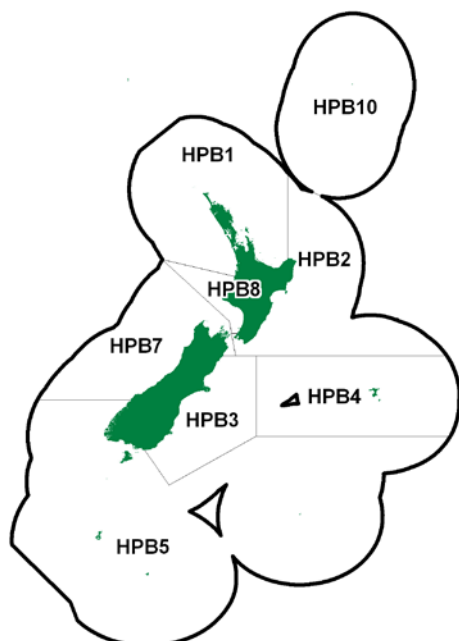


GROPER (HPB)

(*Polyprion oxygeneios*, *Polyprion americanus*)
Hapuku, Moeone



1. FISHERY SUMMARY

1.1 Commercial fisheries

Both groper species, *Polyprion oxygeneios* (hapuku) and *P. americanus* (bass), occur in shelf and slope waters of the New Zealand mainland and offshore islands, from the Kermadecs to the Auckland Islands. The groper fishery takes both species, but in different proportions by region, depth, fishing method and season, and these have changed over time. Reported catches generally do not distinguish between species, and published data combine them. In earlier years, bluenose (*Hyperoglyphe antarctica*) landings were sometimes also combined with groper. In this document, groper is used as collective term for hapuku and bass. Historical estimated and recent reported grouper landings and TACCs are shown in Tables 2 and 3, while Figure 1 shows the historical and recent landings and TACC values for the main grouper stocks.

Table 1: Reported total New Zealand landings (t) of groper from 1948 to 1983.

| Year | Landings | Year | Landings | Year | Landings | Year | Landings |
|------|----------|------|----------|------|----------|------|----------|
| 1948 | 1 665 | 1957 | 1 368 | 1966 | 1 222 | 1975 | 1 422 |
| 1949 | 1 969 | 1958 | 1 532 | 1967 | 1 314 | 1976 | 1 512 |
| 1950 | 1 709 | 1959 | 1 310 | 1968 | 1 073 | 1977 | 1 942 |
| 1951 | 1 396 | 1960 | 1 223 | 1969 | 1 122 | 1978 | 1 488 |
| 1952 | 1 430 | 1961 | 1 203 | 1970 | 1 499 | 1979 | 2 078 |
| 1953 | 1 403 | 1962 | 1 173 | 1971 | 1 346 | 1980 | 2 435 |
| 1954 | 1 364 | 1963 | 1 194 | 1972 | 1 120 | 1981 | 2 379 |
| 1955 | 1 305 | 1964 | 1 370 | 1973 | 1 312 | 1982 | 2 218 |
| 1956 | 1 399 | 1965 | 1 249 | 1974 | 1 393 | 1983 | 2 511 |

Reported foreign catches are included from 1974.
Source: MPI Fisheries data.

The main fishery comprises a number of domestic fishers working small to medium sized vessels - longliners, setnetters and trawlers, at a variety of depths (according to method) out to 500 m (Paul 2002a). Over 90% of early (to 1950) total groper catches were taken by longline. Trawl catches rose from 5–10% during this period to 20–30% by the late 1970s. A setnet fishery developed in the late 1970s and early 1980s, mainly at Kaikoura, taking 14% in 1983 and then subsequently declining.

From 1950 to the mid 1980s, line-fishing took 70–80% of the catch. After the introduction of the QMS in 1986, the proportion of the catch taken by lines appeared to drop.

The Cook Strait region has always supported the main groper fishery, followed by the Canterbury Bight; both show the same slow decline from 1949 to 1986 (equivalent regional data from subsequent years are not available). Northland, Bay of Plenty and Hawke Bay fisheries developed at different rates during the 1960s and 1970s. In most other areas, the groper fishery has been small and/or variable.

The first recorded landings of about 1500 t in 1936 were typical of the range of catches (1000–2000 t) from then until 1978. After a decrease during the war when effort was restricted, landings in the total fishery slowly declined from almost 2000 t in 1949 to about 1300 t in the mid 1970s. They then increased sharply to 2700 t in 1983–84 (Tables 1 and 2). Figure 1 shows the historical landings and TACC values for the main HPB stocks.

Landings and TACCs for all Fishstocks are given in Table 3. Total landings of groper were relatively stable throughout the mid 1990s, remaining below 1500 t until 1998–99. From 1999–2000 onwards, catches have generally ranged between 1200 t and 1700 t. Although the TACC in HPB 3 has been exceeded in some years, catches have generally remained within the quotas for individual Fishstocks and have never exceeded the TACC.

For the 1991–92 fishing year the conversion factor for headed and gutted groper was increased from 1.40 to 1.45, for fish landed in this state (about 75% of the total), this will result in a reduction in removals from the stock of 3.5% for the same nominal quota.

Table 2: Reported landings (t) for the main QMAs from 1931 to 1982.

