0.2000 | 5.9 | 40.0 | 24.1 | 162.6 |
| TOTAL | 15375. | 21193. | | 1381. | 2725. | 11344. | 14897. |

RESULTS FOR YEAR 1984

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0140 | 56.7 | 31.2 | 3633.1 | 1998.2 |
| 4 | 3633.1 | 2470.5 | 0.0780 | 247.4 | 168.2 | 2751.3 | 1870.9 |
| 5 | 2749.4 | 3574.3 | 0.1440 | 335.0 | 435.5 | 1949.2 | 2533.9 |
| 6 | 1937.1 | 3603.0 | 0.2000 | 319.3 | 593.9 | 1298.5 | 2415.1 |
| 7 | 1268.3 | 3386.4 | 0.2000 | 209.1 | 558.2 | 850.2 | 2270.0 |
| 8 | 750.5 | 2566.7 | 0.2000 | 123.7 | 423.1 | 503.1 | 1720.5 |
| 9 | 463.3 | 1941.3 | 0.2000 | 76.4 | 320.0 | 310.6 | 1301.3 |
| 10 | 293.7 | 1450.8 | 0.2000 | 48.4 | 239.1 | 196.9 | 972.5 |
| 11 | 163.7 | 969.2 | 0.2000 | 27.0 | 159.8 | 109.7 | 649.7 |
| 12 | 85.2 | 576.1 | 0.2000 | 14.0 | 95.0 | 57.1 | 386.1 |
| TOTAL | 15844. | 23013. | | 1457. | 3024. | 11660. | 16118. |

Table 3. (cont'd)



RESULTS FOR YEAR 1985

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0140 | 56.7 | 31.2 | 3633.1 | 1998.2 |
| 4 | 3633.1 | 2470.5 | 0.0780 | 247.4 | 168.2 | 2751.3 | 1870.9 |
| 5 | 2751.3 | 3576.7 | 0.1440 | 335.2 | 435.8 | 1950.5 | 2535.6 |
| 6 | 1949.2 | 3625.4 | 0.2000 | 321.3 | 597.6 | 1306.6 | 2430.2 |
| 7 | 1298.5 | 3466.9 | 0.2000 | 214.0 | 571.5 | 870.4 | 2323.9 |
| 8 | 850.2 | 2907.6 | 0.2000 | 140.1 | 479.3 | 569.9 | 1949.0 |
| 9 | 503.1 | 2107.9 | 0.2000 | 82.9 | 347.5 | 337.2 | 1412.9 |
| 10 | 310.6 | 1534.2 | 0.2000 | 51.2 | 252.9 | 208.2 | 1028.4 |
| 11 | 196.9 | 1165.4 | 0.2000 | 32.4 | 192.1 | 132.0 | 781.2 |
| 12 | 166.9 | 1128.0 | 0.2000 | 27.5 | 185.9 | 111.8 | 756.1 |
| TOTAL | 16160. | 24458. | | 1509. | 3262. | 11871. | 17066. |

RESULTS FOR YEAR 1986

| AGE | POPULATION NUMBERS | POPULATION WEIGHTS | FISHING MORTALITY | CATCH NUMBERS | CATCH WEIGHTS | RESIDUAL NUMBERS | RESIDUAL WEIGHTS |
|---|---|---|---|---|---|---|---|
| 3 | 4500.0 | 2475.0 | 0.0140 | 56.7 | 31.2 | 3633.1 | 1998.2 |
| 4 | 3633.1 | 2470.5 | 0.0780 | 247.4 | 168.2 | 2751.3 | 1870.9 |
| 5 | 2751.3 | 3576.7 | 0.1440 | 335.2 | 435.8 | 1950.5 | 2535.6 |
| 6 | 1950.5 | 3627.9 | 0.2000 | 321.5 | 598.0 | 1307.4 | 2431.9 |
| 7 | 1306.6 | 3488.5 | 0.2000 | 215.4 | 575.0 | 875.8 | 2338.4 |
| 8 | 870.4 | 2976.7 | 0.2000 | 143.5 | 490.7 | 583.4 | 1995.4 |
| 9 | 569.9 | 2387.8 | 0.2000 | 93.9 | 393.6 | 382.0 | 1600.6 |
| 10 | 337.2 | 1665.9 | 0.2000 | 55.6 | 274.6 | 226.0 | 1116.7 |
| 11 | 208.2 | 1232.4 | 0.2000 | 34.3 | 203.2 | 139.5 | 826.1 |
| 12 | 243.8 | 1648.1 | 0.2000 | 40.2 | 271.7 | 163.4 | 1104.8 |
| TOTAL | 16371. | 25550. | | 1544. | 3442. | 12013. | 17818. |

