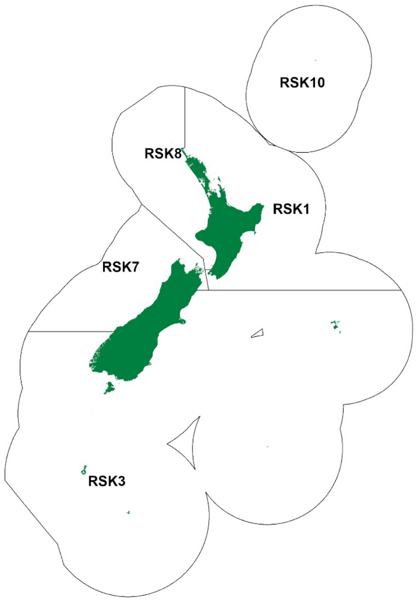
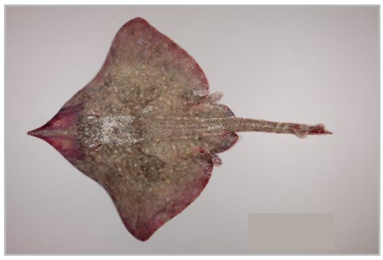
# ROUGH SKATE (RSK)

(*Zearaja nasuta*)
Waewae, Uku



## 1. FISHERY SUMMARY

Allowances, TACCs, and TACs are shown in Table 1.

**Table 1: Recreational and Customary non-commercial allowances, other mortality, TACCs, and TACs (t) for rough skate by Fishstock.**

| Fishstock | Recreational allowance | Customary non-commercial allowance | Other sources of mortality | TACC | TAC |
|---|---|---|---|---|---|
| RSK 1 | 1 | 1 | 1 | 111 | 114 |
| RSK 3 | 1 | 1 | 17 | 1 653 | 1 672 |
| RSK 7 | 1 | 1 | 2 | 201 | 205 |
| RSK 8 | 1 | 1 | 4 | 37 | 43 |
| RSK 10 | 0 | 0 | 0 | 0 | 0 |

### 1.1 Commercial fisheries

Rough skates (*Zearaja nasuta*, RSK), which are also known as barndoor skates, are fished commercially in New Zealand in close association with smooth skates. Although rough skates reach considerably smaller sizes than smooth skates, RSK is still landed and processed. Two other species of deepwater skate (*Bathyraja shuntovi* and *Raja hyperborea*) are large enough to be of commercial interest but are relatively uncommon and probably comprise a negligible proportion of the landings.

Skate flesh ammoniates rapidly after death, so the wings are removed at sea, and chilled or frozen. On arrival at the shore factories, the wings are machine-skinned, graded, and packed for sale. Most of the product is exported to Europe, especially France and Italy. Skates of all sizes are processed, although some factories impose a minimum weight limit of about 1 kg (200 g per wing), and occasionally wings from very large smooth skates are difficult to market.

Rough skates occur throughout New Zealand but are most abundant around the South Island in depths down to 500 m. Most of the catch is taken as bycatch by bottom trawlers, but skates are also taken by longliners. Significant longline bycatch has been reported from the Bounty Plateau in QMA 6. There is no clear separation of the depth ranges inhabited by rough and smooth skates; however, smooth skates tend to occur slightly deeper than rough skates (Beentjes & Stevenson 2000, 2001, Stevenson & Hanchet 2000).

Many fishers and processors did not previously distinguish rough and smooth skates in their landing returns and coded them instead as ‘skates’ (SKA). Because it is impossible to determine the species composition of the catch from landings data prior to introduction of these species into the QMS in 2003, all pre-QMS data reported here consist of the sum of the three species codes RSK, SSK, and SKA. Landings have been converted from processed weight to whole weight by application of conversion factors. Further, following introduction into the QMS in 2003, the two skate species were not always correctly identified and a considerable, but unknown, catch of either species is misidentified with over-reporting of rough skate and, correspondingly, under-reporting of smooth skate (Beentjes 2005). Neither fishers nor processors were distinguishing between the two skate species or reporting catches of each species correctly at the time of the study in 2004. It is not known if reporting has improved since this time.

There have been historical changes to the conversion factors applied to skates by MAF Fisheries and Ministry of Fisheries. No record seems to have been kept of the conversion factors in use before 1987, so it is not possible to reconstruct the time series of landings data using the currently accepted factors. Consistent and appropriate conversion factors have been applied to skate landings since the end of the 1986–87 fishing year. Before that, it appears that a lower conversion factor was applied, resulting in an underestimation of landed weight by about 20%. No correction has been made for that in this report.

New Zealand annual skate landings, estimated from a variety of sources, are shown in Table 2. No FSU deepwater data were available before 1983, and it is not known whether deepwater catches, including those of foreign fishing vessels, were significant during that period. CELR and CLR data are provided by inshore and deepwater trawlers, respectively. ‘CELR estimated’ landings were always less than ‘CELR landed’ landings, because the former include only the top five fish species (by weight) caught by trawlers, whereas the latter include all species landed. As a relatively minor bycatch, skates frequently do not fall into the top five species. The sum of the ‘CELR landed’ and CLR data provides an estimate of the total skate landings. This estimate usually agreed well with LFRR data supplied by fish processors, especially in 1993–94 and 1994–95, but in 1992–93 the difference was 467 t. The ‘best estimate’ of the annual historical landings comes from FSU data up to 1985–86, and LFRR data thereafter.