| Year | HPB 1 | HPB 2 | HPB 3 | HPB 4 | Year | HPB 1 | HPB 2 | HPB 3 | HPB 4 |
|---------|-------|-------|-------|-------|------|-------|-------|-------|-------|
| 1931-32 | 231 | 0 | 207 | 2 | 1957 | 133 | 380 | 419 | 23 |
| 1932-33 | 201 | 276 | 242 | 0 | 1958 | 115 | 473 | 458 | 30 |
| 1933-34 | 198 | 330 | 173 | 25 | 1959 | 147 | 406 | 350 | 54 |
| 1934-35 | 204 | 304 | 212 | 57 | 1960 | 122 | 394 | 331 | 48 |
| 1935-36 | 179 | 201 | 146 | 70 | 1961 | 135 | 369 | 348 | 50 |
| 1936-37 | 129 | 445 | 115 | 12 | 1962 | 163 | 355 | 298 | 40 |
| 1937-38 | 119 | 523 | 315 | 15 | 1963 | 197 | 315 | 321 | 56 |
| 1938-39 | 90 | 621 | 479 | 8 | 1964 | 224 | 397 | 365 | 41 |
| 1939-40 | 118 | 502 | 409 | 12 | 1965 | 212 | 368 | 325 | 68 |
| 1940-41 | 120 | 444 | 286 | 9 | 1966 | 213 | 415 | 315 | 4 |
| 1941-42 | 80 | 450 | 302 | 10 | 1967 | 229 | 448 | 275 | 0 |
| 1942-43 | 69 | 287 | 315 | 9 | 1968 | 139 | 357 | 264 | 0 |
| 1943-44 | 59 | 316 | 271 | 8 | 1969 | 197 | 454 | 220 | 0 |
| 1944 | 55 | 332 | 286 | 9 | 1970 | 259 | 670 | 239 | 2 |
| 1945 | 106 | 311 | 271 | 3 | 1971 | 191 | 562 | 289 | 4 |
| 1946 | 154 | 326 | 409 | 7 | 1972 | 401 | 370 | 188 | 0 |
| 1947 | 98 | 401 | 563 | 5 | 1973 | 419 | 481 | 215 | 0 |
| 1948 | 111 | 450 | 526 | 11 | 1974 | 356 | 457 | 208 | 2 |
| 1949 | 174 | 498 | 547 | 7 | 1975 | 227 | 315 | 213 | 18 |
| 1950 | 141 | 423 | 555 | 9 | 1976 | 183 | 220 | 350 | 107 |
| 1951 | 104 | 353 | 381 | 19 | 1977 | 277 | 301 | 265 | 87 |
| 1952 | 112 | 368 | 373 | 35 | 1978 | 348 | 470 | 194 | 10 |
| 1953 | 105 | 349 | 431 | 33 | 1979 | 620 | 487 | 355 | 147 |
| 1954 | 156 | 355 | 397 | 32 | 1980 | 956 | 376 | 414 | 40 |
| 1955 | 142 | 351 | 419 | 26 | 1981 | 693 | 373 | 457 | 59 |
| 1956 | 106 | 404 | 439 | 32 | 1982 | 957 | 336 | 402 | 26 |

| Year | HPB 5 | HPB 7 | HPB 8 | Year | HPB 5 | HPB 7 | HPB 8 |
|---------|-------|-------|-------|------|-------|-------|-------|
| 1931-32 | 130 | 13 | 13 | 1957 | 92 | 246 | 76 |
| 1932-33 | 91 | 98 | 53 | 1958 | 96 | 250 | 109 |
| 1933-34 | 99 | 127 | 53 | 1959 | 68 | 198 | 87 |
| 1934-35 | 115 | 106 | 56 | 1960 | 100 | 150 | 77 |
| 1935-36 | 33 | 109 | 33 | 1961 | 82 | 139 | 80 |
| 1936-37 | 29 | 156 | 50 | 1962 | 101 | 142 | 75 |
| 1937-38 | 29 | 148 | 52 | 1963 | 75 | 159 | 71 |
| 1938-39 | 75 | 156 | 50 | 1964 | 76 | 193 | 74 |
| 1939-40 | 59 | 155 | 43 | 1965 | 48 | 176 | 52 |
| 1940-41 | 54 | 142 | 41 | 1966 | 49 | 163 | 62 |
| 1941-42 | 46 | 150 | 44 | 1967 | 49 | 228 | 85 |

GROPER (HPB)

Table 2 [Continued]

| Year | HPB 5 | HPB 7 | HPB 8 | Year | HPB 5 | HPB 7 | HPB 8 |
|---------|-------|-------|-------|------|-------|-------|-------|
| 1942-43 | 44 | 115 | 35 | 1968 | 67 | 176 | 70 |
| 1943-44 | 42 | 112 | 42 | 1969 | 30 | 138 | 84 |
| 1944 | 60 | 188 | 117 | 1970 | 54 | 175 | 97 |
| 1945 | 65 | 173 | 128 | 1971 | 41 | 181 | 78 |
| 1946 | 83 | 229 | 190 | 1972 | 29 | 99 | 33 |
| 1947 | 142 | 250 | 175 | 1973 | 30 | 136 | 32 |
| 1948 | 140 | 275 | 151 | 1974 | 43 | 140 | 72 |
| 1949 | 142 | 364 | 236 | 1975 | 55 | 379 | 62 |
| 1950 | 116 | 281 | 184 | 1976 | 101 | 445 | 37 |
| 1951 | 102 | 267 | 171 | 1977 | 47 | 575 | 113 |
| 1952 | 100 | 281 | 162 | 1978 | 59 | 280 | 67 |
| 1953 | 96 | 252 | 137 | 1979 | 113 | 276 | 71 |
| 1954 | 77 | 235 | 112 | 1980 | 199 | 315 | 105 |
| 1955 | 82 | 197 | 88 | 1981 | 218 | 381 | 166 |
| 1956 | 114 | 227 | 77 | 1982 | 133 | 256 | 46 |

Notes:

1. The 1931–1943 years are April–March but from 1944 onwards are calendar years.
2. Data up to 1985 are from fishing returns; Data from 1986 to 1990 are from Quota Management Reports.
3. Data for the period 1931 to 1982 are based on reported landings by harbour and are likely to be underestimated as a result of under-reporting and discarding practices. Data includes both foreign and domestic landings.

Table 3: Reported landings (t) of groper by Fishstock from 1983–84 to present and actual TACCs (t) from 1986–87 to present. QMS data from 1986–present. [Continued on next page].