Table 4. Revision of Table 6.

| Year | Can (N) OT-5 CPUE | Method 1 | Method 2 | Method 3 | Method 4 | Methods 1 - 4 |
|---|---|---|---|---|---|---|
| 1972 | .548 | 217 | 203 | 237 | 214 | 217 |
| 1973 | .530 | 159 | 152 | 234 | 217 | 190 |
| 1974 | .535 | 159 | 150 | 211 | 125 | 161 |
| 1975 | .204 | 90 | 136 | 67 | 61 | 88 |
| 1976 | .415 | 144 | 130 | 63 | 111 | 112 |
| 1977 | .314 | 112 | 110 | 83 | 89 | 98 |
| 1978 | .413* | 119 | 118 | 107 | 182 | 132 |
| | | 1000 | 999 | 1000 | 999 | |
| Slope | | .9972 | 1.0584 | .0014 | .5987 | .8161 |
| Intercept | | -1.7198 | -1.8609 | .2128 | -.8273 | -1.3176 |
| r | | .94 | .67 | .87 | .92 | .94 |
| df | | 4 | 4 | 4 | 4 | 4 |
| regression | | LA | LA | AA | LA | LA |
| 'r' values from other regressions | AA | .89 | .65 | | .85 | .90 |
| | LA | | | .86 | | |
| | AL | .87 | .58 | .81 | .82 | .85 |
| | LL | .93 | .58 | .80 | .90 | .89 |

*values estimated using LA Regression of CPUE on Method 1-4

Table 5. Revision of Table 8. Comparisons of total effort data from different countries and tonnage classes and their relation to the average F values calculated from the VPA for cod in Subdivision 3Ps.

| Year | Can (N) OT 4 S.A. | Spain PT 4 S.A. | Can (N) OT 4 | Spain PT 4 | Can (N) OT 5 | Can (N) OT 5 Standard | $\bar{F}$ (6-10) | Weighted F |
|---|---|---|---|---|---|---|---|---|
| 1963 | 89.2 | 53.8 | 91.7 | 47.7 | | 86.6 | .35 | .34 |
| 1964 | 129.4 | 51.8 | 110.3 | 36.5 | | 104.2 | .42 | .48 |
| 1965 | 72.7 | 51.3 | 68.8 | 33.2 | 73.5 | 67.9 | .48 | .46 |
| 1966 | 93.0 | 50.3 | 80.8 | 42.1 | 75.2 | 75.7 | .71 | .67 |
| 1967 | 143.8 | 51.9 | 125.0 | 47.6 | 83.9 | 97.9 | .46 | .51 |
| 1968 | 112.4 | 53.2 | 115.8 | 44.1 | 106.8 | 108.0 | .51 | .48 |
| 1969 | 76.7 | 44.8 | 74.4 | 38.7 | 79.1 | 74.3 | .75 | .55 |
| 1970 | 169.2 | 64.2 | 152.6 | 56.0 | 121.9 | 132.0 | .58 | .70 |
| 1971 | 110.7 | 53.7 | 116.5 | 50.0 | 101.5 | 105.6 | .68 | .73 |
| 1972 | 58.9 | 48.5 | 57.6 | 42.6 | 80.9 | 65.0 | .42 | .55 |
| 1973 | 174.3 | 76.2 | 146.6 | 61.8 | 99.3 | 115.4 | .64 | .60 |
| | | | Average F's | | | | | |
| Slope | .0004 | .0018 | .0005 | .0033 | .0003 | .0005 | | |
| Inter-cept | .4997 | .4489 | .4927 | .3974 | .5574 | .4997 | | |
| r | .1181 | .1136 | .1195 | .2040 | .0363 | .0827 | | |
| | | | Weighted F's | | | | | |
| r | .33 | .27 | .34 | .42 | .44 | .35 | | |

Table 6. Revision of Table 13.

| Survey Year | Age | Year-Class | Survey Abundance | Predicted Stock size |
|---|---|---|---|---|
| 1977 | 1 | 1976 | 6 | 4,198 |
| | 2 | 1975 | 136 | 3,357 |
| | 3 | 1974 | 2,197 | 4,170 |
| 1976 | 1 | 1975 | 203 | 5,288 |
| | 2 | 1974 | 2,855 | 5,314 |
| | 3 | 1973 | 1,855 | 4,072 |
| 1975 | 1 | 1974 | 198 | 5,261 |
| | 2 | 1973 | 398 | |
| | 3 | 1972 | 1,117 | |

Average Recruitment at 3 Years

| | | |
|---|---|---|
| 1976 | 4,198 | Ave. = 4479 (4500) |
| 1975 | 4,323 | |
| 1974 | 4,915 | |
| 1973 | 4,072 | |