**Table 2: New Zealand skate landings for calendar years 1974–1983, and fishing years (1 October–30 September) 1983–84 to 1995–96. Values in parentheses are based on part of the fishing year only. Landings do not include foreign catch before 1983, or unreported discards. FSU = Fisheries Statistics Unit; CELR = Catch, Effort and Landing Return; CLR = Catch Landing Return; LFRR = Licensed Fish Receivers Return; Best Estim. = best available estimate of the annual skate catch; - = no data.**

| | FSU | | | CELR | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Inshore | Deepwater | Total | Estim. | Landed | CLR | CELR Landed +CLR | LFRR | Best Estim. |
| 1974 | 23 | – | – | – | – | – | – | – | 23 |
| 1975 | 30 | – | – | – | – | – | – | – | 30 |
| 1976 | 28 | – | – | – | – | – | – | – | 28 |
| 1977 | 27 | – | – | – | – | – | – | – | 27 |
| 1978 | 36 | – | – | – | – | – | – | – | 36 |
| 1979 | 165 | – | – | – | – | – | – | – | 165 |
| 1980 | 441 | – | – | – | – | – | – | – | 441 |
| 1981 | 426 | – | – | – | – | – | – | – | 426 |
| 1982 | 648 | – | – | – | – | – | – | – | 648 |
| 1983 | 634 | 178 | 812 | – | – | – | – | – | 812 |
| 1983–84 | 686 | 298 | 983 | – | – | – | – | – | 983 |
| 1984–85 | 636 | 250 | 886 | – | – | – | – | – | 886 |
| 1985–86 | 613 | 331 | 944 | – | – | – | – | – | 944 |
| 1986–87 | 723 | 285 | 1 007 | – | – | – | – | 1 019 | 1 019 |
| 1987–88 | 1 005 | 421 | 1 426 | – | – | – | – | 1 725 | 1 725 |
| 1988–89 | (530) | (136) | (665) | (252) | (265) | (28) | (293) | 1 513 | 1 513 |
| 1989–90 | – | – | – | 780 | 1 171 | 410 | 1 581 | 1 769 | 1 769 |
| 1990–91 | – | – | – | 796 | 1 334 | 359 | 1 693 | 1 820 | 1 820 |
| 1991–92 | – | – | – | 1 112 | 1 994 | 703 | 2 698 | 2 620 | 2 620 |
| 1992–93 | – | – | – | 1 175 | 2 595 | 824 | 3 418 | 2 951 | 2 951 |
| 1993–94 | – | – | – | 1 247 | 2 236 | 788 | 3 024 | 2 997 | 2 997 |
| 1994–95 | – | – | – | 956 | 1 973 | 829 | 2 803 | 2 789 | 2 789 |
| 1995–96 | – | – | – | – | – | – | – | 2 789 | 2 789 |

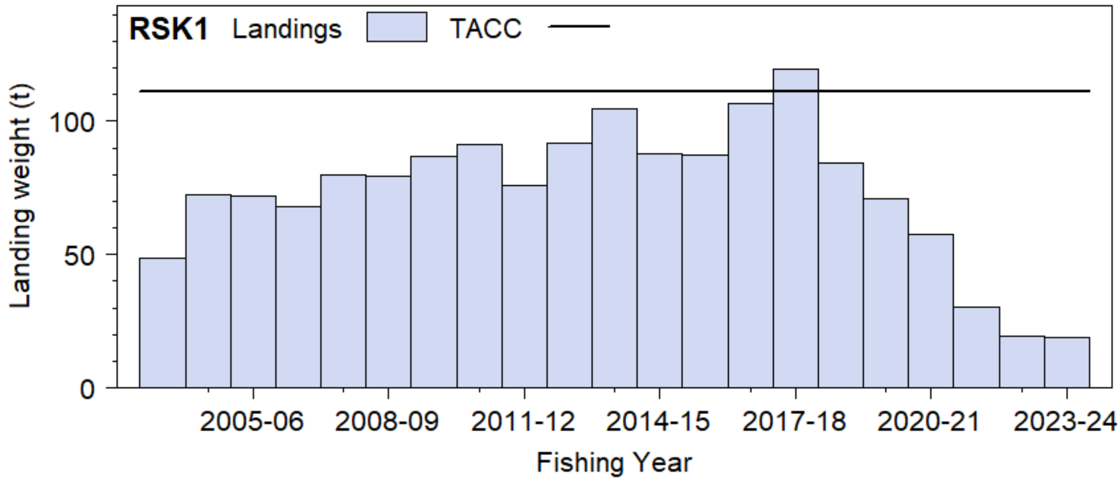
Total skate landings (based on the ‘best estimate’ in Table 2) were negligible up to 1978, presumably because of a lack of suitable markets and the availability of other more abundant and more desirable species. Landings then increased linearly to reach nearly 3000 t in 1992–93 and 1993–94, and remained between 2600 and 3100 t until the separation of skate species under the QMS. Reported landings of rough skate are provided in Table 3.