| Fishstock FMA (s) | HPB 1 1 & 9 | | HPB 2 2 | | HPB 3 3 | | HPB 4 | | HPB 5 5 & 6 | |
|----------------------|----------------|------|------------|------|------------|------|----------|------|----------------|------|
| | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1983–84* | 974 | - | 493 | - | 505 | - | 55 | - | 395 | - |
| 1984–85* | 642 | - | 388 | - | 418 | - | 52 | - | 228 | - |
| 1985–86* | 569 | - | 270 | - | 391 | - | 53 | - | 126 | - |
| 1986–87 | 238 | 360 | 179 | 210 | 260 | 270 | 42 | 300 | 131 | 410 |
| 1987–88 | 248 | 388 | 202 | 219 | 268 | 286 | 43 | 315 | 91 | 414 |
| 1988–89 | 231 | 405 | 187 | 248 | 259 | 294 | 49 | 315 | 70 | 425 |
| 1989–90 | 310 | 465 | 179 | 263 | 283 | 318 | 40 | 322 | 127 | 430 |
| 1990–91 | 350 | 480 | 225 | 263 | 311 | 326 | 77 | 323 | 120 | 436 |
| 1991–92 | 277 | 480 | 252 | 263 | 298 | 326 | 58 | 323 | 112 | 446 |
| 1992–93 | 375 | 480 | 273 | 264 | 299 | 327 | 68 | 323 | 128 | 446 |
| 1993–94 | 363 | 480 | 287 | 264 | 306 | 330 | 90 | 323 | 147 | 446 |
| 1994–95 | 334 | 481 | 259 | 264 | 274 | 335 | 149 | 323 | 161 | 451 |
| 1995–96 | 335 | 481 | 214 | 264 | 321 | 335 | 173 | 323 | 144 | 451 |
| 1996–97 | 331 | 481 | 234 | 264 | 301 | 335 | 131 | 323 | 149 | 451 |
| 1997–98 | 375 | 481 | 260 | 266 | 329 | 335 | 88 | 323 | 91 | 451 |
| 1998–99 | 433 | 481 | 256 | 266 | 348 | 335 | 121 | 323 | 97 | 451 |
| 1999–00 | 471 | 481 | 229 | 266 | 385 | 335 | 66 | 323 | 169 | 451 |
| 2000–01 | 450 | 481 | 220 | 266 | 381 | 335 | 45 | 323 | 188 | 451 |
| 2001–02 | 427 | 481 | 226 | 266 | 343 | 335 | 82 | 323 | 169 | 451 |
| 2002–03 | 442 | 481 | 273 | 266 | 350 | 335 | 79 | 323 | 212 | 451 |
| 2003–04 | 433 | 481 | 281 | 266 | 335 | 335 | 87 | 323 | 166 | 451 |
| 2004–05 | 433 | 481 | 263 | 266 | 371 | 335 | 147 | 323 | 208 | 451 |
| 2005–06 | 425 | 481 | 280 | 266 | 406 | 335 | 185 | 323 | 167 | 451 |
| 2006–07 | 483 | 481 | 245 | 266 | 394 | 335 | 222 | 323 | 157 | 451 |
| 2007–08 | 439 | 481 | 253 | 266 | 341 | 335 | 241 | 323 | 138 | 451 |
| 2008–09 | 415 | 481 | 253 | 266 | 391 | 335 | 138 | 323 | 153 | 451 |
| 2009–10 | 374 | 481 | 249 | 266 | 358 | 335 | 213 | 323 | 152 | 451 |
| 2010–11 | 371 | 481 | 222 | 266 | 322 | 335 | 231 | 323 | 128 | 451 |
| 2011–12 | 312 | 481 | 193 | 266 | 336 | 335 | 265 | 323 | 158 | 451 |
| 2012–13 | 314 | 481 | 206 | 266 | 337 | 335 | 156 | 323 | 140 | 451 |
| 2013–14 | 319 | 481 | 224 | 266 | 301 | 335 | 169 | 323 | 143 | 451 |
| 2014–15 | 314 | 481 | 180 | 266 | 280 | 335 | 156 | 323 | 126 | 451 |
| 2015–16 | 270 | 481 | 143 | 266 | 315 | 335 | 144 | 323 | 143 | 451 |

| | HPB 7 7 | | HPB 8 8 | | HPB 10 10 | | Total | |
|----------|------------|------|------------|------|--------------|------|----------|-------|
| | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1983–84* | 174 | - | 46 | - | 0 | - | 2 698 | - |
| 1984–85* | 207 | - | 33 | - | 0 | - | 2 039 | - |
| 1985–86* | 199 | - | 25 | - | 0 | - | 1 697 | - |
| 1986–87 | 149 | 210 | 35 | 60 | 0 | 10 | 1 036 | 1 830 |
| 1987–88 | 158 | 215 | 66 | 76 | 0 | 10 | 1 076 | 1 923 |
| 1988–89 | 132 | 226 | 39 | 78 | 1 | 10 | 968 | 2 001 |
| 1989–90 | 119 | 229 | 43 | 80 | 0 | 10 | 1 098 | 2 117 |
| 1990–91 | 128 | 235 | 48 | 80 | 23# | 10 | 1 282 | 2 153 |
| 1991–92 | 175 | 235 | 50 | 80 | 83# | 10 | 1 319 | 2 163 |
| 1992–93 | 186 | 236 | 62 | 80 | 22# | 10 | 1 405 | 2 165 |
| 1993–94 | 193 | 236 | 69 | 80 | 0 | 10 | 1 455 | 2 167 |
| 1994–95 | 192 | 236 | 68 | 80 | 0 | 10 | 1 437 | 2 179 |

Table 3 [Continued]

| | HPB 7 | | HPB 8 | | HPB 10 | | Total | |
|---------|----------|------|----------|------|----------|------|----------|-------|
| | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1995-96 | 214 | 236 | 78 | 80 | 0 | 10 | 1 479 | 2 179 |
| 1996-97 | 186 | 236 | 71 | 80 | 15 | 10 | 1 418 | 2 179 |
| 1997-98 | 147 | 236 | 60 | 80 | 33# | 10 | 1 406 | 2 181 |
| 1998-99 | 218 | 236 | 78 | 80 | 3# | 10 | 1 562 | 2 181 |
| 1999-00 | 165 | 236 | 65 | 80 | 0# | 10 | 1 561 | 2 181 |
| 2000-01 | 171 | 236 | 64 | 80 | 0# | 10 | 1 519 | 2 181 |
| 2001-02 | 204 | 236 | 62 | 80 | < 1 | 10 | 1 514 | 2 181 |
| 2002-03 | 233 | 236 | 72 | 80 | 0 | 10 | 1 661 | 2 181 |
| 2003-04 | 239 | 236 | 66 | 80 | 0 | 10 | 1 607 | 2 181 |
| 2004-05 | 240 | 236 | 80 | 80 | 0 | 10 | 1 742 | 2 181 |
| 2005-06 | 207 | 236 | 56 | 80 | 0 | 10 | 1 728 | 2 181 |
| 2006-07 | 206 | 236 | 66 | 80 | 0 | 10 | 1 773 | 2 181 |
| 2007-08 | 195 | 236 | 44 | 80 | 0 | 10 | 1 651 | 2 181 |
| 2008-09 | 207 | 236 | 71 | 80 | 0 | 10 | 1 628 | 2 181 |
| 2009-10 | 221 | 236 | 66 | 80 | 0 | 10 | 1 633 | 2 181 |
| 2010-11 | 191 | 236 | 80 | 80 | 0 | 10 | 1 543 | 2 181 |
| 2011-12 | 173 | 236 | 61 | 80 | 0 | 10 | 1 187 | 2 181 |
| 2012-13 | 209 | 236 | 75 | 80 | 0 | 10 | 1 436 | 2 181 |
| 2013-14 | 182 | 236 | 63 | 80 | 0 | 10 | 1 401 | 2 181 |
| 2014-15 | 132 | 236 | 67 | 80 | 0 | 10 | 1 254 | 2 181 |
| 2015-16 | 148 | 236 | 73 | 80 | 0 | 10 | 1 236 | 2 181 |

* FSU data.