Table 7. Revision of Table 12.

| Year-Class | 1 year | 2 year | 3 year | VPA 3 year |
|---|---|---|---|---|
| 1976 | 6 | | | |
| 1975 | 203 | 136 | | |
| 1974 | 198 | 2855 | 2197 | 2121 |
| 1973 | 579 | 398 | 1855 | 5783 |
| 1972 | 20 | 1753 | 1117 | 5310 |
| 1971 | 18 | 834 | 1745 | 3778 |
| 1970 | | 527 | 1057 | 2776 |
| 1969 | 287 | | 822 | 3223 |
| 1968 | 18 | 5765 | | 5636 |
| 1967 | 174 | 1746 | 3219 | 3479 |
| 1966 | 141 | 25634 | 9512 | 5515 |
| 1965 | | 5551 | 11601 | 7326 |
| 1964 | 8885 | | 11512 | 10014 |
| 1963 | 408 | 5062 | | 8463 |
| 1962 | 620 | 5527 | 23002 | 8560 |
| 1961 | 68 | 3781 | 8368 | 7005 |
| 1960 | | 1383 | 4558 | 4196 |
| Slope | 5.5369 | .7198 | .2862 | |
| Intercept | 4164.4 | 3259.2 | 3540.9 | |
| r | .65 | .70 | .78 | |
| df | 10 | 10 | 11 | |
| Regression | AA | AA | AA | |

Table 8. Revision of Table 14 - $F_{opt}$ = 0.2

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY* 0.2000 YEAR 1977

| AGE | POP. NO. *X10-3< | CATCH NO. *X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. *METRIC TONS< | CATCH WT. *METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4900. | 92. | 0.021 | 0.550 | 2695.0 | 50.6 | 3928.4 |
| 4 | 4363. | 949. | 0.273 | 0.680 | 2966.8 | 645.3 | 2718.7 |
| 5 | 2324. | 841. | 0.505 | 1.300 | 3021.2 | 1093.3 | 1148.3 |
| 6 | 711. | 326. | 0.700 | 1.860 | 1322.5 | 610.1 | 289.1 |
| 7 | 204. | 94. | 0.699 | 2.670 | 544.7 | 251.0 | 83.0 |
| 8 | 67. | 40. | 0.697 | 3.420 | 297.5 | 136.8 | 35.5 |
| 9 | 56. | 27. | 0.709 | 4.190 | 243.0 | 113.1 | 23.4 |
| 10 | 26. | 12. | 0.700 | 4.940 | 128.4 | 59.3 | 10.6 |
| 11 | 13. | 6. | 0.700 | 5.920 | 77.0 | 35.5 | 5.3 |
| 12 | 11. | 5. | 0.685 | 6.760 | 74.4 | 33.8 | 4.5 |
| TOTAL | 12697. | 2394. | | | 11370.5 | 3028.8 | 8246.8 |

NATURAL MORTALITY* 0.2000 YEAR 1978

| AGE | POP. NO. *X10-3< | CATCH NO. *X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. *METRIC TONS< | CATCH WT. *METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4300. | 123. | 0.032 | 0.550 | 2365.0 | 67.5 | 3409.7 |
| 4 | 3928. | 576. | 0.176 | 0.680 | 2671.3 | 391.9 | 2697.3 |
| 5 | 2719. | 687. | 0.325 | 1.300 | 3534.3 | 893.6 | 1608.3 |
| 6 | 1148. | 381. | 0.451 | 1.860 | 2135.9 | 708.0 | 598.9 |
| 7 | 289. | 96. | 0.451 | 2.670 | 771.8 | 255.8 | 150.8 |
| 8 | 83. | 28. | 0.451 | 3.420 | 283.9 | 94.1 | 43.3 |
| 9 | 35. | 12. | 0.451 | 4.190 | 148.7 | 49.3 | 18.5 |
| 10 | 23. | 8. | 0.451 | 4.940 | 115.4 | 38.3 | 12.2 |
| 11 | 11. | 4. | 0.451 | 5.920 | 62.6 | 20.7 | 5.5 |
| 12 | 5. | 2. | 0.451 | 6.760 | 35.7 | 11.8 | 2.8 |
| TOTAL | 12542. | 1915. | | | 12124.7 | 2531.2 | 8547.1 |