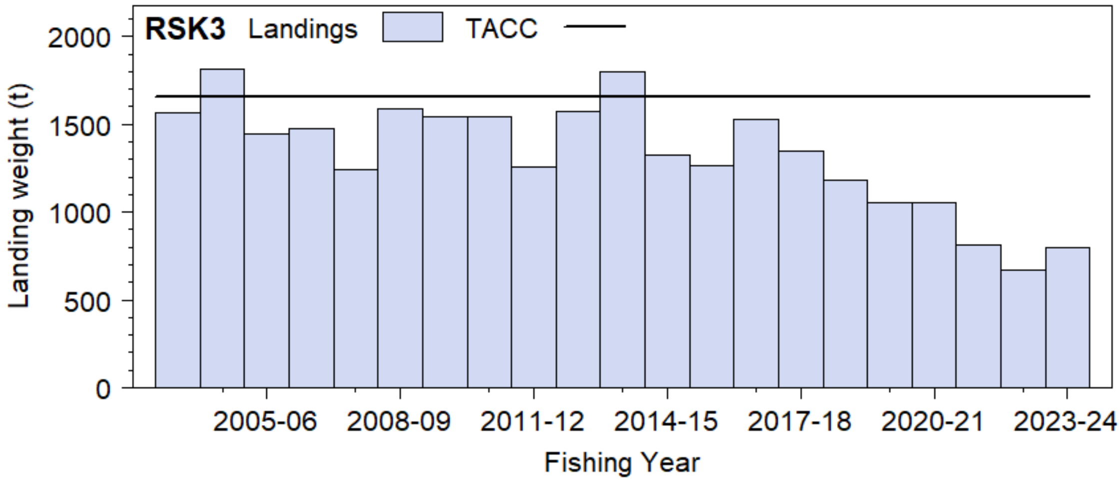
Figure 1 shows the historical landings and TACC values for the main RSK stocks. Owing to problems associated with identification of rough and smooth skates, reported landings of each species are probably not accurate (Beentjes 2005). Initiatives to improve identification of these species begun in 2003 may have resulted in more accurate data. About 83% of rough skate landings since the fishing year 2003–04 have come from RSK 3. Landings recorded for RSK 3 have generally been below the TACC, averaging just over 1500 t annually from 2003–04 to 2018–19 and landings between 2019–20 and 2022–23 were the lowest since inclusion in the QMS. In contrast RSK 8 was been consistently over-caught, relative to the TACC prior to 2021–22. It was put on Schedule 6 on 1 October 2006. Owing to discarding and misidentification of the two skate species, RSK and SSK, catches are likely to be inaccurate. The TACC for RSK 8 was increased to 37 t in 2022–23.

**Table 3: Reported landings (t) of SKA and RSK by QMA and fishing year, 1996–97 to present.**

| Fishstock | RSK 1 | | RSK 3 | | RSK 7 | | RSK 8 | | RSK 10 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMA | 1–2 | | 3–6 | | 7 | | 8–9 | | 10 | | | Total |
| Skate (SKA)* | Land. | TACC | Land. | TACC | Land. | TACC | Land. | TACC | Land. | TACC | Land. | TACC |
| 1996–97 | 43 | - | 894 | - | 380 | - | 30 | - | 0 | - | 1 347 | - |
| 1997–98 | 44 | - | 855 | - | 156 | - | 31 | - | 0 | - | 1 086 | - |
| 1998–99 | 48 | - | 766 | - | 228 | - | 12 | - | 0 | - | 1 054 | - |
| 1999–00 | 75 | - | 775 | - | 253 | - | 25 | - | 0 | - | 1 128 | - |
| 2000–01 | 88 | - | 933 | - | 285 | - | 28 | - | 0 | - | 1 334 | - |
| 2001–02 | 132 | - | 770 | - | 311 | - | 35 | - | 0 | - | 1 248 | - |
| 2002–03 | 121 | - | 857 | - | 293 | - | 32 | - | 0 | - | 1 303 | - |
| 2003–04 | < 1 | - | < 1 | - | < 1 | - | < 1 | - | 0 | - | 1 | - |
| **Rough skate (RSK)** | | | | | | | | | | | | |
| 1996–97 | 15 | - | 265 | - | 69 | - | 3 | - | 0 | - | 352 | - |
| 1997–98 | 32 | - | 493 | - | 44 | - | 5 | - | 0 | - | 574 | - |
| 1998–99 | 22 | - | 607 | - | 33 | - | 4 | - | 0 | - | 666 | - |
| 1999–00 | 20 | - | 720 | - | 37 | - | 2 | - | 0 | - | 779 | - |
| 2000–01 | 27 | - | 569 | - | 42 | - | 4 | - | 0 | - | 642 | - |
| 2001–02 | 24 | - | 607 | - | 25 | - | 3 | - | 0 | - | 659 | - |
| 2002–03 | 18 | - | 1 060 | - | 27 | - | 11 | - | 0 | - | 1 118 | - |
| 2003–04 | 48 | 111 | 1 568 | 1 653 | 192 | 201 | 33 | 21 | 0 | 0 | 1 842 | 1 986 |
| 2004–05 | 72 | 111 | 1 815 | 1 653 | 173 | 201 | 55 | 21 | 0 | 0 | 2 115 | 1 986 |
| 2005–06 | 72 | 111 | 1 446 | 1 653 | 153 | 201 | 28 | 21 | 0 | 0 | 1 699 | 1 986 |
| 2006–07 | 68 | 111 | 1 475 | 1 653 | 197 | 201 | 35 | 21 | 0 | 0 | 1 768 | 1 986 |
| 2007–08 | 80 | 111 | 1 239 | 1 653 | 206 | 201 | 46 | 21 | 0 | 0 | 1 573 | 1 986 |
| 2008–09 | 79 | 111 | 1 591 | 1 653 | 226 | 201 | 46 | 21 | 0 | 0 | 1 942 | 1 986 |
| 2009–10 | 87 | 111 | 1 546 | 1 653 | 225 | 201 | 46 | 21 | 0 | 0 | 1 905 | 1 986 |
| 2010–11 | 91 | 111 | 1 547 | 1 653 | 199 | 201 | 45 | 21 | 0 | 0 | 1 882 | 1 986 |
| 2011–12 | 76 | 111 | 1 257 | 1 653 | 189 | 201 | 41 | 21 | 0 | 0 | 1 563 | 1 986 |
| 2012–13 | 92 | 111 | 1 573 | 1653 | 180 | 201 | 44 | 21 | 0 | 0 | 1 889 | 1 986 |
| 2013–14 | 105 | 111 | 1 798 | 1 653 | 166 | 201 | 54 | 21 | 0 | 0 | 2 122 | 1 986 |
| 2014–15 | 88 | 111 | 1 324 | 1 653 | 151 | 201 | 41 | 21 | 0 | 0 | 1 605 | 1 986 |
| 2015–16 | 87 | 111 | 1 263 | 1 653 | 171 | 201 | 31 | 21 | 0 | 0 | 1 553 | 1 986 |
| 2016–17 | 106 | 111 | 1 528 | 1 653 | 165 | 201 | 37 | 21 | 0 | 0 | 1 836 | 1 986 |
| 2017–18 | 120 | 111 | 1 345 | 1 653 | 153 | 201 | 39 | 21 | 0 | 0 | 1 657 | 1 986 |
| 2018–19 | 84 | 111 | 1 185 | 1 653 | 136 | 201 | 26 | 21 | 0 | 0 | 1 432 | 1 986 |
| 2019–20 | 71 | 111 | 1 054 | 1 653 | 163 | 201 | 39 | 21 | 0 | 0 | 1 326 | 1 986 |
| 2020–21 | 57 | 111 | 1 054 | 1 653 | 173 | 201 | 47 | 21 | 0 | 0 | 1 331 | 1 986 |
| 2021–22 | 30 | 111 | 811 | 1 653 | 137 | 201 | 20 | 21 | 0 | 0 | 998 | 1 986 |
| 2022–23 | 19 | 111 | 673 | 1 653 | 104 | 201 | 15 | 37 | 0 | 0 | 811 | 2 002 |
| 2023–24 | 19 | 111 | 797 | 1 653 | 122 | 201 | 14 | 37 | 0 | 0 | 952 | 2 002 |