Values in HPB 10 included catches taken under exploratory permit.

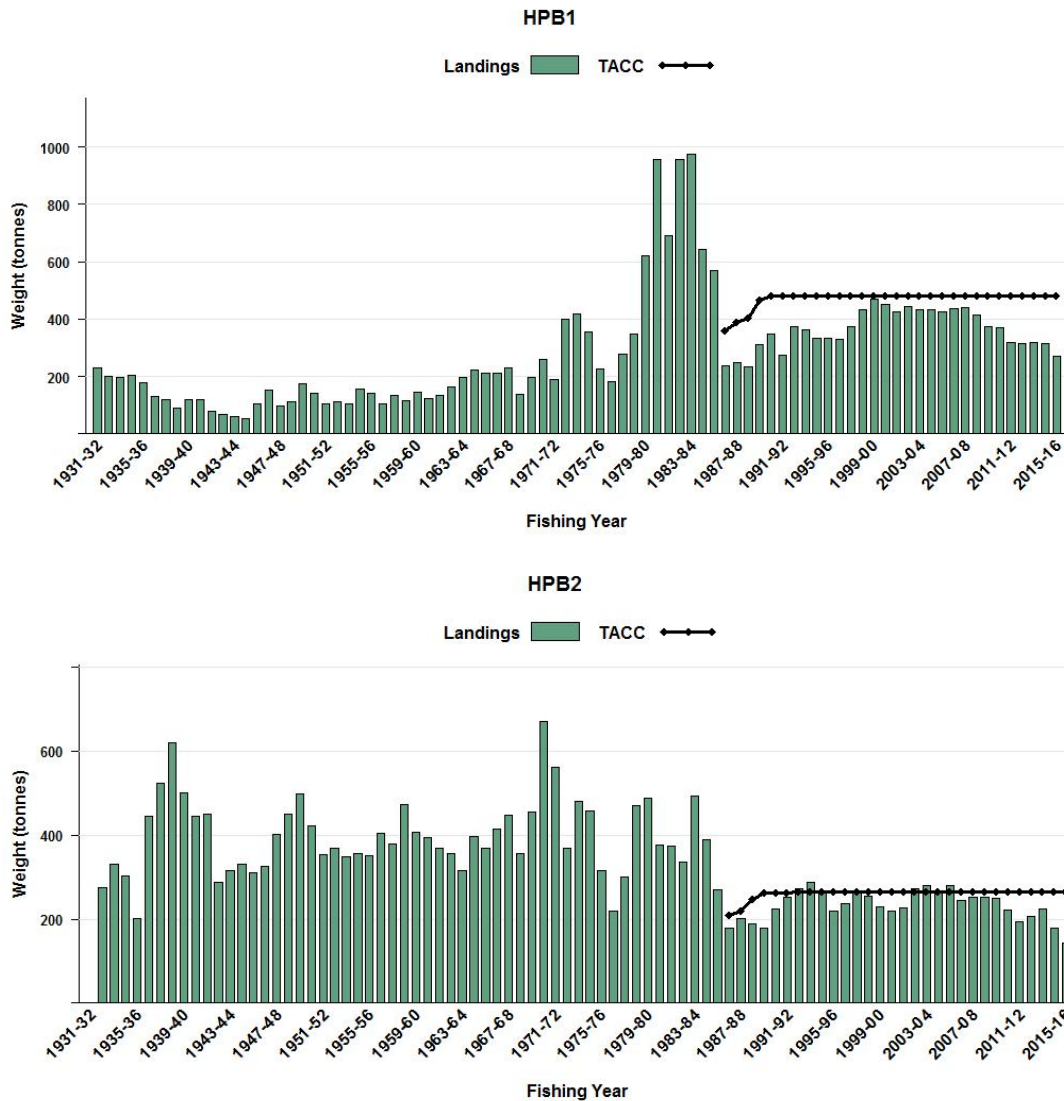


Figure 1: Total reported landings and TACC for the seven main HPB stocks. From top to bottom: HPB 1 (Auckland) and HPB 2 (Central East) [Continued on the next page].

GROPER (HPB)