Table 8 (cont'd) - Revision of Table 14.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY* 0.2000 YEAR 1979

| AGE | POP. NO. *X10-3< | CATCH NO. *X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. *METRIC TONS< | CATCH WT. *METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4200. | 53. | 0.014 | 0.550 | 2310.0 | 29.1 | 3390.9 |
| 4 | 3410. | 232. | 0.078 | 0.680 | 2318.6 | 157.9 | 2582.1 |
| 5 | 2697. | 329. | 0.144 | 1.300 | 3506.4 | 427.2 | 1912.2 |
| 6 | 1608. | 265. | 0.200 | 1.860 | 2991.4 | 493.1 | 1078.1 |
| 7 | 599. | 99. | 0.200 | 2.670 | 1599.0 | 263.6 | 401.4 |
| 8 | 151. | 25. | 0.200 | 3.420 | 515.6 | 85.0 | 101.1 |
| 9 | 43. | 7. | 0.200 | 4.190 | 181.4 | 29.9 | 29.0 |
| 10 | 19. | 3. | 0.200 | 4.940 | 91.4 | 15.1 | 12.4 |
| 11 | 12. | 2. | 0.200 | 5.920 | 72.2 | 11.9 | 8.2 |
| 12 | 6. | 1. | 0.200 | 6.760 | 37.3 | 6.1 | 3.7 |
| TOTAL | 12744. | 1016. | | | 13623.2 | 1518.9 | 9519.0 |

NATURAL MORTALITY* 0.2000 YEAR 1980

| AGE | POP. NO. *X10-3< | CATCH NO. *X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. *METRIC TONS< | CATCH WT. *METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3391. | 231. | 0.078 | 0.680 | 2305.8 | 157.0 | 2567.9 |
| 5 | 2582. | 315. | 0.144 | 1.300 | 3356.8 | 409.0 | 1830.5 |
| 6 | 1912. | 315. | 0.200 | 1.860 | 3556.6 | 586.3 | 1281.8 |
| 7 | 1078. | 178. | 0.200 | 2.670 | 2878.4 | 474.5 | 722.6 |
| 8 | 401. | 66. | 0.200 | 3.420 | 1372.9 | 226.3 | 269.1 |
| 9 | 101. | 17. | 0.200 | 4.190 | 423.4 | 69.8 | 67.7 |
| 10 | 29. | 5. | 0.200 | 4.940 | 143.4 | 23.6 | 19.5 |
| 11 | 12. | 2. | 0.200 | 5.920 | 73.4 | 12.1 | 8.3 |
| 12 | 8. | 1. | 0.200 | 6.760 | 55.2 | 9.1 | 5.5 |
| TOTAL | 14015. | 1186. | | | 16641.0 | 1998.9 | 10406.0 |

Table 8. (cont'd) Revision of Table 14.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1981

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2568. | 313. | 0.144 | 1.300 | 3338.3 | 406.7 | 1820.5 |
| 6 | 1631. | 302. | 0.200 | 1.860 | 3404.8 | 561.2 | 1227.1 |
| 7 | 1282. | 211. | 0.200 | 2.670 | 3422.3 | 564.1 | 859.2 |
| 8 | 723. | 119. | 0.200 | 3.420 | 2471.4 | 407.4 | 484.4 |
| 9 | 269. | 44. | 0.200 | 4.190 | 1127.5 | 185.9 | 180.4 |
| 10 | 68. | 11. | 0.200 | 4.940 | 334.6 | 55.2 | 45.4 |
| 11 | 19. | 3. | 0.200 | 5.920 | 115.2 | 19.0 | 13.0 |
| 12 | 8. | 1. | 0.200 | 6.760 | 56.2 | 9.3 | 5.6 |
| TOTAL | 14900. | 1309. | | | 19215.8 | 2408.2 | 11019.9 |

NATURAL MORTALITY# 0.2000 YEAR 1982

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1820. | 300. | 0.200 | 1.860 | 3386.0 | 558.2 | 1220.3 |
| 7 | 1227. | 202. | 0.200 | 2.670 | 3276.2 | 540.1 | 822.5 |
| 8 | 859. | 142. | 0.200 | 3.420 | 2938.4 | 484.4 | 575.9 |
| 9 | 484. | 80. | 0.200 | 4.190 | 2029.6 | 334.6 | 324.7 |
| 10 | 180. | 30. | 0.200 | 4.940 | 891.1 | 146.9 | 120.9 |
| 11 | 45. | 7. | 0.200 | 5.920 | 268.8 | 44.3 | 30.4 |
| 12 | 13. | 2. | 0.200 | 6.760 | 88.2 | 14.5 | 8.7 |
| TOTAL | 15514. | 1403. | | | 21400.6 | 2758.1 | 11438.4 |

Table 8 (cont'd) Revision of Table 14.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1983