*Use of the code SKA ceased once skates were introduced into the QMS in October 2003 and rough skates and smooth skates were recognised as separate species. From this time all landings of skates have been reported against either the RSK or SSK code.



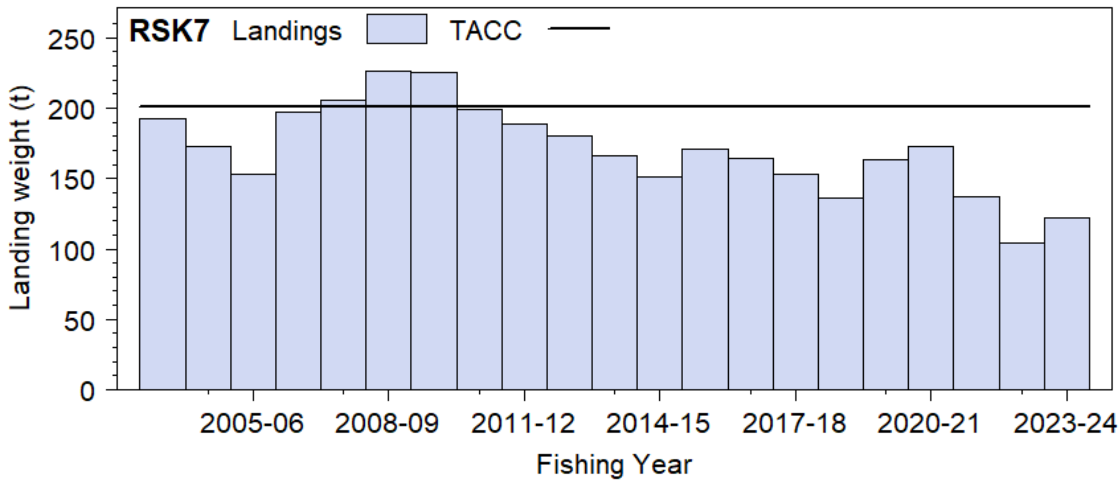




**Figure 1: Reported commercial landings and TACC for the four main RSK stocks. From top to bottom: RSK 1 (Auckland East), RSK 3 (South East Coast and South East Chatham Rise, Sub-Antarctic, Southland). [Continued on next page]**

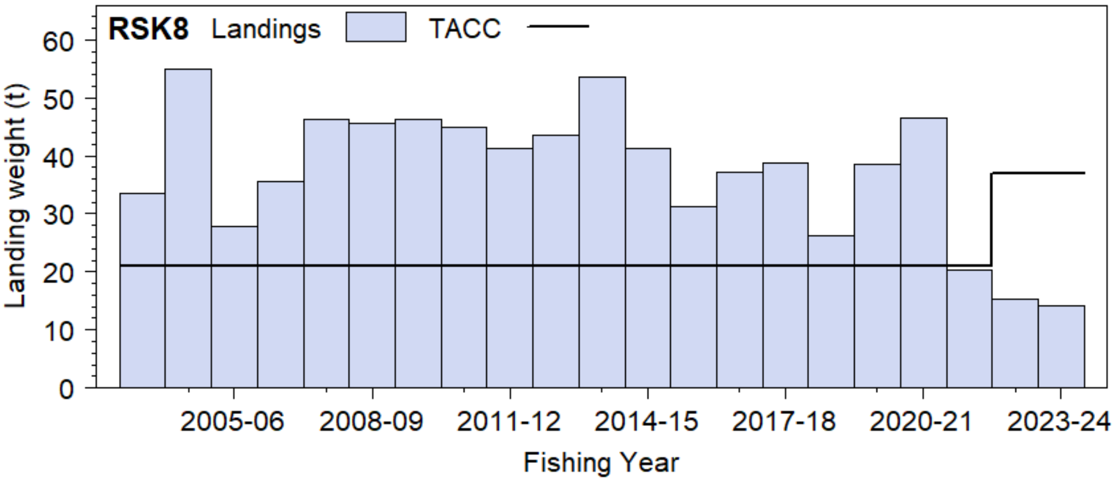



**Figure 1 [Continued]: Reported commercial landings and TACC for the four main RSK stocks. RSK 7 (Challenger), and RSK 8 (Central Egmont, Auckland West).**

### 1.2 Recreational fisheries
Recreational fishing surveys indicate that rough skates are very rarely caught by recreational fishers.