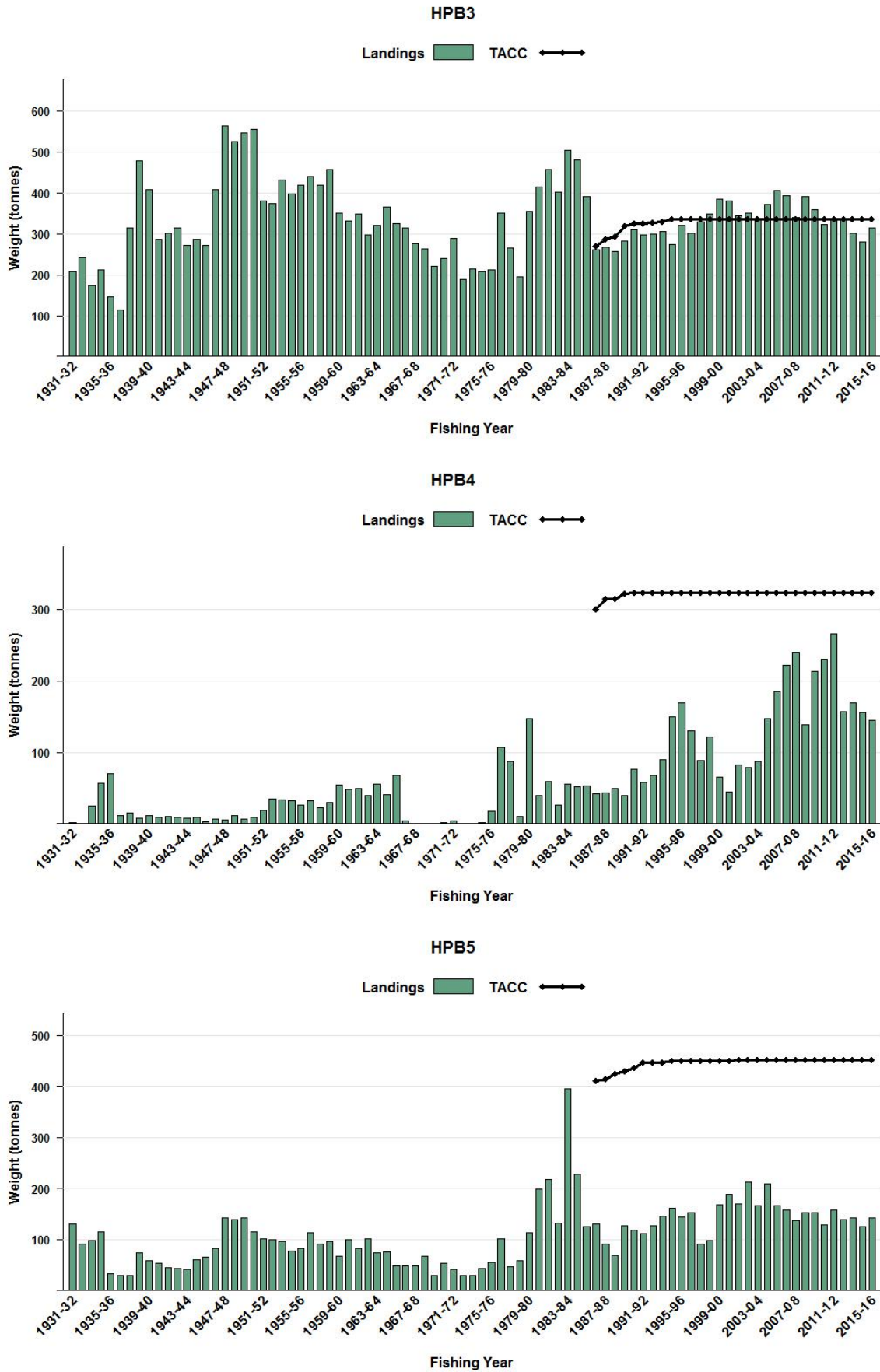


Figure 1 [Continued]: Total reported landings and TACC for the seven main HPB stocks. From top to bottom: HPB 3 (South East Coast), HPB 4 (Chatham Rise), and HPB 5 (Southland, Sub-Antarctic). [Continued on next page].

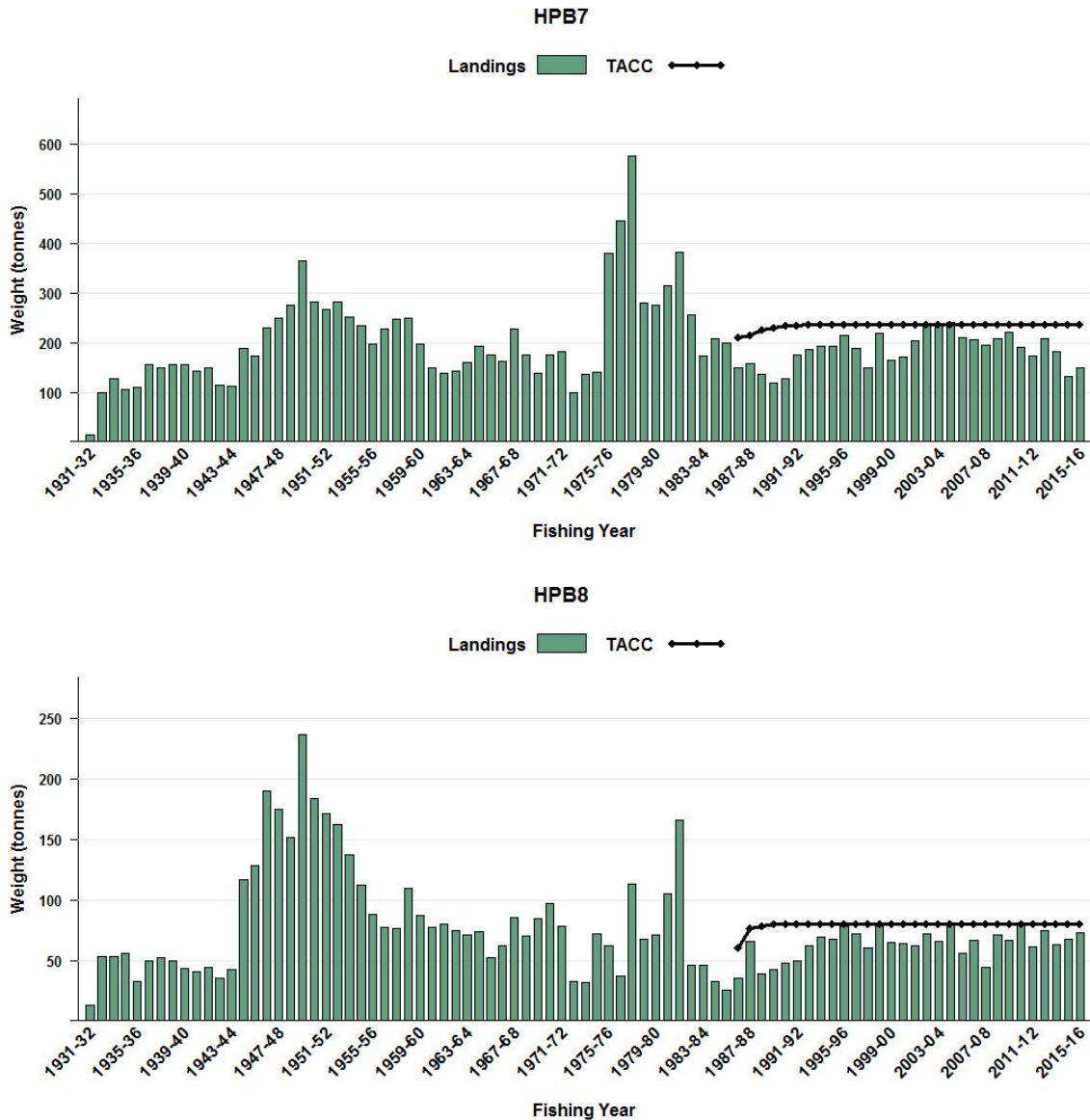


Figure 1 [Continued]: Total reported landings and TACC for the seven main HPB stocks. From top to bottom: HPB 7 (Challenger) and HPB 8 (Central).