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1220. | 201. | 0.200 | 2.670 | 3258.2 | 537.1 | 818.0 |
| 8 | 823. | 136. | 0.200 | 3.420 | 2813.0 | 463.7 | 551.4 |
| 9 | 576. | 95. | 0.200 | 4.190 | 2413.2 | 397.8 | 386.1 |
| 10 | 325. | 54. | 0.200 | 4.940 | 1604.0 | 264.4 | 217.7 |
| 11 | 121. | 20. | 0.200 | 5.920 | 715.8 | 118.0 | 81.0 |
| 12 | 30. | 5. | 0.200 | 6.760 | 205.8 | 33.9 | 20.4 |
| TOTAL | 15930. | 1471. | | | 23160.0 | 3048.1 | 11716.8 |

NATURAL MORTALITY# 0.2000 YEAR 1984

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 818. | 135. | 0.200 | 3.420 | 2797.5 | 461.1 | 548.3 |
| 9 | 551. | 91. | 0.200 | 4.190 | 2310.2 | 380.8 | 369.6 |
| 10 | 386. | 64. | 0.200 | 4.940 | 1907.1 | 314.4 | 258.8 |
| 11 | 218. | 36. | 0.200 | 5.920 | 1288.5 | 212.4 | 145.9 |
| 12 | 81. | 13. | 0.200 | 6.760 | 547.9 | 90.3 | 54.3 |
| TOTAL | 16196. | 1515. | | | 24492.2 | 3267.7 | 11895.6 |

Table 8 (cont'd) Revision of Table 14.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1985

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 876. | 144. | 0.200 | 3.420 | 2997.3 | 494.1 | 587.5 |
| 9 | 548. | 90. | 0.200 | 4.190 | 2297.4 | 378.7 | 367.5 |
| 10 | 370. | 61. | 0.200 | 4.940 | 1825.7 | 301.0 | 247.7 |
| 11 | 259. | 43. | 0.200 | 5.920 | 1532.0 | 252.5 | 173.5 |
| 12 | 146. | 24. | 0.200 | 6.760 | 986.3 | 162.6 | 97.8 |
| TOTAL | 16341. | 1539. | | | 25279.7 | 3397.5 | 11992.7 |

NATURAL MORTALITY# 0.2000 YEAR 1986

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 57. | 0.014 | 0.550 | 2475.0 | 31.2 | 3633.1 |
| 4 | 3633. | 247. | 0.078 | 0.680 | 2470.5 | 168.2 | 2751.3 |
| 5 | 2751. | 335. | 0.144 | 1.300 | 3576.7 | 435.8 | 1950.5 |
| 6 | 1950. | 322. | 0.200 | 1.860 | 3627.9 | 598.0 | 1307.4 |
| 7 | 1307. | 216. | 0.200 | 2.670 | 3490.9 | 575.4 | 876.4 |
| 8 | 876. | 144. | 0.200 | 3.420 | 2997.3 | 494.1 | 587.5 |
| 9 | 587. | 97. | 0.200 | 4.190 | 2461.5 | 405.8 | 393.8 |
| 10 | 368. | 61. | 0.200 | 4.940 | 1815.7 | 299.3 | 246.4 |
| 11 | 248. | 41. | 0.200 | 5.920 | 1466.6 | 241.8 | 166.1 |
| 12 | 173. | 29. | 0.200 | 6.760 | 1172.6 | 193.3 | 116.3 |
| TOTAL | 16395. | 1548. | | | 25554.7 | 3442.9 | 12028.7 |

Table 9. Revision of Table 15 - $F_{max}$ = 0.30

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1977

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4900. | 92. | 0.021 | 0.550 | 2695.0 | 50.6 | 3928.4 |
| 4 | 4363. | 949. | 0.273 | 0.680 | 2966.8 | 645.3 | 2718.7 |
| 5 | 2324. | 841. | 0.505 | 1.300 | 3021.2 | 1093.3 | 1148.3 |
| 6 | 711. | 328. | 0.700 | 1.860 | 1322.5 | 610.1 | 289.1 |
| 7 | 204. | 94. | 0.699 | 2.670 | 544.7 | 251.0 | 83.0 |
| 8 | 87. | 40. | 0.697 | 3.420 | 297.5 | 136.8 | 35.5 |
| 9 | 58. | 27. | 0.709 | 4.190 | 243.0 | 113.1 | 23.4 |
| 10 | 26. | 12. | 0.700 | 4.940 | 128.4 | 59.3 | 10.6 |
| 11 | 13. | 6. | 0.700 | 5.920 | 77.0 | 35.5 | 5.3 |
| 12 | 11. | 5. | 0.685 | 6.760 | 74.4 | 33.8 | 4.5 |
| TOTAL | 12697. | 2394. | | | 11370.5 | 3028.8 | 8246.8 |