### 1.3 Customary non-commercial fisheries
Quantitative information on the level of customary non-commercial take is not available.

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

### 1.5 Other sources of mortality
Because skates are taken mainly as bycatch of bottom trawl fisheries, historical catches have probably been proportional to the amount of effort in the target trawl fisheries. Past catches were probably higher than historical landings data suggest, because of unrecorded discards and unrecorded foreign catch before 1983.

## 2. BIOLOGY

Little is known about the reproductive biology of rough skates. Rough skates reproduce by laying yolky eggs, enclosed in leathery cases, on the seabed. Rough skates lay their eggs in spring-summer (Francis 1997). Two eggs are laid at a time, but the number of eggs laid annually by a female is unknown. A single embryo develops inside each egg case and the young hatch at about 10–15 cm pelvic length (body length excluding the tail) (Francis 1997). Biological parameters relevant to stock assessment are shown in Table 4.

**Table 4: Estimates of biological parameters for Rough skates (RSK).**

| Fishstock | | | Estimate | Source |
|---|---|---|---|---|
| 1. Natural mortality ($M$) | | | | |
| RSK 3 | | | 0.25–0.35 | Francis et al (2001b) |
| 2. Weight = $a$ (length)$^b$ (weight in g, length in cm pelvic length) | | | | |
| | $a$ | | $b$ | |
| RSK males | 0.0393 | | 2.838 | Francis (1997) |
| RSK females | 0.0218 | | 3.001 | Francis (1997) |
| 3. von Bertalanffy growth parameters | | | | |
| | $K$ | $t_0$ | $L_\infty$ | |
| RSK 3 (both sexes) | 0.16 | -1.2 | 91.3 | Francis et al (2001b) |
| RSK 3 (both sexes) | 0.096 | -0.78 | 151.8 | Francis et al (2004) |

Rough skates grow to at least 79 cm pelvic length, and females grow larger than males. The greatest reported age is 9 years for a 70 cm pelvic length female, and females may live longer than males (Francis et al 2001a, b). There are no apparent differences in growth rate between the sexes. Males reach 50% maturity at about 52 cm and 4 years, and females at 59 cm and 6 years. The most plausible estimate of *M* is 0.25–0.35.

# 3. STOCKS AND AREAS

Nothing is known about stock structure or movement patterns in skates. Inshore trawl surveys of the east and west coasts of the South Island used to tag and release live rough skate, but this has been discontinued. Tag returns have been low and data from what returns there have been have not been analysed. Rough skates are distributed throughout most of New Zealand, from the Three Kings Islands to Campbell Island and the Chatham Islands, including the Challenger Plateau, Chatham Rise, and Bounty Plateau. Rough skates have not been recorded from QMA 10.

In this report, rough skate landings have been presented by QMA. QMAs would form appropriate management units in the absence of any information on biological stocks.

# 4. STOCK ASSESSMENT

## 4.1 Biomass estimates

### 4.1.1 Trawl Surveys

Relative biomass estimates are available for rough skates from a number of trawl survey series (Table 5). In the first survey (1991) of each of two series (east coast South Island and Chatham Rise), the two skate species were not (fully) distinguished. Furthermore, there are doubts about the accuracy of species identification in some other earlier surveys (prior to 1996).

All potential surveys were reviewed to determine which might provide reliable indices for abundance (Holmes et al 2022). Surveys rejected are listed in Table 6 together with the main reasons for their exclusion. Indices taken forward for consideration for partial quantitative assessment were:

- east coast South Island (ECSI) *Kaharoa* trawl survey, and
- west coast South Island (WCSI) *Kaharoa* trawl survey.

Estimates of biomass for RSK from the ECSI *Kaharoa* and WCSI *Kaharoa* trawl surveys are provided in Figures 2 and 3. Biomass estimates have been relatively stable for the ECSI time series since the latter was reinstated in 2007. Biomass estimates have fluctuated for the WCSI time series. CVs are relatively low for both time series (generally < 30%).

**ECSI trawl surveys**

The east coast South Island winter surveys from 1991 to 1996 (30–400 m) were replaced by summer trawl surveys (1996–97 to 2000–01) which also included the 10–30 m depth range; but these were discontinued after the fifth in the annual time series because of the extreme fluctuations in catchability between surveys (Beentjes & Stevenson 2001). The winter surveys were reinstated in 2007, and this time were expanded to include the 10–30 m depth range, in order to monitor elephantfish and red gurnard which were officially included in the list of target species in 2012. The 2007 survey and all surveys from 2012 onwards provide full coverage of the 10–30 m depth range.

The proportion of  biomass captured in the 10–30 m depth ranged from 16% to 37%, (2007 to 2024) indicating that it is essential to monitor the core plus shallow strata (10–400 m) for this species (MacGibbon et al 2024). The core strata biomass series was higher in the period since the reinstatement of the survey in 2007 than in the 1990s and, in 2014 and 2016, biomass was more than double that of the highest biomass estimate of the 1990s (Table 5, Figure 2) (MacGibbon et al 2024). The biomass estimate in 2021 was double that of 2018 and the highest in the series for both core and core plus shallow strata (Figure 2), before declining steeply in 2022 back to the 2018 level, and again in2024, to  pre-2007 levels. . Biomass estimates for the core strata (30–400 m) and core plus shallow (10–400 m) have similar trends (Figure 2) for overlapping periods.