1.2 Recreational fisheries

Groper are taken by handline and setline, and to a lesser extent by setnets. Recreational catch estimates from surveys undertaken in the 1990s are given in Tables 4–6.

Table 4: Estimated number of groper harvested by recreational fishers by Fishstock and survey, the corresponding estimated survey harvest and the estimated Fishstock harvest. Surveys were carried out in different years in the MAF Fisheries regions: South in 1991–92, Central in 1992–93 and North in 1993–94 (Teirney et al 1997).

| Fishstock | Survey | Total | | Survey harvest (t) |
|-----------|---------|--------|--------|--------------------|
| | | Number | CV (%) | |
| HPB 1 | North | 22 000 | 17 | 190–220 |
| HPB 2 | North | 1 000 | - | 5–10 |
| HPB 2 | Central | 10 000 | 37 | 45–85 |
| HPB 3 | Central | 3 000 | - | 10–30 |
| HPB 3 | South | 4 000 | 40 | 10–30 |
| HPB 5 | Central | 7 000 | 36 | 20–40 |
| HPB 5 | South | 2 000 | - | 5–15 |
| HPB 7 | Central | 12 000 | 40 | 45–115 |
| HPB 8 | Central | 1 000 | - | 5–10 |

Table 5: Results of a national diary survey of recreational fishers in 1996, indicating estimated number of groper harvested by recreational fishers by Fishstock and the corresponding harvest tonnage. The mean weights used

GROPER (HPB)

to convert numbers to catch weight are considered the best available estimates. Estimated harvest is also presented as a range to reflect the uncertainty in the estimates (from Bradford 1998).

| Fishstock | Number caught | Harvest CV (%) | Point range (t) | Estimate (t) |
|-----------|---------------|----------------|-----------------|--------------|
| HPB 1 | 11 000 | 17 | 40–60 | 49 |
| HPB 2 | 23 000 | 22 | 75–125 | 100 |
| HPB 3 | 4 000 | - | - | - |
| HPB 5 | 2 000 | - | - | - |
| HPB 7 | 9 000 | - | - | - |
| HPB 8 | < 500 | - | - | - |

Table 6: Results of the 1999–2000 national diary survey of recreational fishers (Dec 1999–Nov 2000). Estimated number of groper harvested by recreational fishers by Fishstock, and the corresponding harvest tonnage. Estimated harvest is presented as a range to reflect the uncertainty in the estimates (Boyd & Reilly 2002).

| Fishstock | Number caught | Harvest CV (%) | Point range (t) | Estimate (t) |
|-----------|---------------|----------------|-----------------|--------------|
| HPB 1 | 60 000 | 39 | 209–476 | 342 |
| HPB 2 | 56 000 | 33 | 307–608 | 457 |
| HPB 3 | 52 000 | 50 | 97–293 | 195 |
| HPB 5 | 6 000 | 70 | 14–80 | 47 |
| HPB 7 | 17 000 | 37 | 79–172 | 125 |
| HPB 8 | 2 000 | 67 | 6–32 | 19 |

A key component of the estimating recreational harvest from diary surveys is determining the proportion of the population that fish. The Recreational Technical Working Group concluded that the harvest estimates from the diary surveys should be used only with the following qualifications: a) they may be very inaccurate; b) the 1996 and earlier surveys contain a methodological error; and, c) the 2000 and 2001 estimates are implausibly high for many important fisheries. The 1999–2000 harvest estimates for each Fishstock should be evaluated with reference to the coefficient of variation.

Recreational harvest appears to have exceeded the commercial catch in HPB 2. The last nationwide recreational survey was undertaken in 2001, but the results for QMA 2 were considered by the Recreational Technical Working Group to be unbelievably high.

1.3 Customary non-commercial fisheries

Groper (hapuku and bass) were certainly taken by early Maori, and would have been available in greater numbers at shallower depths than is the case at present. Traditional groper grounds are known in several regions. Quantitative information on the current level of customary non-commercial catch is not available.

1.4 Illegal catch

Quantitative information on the level of illegal catch is not available.

1.5 Other sources of mortality

None are apparent.

2. BIOLOGY

Both hapuku and bass are widely distributed around New Zealand, generally over rough ground from the central shelf (about 100 m) to the shelf edge and down the upper slope. Their lower limits are ill-defined, but hapuku extends to at least 300 m and bass to 500 m.

Hapuku mature sexually between 10 and 13 years old and may live in excess of 60 years (Francis et al 1999). Cook Strait hapuku mature over a wide size range, with the size at 50% maturity at 80–85 cm total length (TL) and 85–90 cm TL for males and females respectively (Paul 2002d). Spawning occurs during winter, anecdotally earlier in the north of New Zealand than in the south, but running ripe fish

are seldom caught and spawning grounds are unknown. The smallest juveniles are virtually unknown, but are mottled, pelagic and epi-pelagic, perhaps schooling in association with drifting weed.

The size range of commercially caught hapuku is 50–140 cm TL, with a broad mode between 70 and 100 cm TL. Bass are slightly larger at 60–150 cm TL, with a mode at 80–110 cm TL, but much bulkier and heavier at equivalent lengths.

There appear to be some regional differences in the size structure of populations. Trawl-caught hapuku on the Stewart-Snares Shelf are mainly 50–80 cm, modal length 60 cm, and therefore juveniles. Trawl-caught hapuku on the Chatham Rise are slightly larger, 50–100 cm, modal length 70 cm, with those on the shelf around the islands having their main mode at 60–75 cm; most of these fish are also juveniles. These offshore regions may be important nurseries.

Both groper species are assumed to be long-lived. Natural mortality in the past was assumed to be 0.2, however, a study of a South American (Juan Fernandez) population suggested that it may be lower (0.13–0.16) (Pavez & Oyarzun 1985). Furthermore, preliminary unvalidated ageing in New Zealand has indicated that maximum age may be greater than 40 years, and that M may be 0.1 or less (Francis et al 1999). This value of M will be retained until clearer information becomes available from ageing. Parker et al (2011) compared regional differences in the catch composition from observer collected data. This report noted that the proportion of age 10+ fish in the catch in the Kermadec and Northeastern regions (FMA 2) was greater than that of Southland.