NATURAL MORTALITY# 0.2000 YEAR 1978

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4300. | 123. | 0.032 | 0.550 | 2365.0 | 67.5 | 3409.7 |
| 4 | 3928. | 576. | 0.176 | 0.680 | 2671.3 | 391.9 | 2697.3 |
| 5 | 2719. | 687. | 0.325 | 1.300 | 3534.3 | 893.6 | 1608.3 |
| 6 | 1148. | 381. | 0.451 | 1.860 | 2135.9 | 708.0 | 598.9 |
| 7 | 289. | 96. | 0.451 | 2.670 | 771.8 | 255.8 | 150.8 |
| 8 | 83. | 28. | 0.451 | 3.420 | 283.9 | 94.1 | 43.3 |
| 9 | 35. | 12. | 0.451 | 4.190 | 148.7 | 49.3 | 18.5 |
| 10 | 23. | 8. | 0.451 | 4.940 | 115.4 | 38.3 | 12.2 |
| 11 | 11. | 4. | 0.451 | 5.920 | 62.6 | 20.7 | 5.5 |
| 12 | 5. | 2. | 0.451 | 6.760 | 35.7 | 11.8 | 2.8 |
| TOTAL | 12542. | 1915. | | | 12124.7 | 2531.2 | 8547.1 |

Table 9. (cont'd) Revision of Table 15

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1979

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4200. | 79. | 0.021 | 0.550 | 2310.0 | 43.5 | 3367.2 |
| 4 | 3410. | 342. | 0.117 | 0.680 | 2318.6 | 232.5 | 2483.4 |
| 5 | 2697. | 477. | 0.216 | 1.300 | 3506.4 | 619.6 | 1779.3 |
| 6 | 1608. | 380. | 0.300 | 1.860 | 2991.4 | 706.2 | 975.5 |
| 7 | 599. | 141. | 0.300 | 2.670 | 1599.0 | 377.5 | 363.2 |
| 8 | 151. | 36. | 0.300 | 3.420 | 515.6 | 121.7 | 91.4 |
| 9 | 43. | 10. | 0.300 | 4.190 | 181.4 | 42.8 | 26.3 |
| 10 | 19. | 4. | 0.300 | 4.940 | 91.4 | 21.6 | 11.2 |
| 11 | 12. | 3. | 0.300 | 5.920 | 72.2 | 17.0 | 7.4 |
| 12 | 6. | 1. | 0.300 | 6.760 | 37.3 | 8.8 | 3.3 |
| TOTAL | 12744. | 1473. | | | 13623.2 | 2191.3 | 9108.2 |

NATURAL MORTALITY# 0.2000 YEAR 1980

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3367. | 338. | 0.117 | 0.680 | 2289.7 | 229.6 | 2452.4 |
| 5 | 2483. | 439. | 0.216 | 1.300 | 3228.4 | 570.5 | 1638.2 |
| 6 | 1779. | 420. | 0.300 | 1.860 | 3309.5 | 781.3 | 1079.2 |
| 7 | 975. | 230. | 0.300 | 2.670 | 2604.5 | 614.9 | 591.7 |
| 8 | 363. | 86. | 0.300 | 3.420 | 1242.3 | 293.3 | 220.3 |
| 9 | 91. | 22. | 0.300 | 4.190 | 383.1 | 90.5 | 55.5 |
| 10 | 26. | 6. | 0.300 | 4.940 | 129.7 | 30.6 | 15.9 |
| 11 | 11. | 3. | 0.300 | 5.920 | 66.4 | 15.7 | 6.8 |
| 12 | 7. | 2. | 0.300 | 6.760 | 50.0 | 11.8 | 4.5 |
| TOTAL | 13605. | 1630. | | | 15778.6 | 2684.7 | 9672.2 |

Table 9. (cont'd) Revision of Table 15.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1981

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2452. | 433. | 0.216 | 1.300 | 3188.2 | 563.4 | 1617.8 |
| 6 | 1638. | 387. | 0.300 | 1.860 | 3047.1 | 719.4 | 993.6 |
| 7 | 1079. | 255. | 0.300 | 2.670 | 2881.5 | 680.3 | 654.6 |
| 8 | 592. | 140. | 0.300 | 3.420 | 2023.4 | 477.7 | 358.9 |
| 9 | 220. | 52. | 0.300 | 4.190 | 923.1 | 217.9 | 133.6 |
| 10 | 55. | 13. | 0.300 | 4.940 | 274.0 | 64.7 | 33.6 |
| 11 | 16. | 4. | 0.300 | 5.920 | 94.3 | 22.3 | 9.7 |
| 12 | 7. | 2. | 0.300 | 6.760 | 46.0 | 10.9 | 4.1 |
| TOTAL | 14168. | 1732. | | | 17405.9 | 3049.1 | 10041.3 |