The rough skate length distributions for the east coast South Island winter trawl survey core strata (30–400 m) have no clear modes, comprise multiple year classes, and very small skate tend to be found in shallow water in some surveys (Beentjes & MacGibbon 2013, Beentjes et al 2015, 2016, McGibbon et al 2019, 2024). The survey appears to be monitoring pre-recruited lengths down to 1+ age and the full recruited distribution, but no individual cohorts are discernible. Length frequency distributions are reasonably consistent among surveys with no lengths measured before 1996. The addition of the 10–30 m depth range has changed the shape of the length frequency distribution only slightly for some surveys, with more smaller skate present (Beentjes et al 2015, 2016, Beentjes & MacGibbon 2013, MacGibbon et al 2019, 2024).

**Table 5: Doorspread biomass estimates (t) and coefficients of variation (CV %) of rough skates.**

| **Year** | **Trip Code** | **Biomass** | **CV** |
|---|---|---|---|
| East coast North Island (RSK 1) Autumn 20–400m | | | |
| 1993 | KAH9304 | 76 | 28 |
| 1994 | KAH9402 | 189 | 12 |
| 1995 | KAH9502 | 52 | 20 |
| 1996 | KAH9602 | 309 | 24 |
| Discontinued | | | |
| East coast South Island (RSK 3) Winter 30–400 m (10–400 m) | | | |
| 1991 | KAH9105 | – | – |
| 1992 | KAH9205 | 224 | 24 |
| 1993 | KAH9306 | 335 | 21 |
| 1994 | KAH9406 | 517 | 20 |
| 1996 | KAH9606 | 177 | 19 |
| 2007 | KAH0705 | 878 (1 261) | 22 (16) |
| 2008 | KAH0806 | 858 | 19 |
| 2009 | KAH0905 | 1 029 | 30 |
| 2012 | KAH1207 | 1 113 (1 414) | 20 (16) |
| 2014 | KAH1402 | 1 153 (1 597) | 38 (28) |
| 2016 | KAH1605 | 1 142 (1 576) | 30 (22) |
| 2018 | KAH1803 | 978 (1 213) | 16 (14) |
| 2021 | KAH2104 | 2 097 (2 486) | 22 (19) |
| 2022 | KAH2204 | 998 (1 219) | 24 (20) |
| 2024 | KAH2402 | 389 (619) | 22 (15) |
| East coast South Island (RSK 3) Summer 30–400 m | | | |
| 1996–97 | KAH9618 | 1 336 | 15 |
| 1997–98 | KAH9704 | 1 082 | 13 |
| 1998–99 | KAH9809 | 1 175 | 10 |
| 1999–00 | KAH9917 | 329 | 23 |
| 2000–01 | KAH0014 | 222 | 34 |
| Sub-Antarctic (RSK 3) Summer 300–800m | | | |
| 1991 | TAN9105 | 42 | 72.8 |
| 1992 | TAN9211 | 52 | 68.8 |
| 1993 | TAN9310 | 133 | 56.9 |
| 2000 | TAN0012 | 201 | 56.4 |
| 2001 | TAN0118 | 158 | 51.3 |
| 2002 | TAN0219 | 55 | 47.4 |
| 2003 | TAN0317 | 78 | 42.9 |
| 2004 | TAN0414 | 25 | 72.4 |
| 2005 | TAN0515 | 116 | 45.9 |
| 2006 | TAN0617 | 159 | 74.1 |
| 2007 | TAN0714 | 115 | 67.3 |
| 2008 | TAN0813 | 362 | 56.9 |
| 2009 | TAN0911 | 190 | 52.4 |
| 2011 | TAN1117 | 106 | 61.6 |
| 2012 | TAN1215 | 68 | 75.4 |
| 2014 | TAN1412 | 11 | 93.4 |
| 2016 | TAN1614 | 6 | 100 |
| 2018 | TAN1811 | 466 | 89.6 |
| 2020 | TAN2014 | 130 | 57.1 |
| West Coast South Island (*Tangaroa*) (RSK 7) 200–800m | | | |
| 2012 | TAN1210 | 12 | 39 |
| 2013 | TAN1308 | 8 | 40 |
| 2016 | TAN1609 | 4 | 48 |
| 2018 | TAN1807 | 5 | 51 |
| 2021 | TAN2107 | 5 | 48 |