Migration patterns are also little known, but are probably related to spawning. Tagging of mostly immature fish in Cook Strait has shown a high level of site fidelity, but about 5% of these fish have moved up to 160 km north and south. Other information is largely anecdotal and speculative. It is known that good fishing grounds, particularly pinnacles and reefs or ledges, can be quickly fished out and take some time to recover, suggesting a high level of residency (except, perhaps, for during the spawning season). On the other hand, trawlers sometimes catch groper on the flat and clear seafloor, and it is not known whether this represents their normal habitat, whether they are simply dispersing by travelling from one rough ground to another, or whether they are on a purposeful spawning migration.

Hapuku and bass prey on a wide variety of fish and invertebrates, including red cod, tarakihi, blue cod, hoki and squid. In Cook Strait, they are preyed upon by sperm whales, although probably neither heavily nor selectively.

Biological parameters relevant to stock assessment are shown in Table 7.

Table 7: Estimates of biological parameters of groper.

| Fishstock | Estimate | Source |
|---|--------------------------|----------------------|
| 1. Natural mortality (M) | | |
| All | $M = 0.1$ | Francis et al (1999) |
| 2. Weight = a (length) ^b (Weight in g, length in cm fork length) | | |
| <u>Both sexes combined</u> | | |
| BAS 1 | $a = 0.2734$ $b = 2.382$ | Johnston (1993) |
| HAP 1 | $a = 0.0142$ $b = 3.003$ | Johnston (1993) |
| HAP 2 | $a = 0.0242$ $b = 2.867$ | Johnston (1993) |
| HAP 7, 8 | $a = 0.0142$ $b = 2.998$ | Johnston (1983) |

(HAP = hapuku, BAS = bass groper)

3. STOCKS AND AREAS

Tagging studies reveal considerable mixing of hapuku between Otago, South Canterbury and Cook Strait. Fishstock boundaries in Cook Strait separate Cook Strait hapuku into three separate "stocks" (HPB 2, HPB 7, and HPB 8), none of which include Otago-Canterbury fish (HPB 3). Current Fishstock boundaries appear inappropriate for the management of Cook Strait and South Island hapuku. Current stock boundaries are based on QMAs and do not reflect biological stocks. Existing data cannot describe the stock structure of New Zealand groper (Paul 2002b). Electrophoretic studies suggest that separate stocks of hapuku could occur. However, the genetic heterogeneity of Cook Strait hapuku, seasonal movements of hapuku through this area, moderately long-distance movements of some tagged hapuku, the presence of both species on open ground and the eventual recovery of heavily exploited reefs, suggest that either each stock is moderately mobile or that there is essentially only one stock (of each species) with some small geographic or temporal genetic differences.

4. STOCK ASSESSMENT

Yield estimates for HPB 4 and HPB 5 have been removed because the previous method used is now considered obsolete. The yield estimates for the other Fishstocks have been revised based on a revision of the estimate of M .

4.1 Estimates of fishery parameters and abundance

Estimates of fishery parameters and abundance are not available. Paul (2002c) found that CPUE indices could not be developed for hapuku and bass either separately or in combination.

4.2 Biomass estimates

Estimates of current and reference biomass are not available. Data for hapuku from the East Coast South Island trawl surveys have moderate CVs (average over all years = 28.17; range 19–35) and although the survey does not extend to the entire habitat range, the survey may be monitoring settled juveniles (Figure 2).

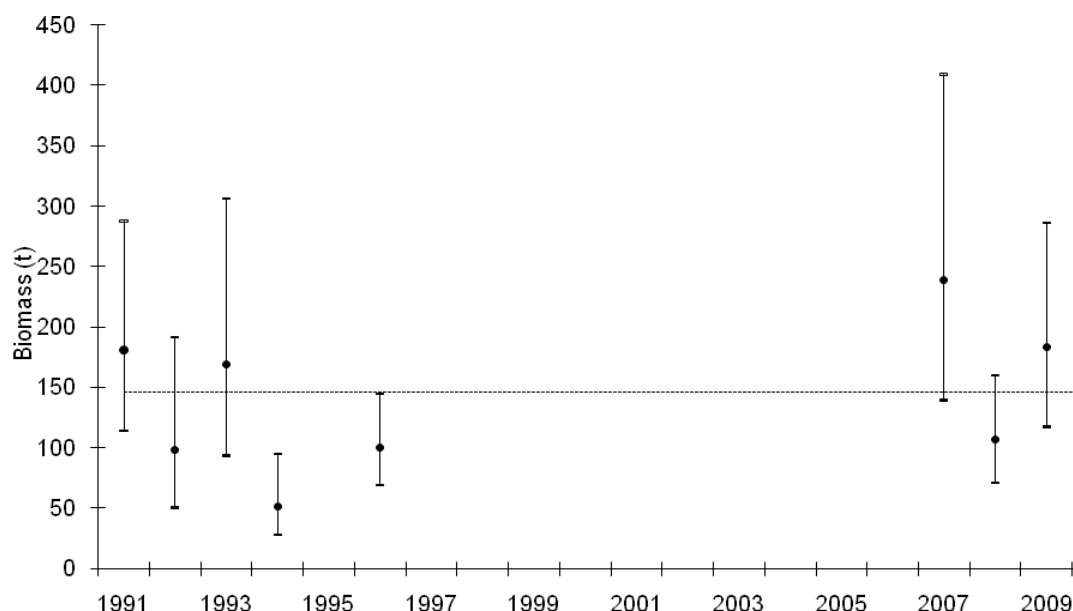


Figure 2: Biomass estimates $\pm 95\%$ CI (estimated from survey CV's assuming a lognormal distribution) and the time series mean (dotted line) from the East Coast South Island trawl survey.

4.4 Yield estimates and projections

Current biomass cannot be estimated, so *CAY* cannot be determined. Yield estimates are summarised in Table 8.

Table 8: Yield estimates (t).

| Parameter | Fishstock | Estimate |
|------------|-----------|----------------------|
| | HPB 4 | Cannot be determined |
| | HPB 5 | Cannot be determined |
| | Total | Cannot be determined |
| <i>CAY</i> | All | Cannot be determined |

4.5 Other factors

Although no distinct stocks of either groper species have been identified, results from trawl surveys suggest that there are reasonably large but dispersed populations over the Stewart-Snares Shelf and the Chatham Rise. The relationship between these "offshore" and the more traditionally fished "inshore" populations is not known due to the lack of information on groper movements. Little is known of the species composition and population structure of groper on the rough bottom shelf and ridges extending northwards from New Zealand.

The relative quantity of groper taken as target and non-target catch has not been investigated, but is likely to have varied both spatially and temporally. Groper have been taken by the foreign licensed, chartered and New Zealand-owned trawlers working offshore grounds; although being regarded as a small bycatch they were not accurately reported before 1986. The *MCY* may therefore be underestimated.