NATURAL MORTALITY# 0.2000 YEAR 1982

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1618. | 382. | 0.300 | 1.860 | 3009.2 | 710.4 | 981.3 |
| 7 | 994. | 235. | 0.300 | 2.670 | 2653.0 | 626.3 | 602.7 |
| 8 | 655. | 155. | 0.300 | 3.420 | 2238.7 | 528.5 | 397.0 |
| 9 | 359. | 85. | 0.300 | 4.190 | 1503.6 | 355.0 | 217.7 |
| 10 | 134. | 32. | 0.300 | 4.940 | 660.1 | 155.8 | 81.0 |
| 11 | 34. | 8. | 0.300 | 5.920 | 199.1 | 47.0 | 20.4 |
| 12 | 10. | 2. | 0.300 | 6.760 | 65.3 | 15.4 | 5.9 |
| TOTAL | 14537. | 1808. | | | 18673.1 | 3334.7 | 10274.6 |

Table 9. (cont'd) Revision of Table 15.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1983

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 981. | 232. | 0.300 | 2.670 | 2620.0 | 618.5 | 595.2 |
| 8 | 603. | 142. | 0.300 | 3.420 | 2061.1 | 486.6 | 365.5 |
| 9 | 397. | 94. | 0.300 | 4.190 | 1663.5 | 392.7 | 240.8 |
| 10 | 218. | 51. | 0.300 | 4.940 | 1075.2 | 253.8 | 132.0 |
| 11 | 81. | 19. | 0.300 | 5.920 | 479.8 | 113.3 | 49.2 |
| 12 | 20. | 5. | 0.300 | 6.760 | 137.9 | 32.6 | 12.4 |
| TOTAL | 14769. | 1863. | | | 19605.8 | 3554.9 | 10415.1 |

NATURAL MORTALITY# 0.2000 YEAR 1984

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 595. | 141. | 0.300 | 3.420 | 2035.5 | 480.5 | 361.0 |
| 9 | 366. | 86. | 0.300 | 4.190 | 1531.6 | 361.6 | 221.7 |
| 10 | 241. | 57. | 0.300 | 4.940 | 1189.6 | 280.8 | 146.1 |
| 11 | 132. | 31. | 0.300 | 5.920 | 781.5 | 184.5 | 80.1 |
| 12 | 49. | 12. | 0.300 | 6.760 | 332.3 | 78.5 | 29.8 |
| TOTAL | 14903. | 1895. | | | 20245.8 | 3706.0 | 10496.4 |

Table 9. (cont'd) Revision of Table 15.

3PS COD PROJECTION OF CATCHES

NATURAL MORTALITY# 0.2000 YEAR 1985

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 638. | 151. | 0.300 | 3.420 | 2180.9 | 514.9 | 386.8 |
| 9 | 361. | 85. | 0.300 | 4.190 | 1512.5 | 357.1 | 218.9 |
| 10 | 222. | 52. | 0.300 | 4.940 | 1095.2 | 258.6 | 134.5 |
| 11 | 146. | 34. | 0.300 | 5.920 | 864.7 | 204.1 | 88.6 |
| 12 | 80. | 19. | 0.300 | 6.760 | 541.3 | 127.8 | 48.6 |
| TOTAL | 14967. | 1910. | | | 20569.9 | 3782.5 | 10535.1 |

NATURAL MORTALITY# 0.2000 YEAR 1986

| AGE | POP. NO. %X10-3< | CATCH NO. %X10-3< | FISHING MORT. | MEAN WT. KG. | POP. WT. %METRIC TONS< | CATCH WT. %METRIC TONS< | RESIDUAL POP. NOS. |
|---|---|---|---|---|---|---|---|
| 3 | 4500. | 85. | 0.021 | 0.550 | 2475.0 | 46.6 | 3607.7 |
| 4 | 3608. | 362. | 0.117 | 0.680 | 2453.3 | 246.0 | 2627.6 |
| 5 | 2628. | 464. | 0.216 | 1.300 | 3415.9 | 603.6 | 1733.4 |
| 6 | 1733. | 409. | 0.300 | 1.860 | 3224.1 | 761.2 | 1051.4 |
| 7 | 1051. | 248. | 0.300 | 2.670 | 2807.1 | 662.7 | 637.7 |
| 8 | 638. | 151. | 0.300 | 3.420 | 2180.9 | 514.9 | 386.8 |
| 9 | 387. | 91. | 0.300 | 4.190 | 1620.6 | 382.6 | 234.6 |
| 10 | 219. | 52. | 0.300 | 4.940 | 1081.6 | 255.3 | 132.8 |
| 11 | 134. | 32. | 0.300 | 5.920 | 796.1 | 187.9 | 81.6 |
| 12 | 89. | 21. | 0.300 | 6.760 | 598.9 | 141.4 | 53.7 |
| TOTAL | 14987. | 1914. | | | 20653.3 | 3802.2 | 10547.2 |