| **Year** | **Trip** | **Biomass** | **CV** |
|---|---|---|---|
| Chatham Rise (RSK 3) Summer 200–800 m | | | |
| 1991–92 | TAN9106 | 0 | – |
| 1992–93 | TAN9212 | 55 | 83.1 |
| 1994 | TAN9401 | 221 | 44.3 |
| 1995 | TAN9501 | 76 | 43.2 |
| 1996 | TAN9601 | 11 | 100 |
| 1997 | TAN9701 | 12 | 58.4 |
| 1998 | TAN9801 | 10 | 100 |
| 1999 | TAN9901 | 34 | 60.1 |
| 2000 | TAN0001 | 0 | – |
| 2001 | TAN0101 | 72 | 58.5 |
| 2002 | TAN0201 | 37 | 64.5 |
| 2003 | TAN0301 | 32 | 63.9 |
| 2004 | TAN0401 | 22 | 60.4 |
| 2005 | TAN0501 | 89 | 45.4 |
| 2006 | TAN0601 | 56 | 59 |
| 2007 | TAN0701 | 29 | 94.9 |
| 2008 | TAN0801 | 0 | – |
| 2009 | TAN0901 | 23 | 66.8 |
| 2010 | TAN1001 | 0 | – |
| 2011 | TAN1101 | 154 | 54.9 |
| 2012 | TAN1201 | 0 | – |
| 2013 | TAN1301 | 38 | 78.5 |
| 2014 | TAN1401 | 37 | 69.1 |
| 2016 | TAN1601 | 47 | 64.7 |
| 2018 | TAN1801 | 10 | 83 |
| 2020 | TAN2001 | 0 | – |
| 2022 | TAN2201 | 9 | 100 |
| Stewart-Snares shelf (RSK 3) Summer 30–600m | | | |
| 1993 | TAN9301 | 592 | 20 |
| 1994 | TAN9402 | 1 064 | 15 |
| 1995 | TAN9502 | 801 | 7 |
| 1996 | TAN9604 | 1 055 | 11 |
| Discontinued | | | |
| South Island west coast and Tasman Bay/Golden Bay (RSK 7) | | | |
| 1992 | KAH9204 | 173 | 27 |
| 1994 | KAH9404 | 196 | 23 |
| 1995 | KAH9504 | 251 | 22 |
| 1997 | KAH9701 | 185 | 30 |
| 2000 | KAH0004 | 186 | 23 |
| 2003 | KAH0304 | 43 | 34 |
| 2005 | KAH0503 | 58 | 30 |
| 2007 | KAH0704 | 256 | 23 |
| 2009 | KAH0904 | 114 | 21 |
| 2011 | KAH1104 | 347 | 23 |
| 2013 | KAH1305 | 243 | 24 |
| 2015 | KAH1503 | 150 | 20 |
| 2017 | KAH1703 | 270 | 21 |
| 2019 | KAH1902 | 132 | 26 |
| 2021 | KAH2103 | 123 | 26 |
| 2023 | KAH2302 | 87 | 24 |

**Table 6: Surveys considered but rejected for providing indices of abundance of rough skates and main reason(s) for their rejection.**

| FMA | Survey | Reason(s) for rejection |
|---|---|---|
| RSK 1 | HAGU Hauraki Gulf | Very low biomass of rough skate present. Only very shallow strata (< 75 m) in recent surveys. |
| RSK 1 | BPLE Bay of Plenty | Very low biomass of rough skate present. Only very shallow strata (< 100 m) in recent surveys. |
| RSK 3 | Chatham Rise | Very low occurrence of rough skate in catches. Relative biomass CVs always > 40%. |
| RSK 3 | Sub-Antarctic Summer | Shallowest strata too deep (>300m). Relative biomass CVs always > 40% (often much higher). |
| RSK 3 | Sub-Antarctic Autumn | Discontinued survey. |
| RSK 3 | Stewart-Snares shelf | Discontinued survey. |
| RSK 7 | WCSI (*Tangaroa*) | Very low occurrence of rough skate in catches. Relative biomass CVs always 40% or higher. |
| RSK 8 | WCNI | Few of the historical surveys go >100 m and cover the area south of Cape Egmont* |

* There is potential to use the WCNI (west coast North Island) survey in future if strata remain consistent with the 2020 survey (including southern strata).

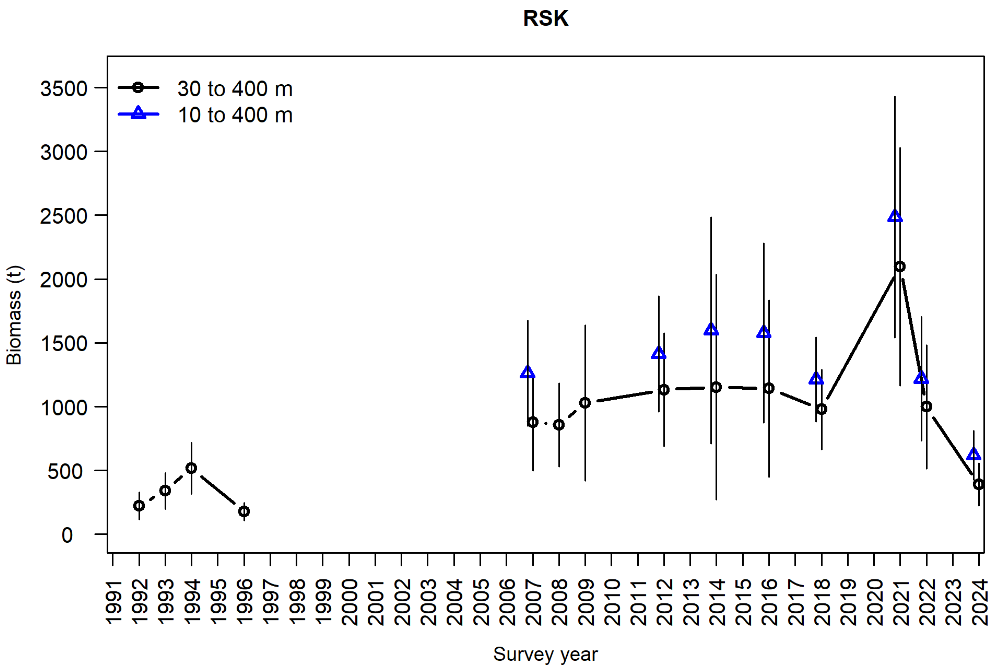



**Figure 2: Rough skate total biomass for the ECSI winter surveys in core strata (30–400 m), and core plus shallow strata (10–400 m). Error bars are ± two standard deviations.**

## WCSI trawl surveys

The west coast South Island autumn trawl surveys have been undertaken since 1992 and regularly catch rough skate (MacGibbon 2019). However, biomass has fluctuated with no apparent trend throughout the time series and CVs are relatively modest, ranging from 20% to 34%, making it unclear to what degree the survey monitors abundance. The amount of rough skate caught in Tasman Bay and Golden Bay (TBGB) can be significant, but it is highly variable between years, ranging between one tonne and 145 tonnes, and shows a different trend to the west coast (Figure 3).