There are three regions where the groper catch has been substantially lower than the TACC.

HPB 1 - Three features of the fishery appear to explain the under-catch of the TACC. (i) A considerable part of the fishing effort which had generated the high catches in the early 1980s left the fishery. (ii) The allocated quota is widely distributed in small units among fishers who appear to use only a modest proportion of it to cover bycatch. (iii) The fishers who hold larger amounts of quota generally also use only a proportion of it to land high-quality fish (in contrast to the earlier bulk landings of lower-quality fish).

HPB 4 and 5 - The original yield estimates made before the introduction of the QMS and the original TAC were based on trawl surveys, not catch histories. The TACCs for these Fishstocks can only be economically targeted around the Chatham Islands in HPB 4, and a few localities in HPB 5. Elsewhere, it is used to cover a small bycatch from trawlers. A moderate quantity of quota is held, unused, by companies which would require it should they resume target fishing for ling and associated species.

5. STATUS OF THE STOCKS

No estimates of current biomass are available. An estimate of B_{AV} is available for HPB 5.

It is not known if current catches or the TACCs are sustainable or at levels that will allow the stocks to move towards a size that will support the maximum sustainable yield.

Yield estimates, TACCs and reported landings are summarised in Table 9.

Table 9: Summary of TACCs (t) and reported landings (t) of groper for the most recent fishing year.

GROPER (HPB)

| Fishstock | QMA | FMAs | 2015–16 | 2015–16 |
|-----------|--------------------------|-------|-------------|-------------------|
| | | | Actual TACC | Reported Landings |
| HPB 1 | Auckland (East, West) | 1 & 9 | 481 | 270 |
| HPB 2 | Central (East) | 2 | 266 | 143 |
| HPB 3 | South-east (Coast) | 3 | 335 | 315 |
| HPB 4 | South-east (Chatham) | 4 | 323 | 144 |
| HPB 5 | Southland, Sub-Antarctic | 5 & 6 | 451 | 143 |
| HPB 7 | Challenger | 7 | 236 | 148 |
| HPB 8 | Central (West) | 8 | 80 | 73 |
| HPB 10 | Kermadec | 10 | 10 | 0 |
| Total | | | 2 182 | 1 236 |

6. FOR FURTHER INFORMATION

- Beentjes, M P; Francis, M P (1999) Movements of hapuku, *Polyprion oxygeneios* determined from tagging studies. *New Zealand Journal of Marine and Freshwater Research* 33(1): 1–12.
- Boyd, R O; Reilly, J L (2002) 1999/2000 national marine recreational fishing survey: harvest estimates. Draft New Zealand Fisheries Assessment Report. (Unpublished report held by Ministry for Primary Industries.)
- Bradford, E (1998) Harvest estimates from the 1996 national recreational fishing surveys. New Zealand Fisheries Assessment Research Document. 1998/16. 27 p. (Unpublished report held by Ministry for Primary Industries.)
- Francis, M P; Mulligan, K P; Davies, N M; Beentjes, M P (1999) Age and growth estimates for New Zealand hapuku, *Polyprion oxygeneios*. *Fishery Bulletin*. 97(2): 227–242.
- Hurst, R J; Bagley, N W; Uozumi, Y (1990) New Zealand-Japan trawl survey of shelf and upper slope species off southern New Zealand, June 1986. *New Zealand Fisheries Technical Report* No. 18. 50 p.
- Johnston, A D (1983) The southern Cook Strait groper fishery. *Fisheries Technical Report* No. 159. 33 p.
- Johnston, R G (Ed.) (1993) Report from the Conversion Factors Working Group and Steering Committee 1992. MAF Fisheries, Greta Point Internal Report No. 201. 171 p. (Unpublished report held in NIWA library, Wellington.)
- McDougall, C R (1975) Age and growth of *Polyprion oxygeneios* (Pisces: Serranidae) in Cook Strait. (Unpublished B.Sc. (Hons) thesis (Zoology), Victoria University of Wellington.)
- Parker, S J; Paul, L J; Francis, M P (2011) Age structure characteristics of hapuku *Polyprion oxygeneios* stocks from existing samples of otoliths. *New Zealand Fisheries Assessment Report 2011/31*. 42 p.
- Paul, L (2002a) A description of the New Zealand fisheries for the two groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*). *New Zealand Fisheries Assessment Report 2002/13*. 47 p.
- Paul, L (2002b) Can existing data describe the stock structure of the two New Zealand groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*)? *New Zealand Fisheries Assessment Report 2002/14*. 24 p.
- Paul, L (2002c) Can separate CPUE indices be developed for the two groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*)? *New Zealand Fisheries Assessment Report 2002/15*. 24 p.
- Paul, L (2002d) Size structure of hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*) populations in New Zealand. *New Zealand Fisheries Assessment Report 2002/16*. 17 p.
- Paul, L J (1985) The estimation of hapuku and bass yields for New Zealand fishing regions. Fisheries Research Division Internal Report No. 26. 31 p. (Unpublished report held in NIWA library, Wellington.)
- Paul, L J; Davies, N M (1988) Groper. New Zealand Fisheries Assessment Research Document 88/15. 27 p. (Unpublished report held by NIWA library, Wellington.)
- Pavez, P; Oyarzun, M E (1985) Determination of the relative efficiency of hooks, and growth parameters of the Juan Fernandez "cod" *Polyprion oxygeneios* Bloch and Schneider, 1801, in the Robinson Crusoe and Santa Clara Islands. In Arana, P (Ed.), "Investigaciones en el Archipelago de Juan Fernandez", pp. 341–345. Escuela de Ciencias del Mar, UCV, Valparaiso. [In Spanish, English summary.]
- Teirney, L D; Kilner, A R; Millar, R E; Bradford, E; Bell, J D (1997) Estimation of recreational catch from 1991/92 to 1993/94 New Zealand Fisheries Assessment Research Document 1997/15. 43 p. (Unpublished report held by NIWA library, Wellington.)
- Teirney, L; McKinnon, S; Kilner, A; Sylvester, T (1991) Marine Recreational Fisheries Working Group Report — November 1991. New Zealand Fisheries Working Group Report 91/1. 46 p.
- Teirney, L D; Olsen, D L (1992) Marine Recreational Fisheries Group Report — November 1992. New Zealand Fisheries Working Group Report 92/1. 13 p.