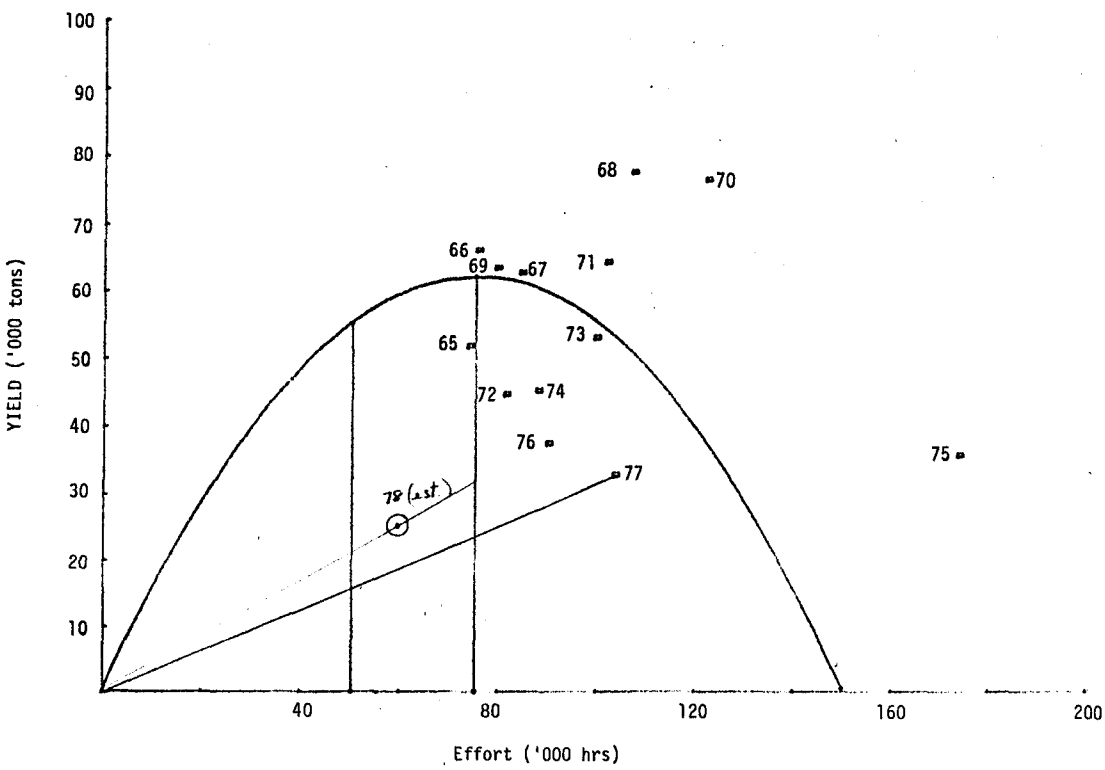


Fig. 5. Yield curve - Subdivision 3Ps cod - Estimated value for 1978.

3Ps Cod. Summary of Tables 3, 14, 15 - CAFSAC Res. Doc. 78/18 + Addendum.

| Year | Population Wt | Terminal F | Catch | Population Wt | Terminal F | Catch | Population Wt | Terminal F | Catch |
|---|---|---|---|---|---|---|---|---|---|
| 1977 | 113,700 | .68 | 30,890 | 113,150 | .68 | 30,288 | 113,150 | .68 | 30,288 |
| 1978 | 120,910 | .44 | 25,000 | 116,830 | .45 | 25,118 | 116,830 | .45 | 25,118 |
| 1979 | 136,110 | .35 | 25,000 | 133,910 | .20 | 14,868 | 133,908 | .30 | 21,443 |
| 1980 | 153,800 | .29 | 25,000 | 162,380 | .20 | 19,347 | 154,000 | .30 | 25,970 |
| 1981 | 172,090 | .24 | 25,000 | 189,060 | .20 | 23,435 | 171,518 | .30 | 29,711 |
| 1982 | 191,630 | .21 | 25,000 | 211,269 | .20 | 27,130 | 184,800 | .30 | 32,891 |
| 1983 | 211,930 | .20 | 27,250 | 229,608 | .20 | 30,153 | 194,842 | .30 | 35,262 |
| 1984 | 230,310 | .20 | 30,240 | 243,417 | .20 | 32,429 | 201,650 | .30 | 36,870 |
| 1985 | 244,580 | .20 | 32,620 | 251,685 | .20 | 33,792 | 205,172 | .30 | 37,700 |
| 1986 | 255,500 | .20 | 34,420 | 254,638 | .20 | 34,279 | 206,139 | .30 | 37,929 |