## Establishing $B_{MSY}$ compatible reference points

In 2022 the Working Group accepted the mean of relative biomass estimates from the core plus shallow strata (10–400 m) ECSI *Kaharoa* survey over the years 2007–2018 as a $B_{MSY}$ proxy for rough skate in RSK 3. This period was chosen because both biomass and catch were relatively stable over this period (Figure 4A). It was also evident (from the core series) that biomass had increased substantially since the 1990s, and this was correlated with a reduction in fishing effort in the mixed species inshore trawl fishery for FMA 3 (Starr et al 2024).

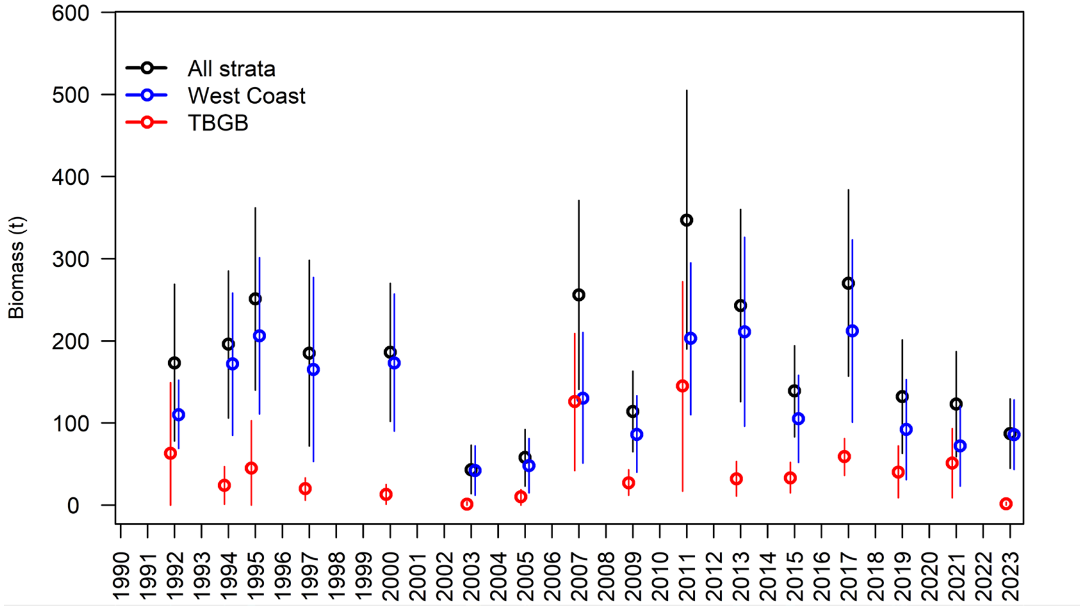



**Figure 3: Rough skate biomass for the west coast South Island inshore trawl survey time series (error bars are ± two standard deviations).**

It was not possible to agree on a target period for RSK 7 because the survey series had high interannual variability during the period when catch information was available, i.e., after 2004 when the two species were introduced to the QMS (Figure 4B). It has already been noted that fluctuations in biomass estimates of rough skate from the WCSI suggest that abundance is probably not being monitored adequately (Stevenson & Hanchet 2000). There was a period of stability in the survey series from 1993 to 2000, but there are no catch data for those years. The WG recommended investigating reasons for the high variability (the biomass estimates have relatively low CVs) of survey biomass in the latter part of the series, with a view to identifying strata with consistent biomass estimates with lower interannual variability.

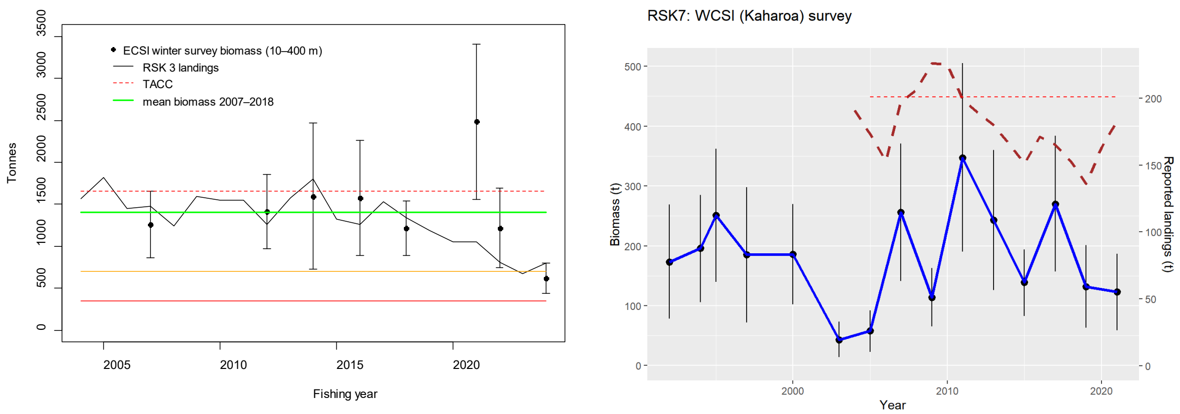



**Figure 4: Left) ECSI Kaharoa trawl survey relative biomass estimates in 10–400 m. Vertical lines are ± 2 se. The green line represents the accepted $B_{MSY}$ proxy of geometric mean abundance over years 2007 to 2018 (1403 t), and the orange line shows soft limit (50% $B_{MSY}$ proxy), and the red line shows hard limit (25% $B_{MSY}$ proxy). Right) WCSI *Kaharoa* inshore trawl survey relative biomass, blue line plus vertical lines showing ± 2 s.d. (left axis). QMR/MHR landings are shown by dashed line and TACC for the management area by red dotted line, with scale on right axis.**

## 4.2 Other factors

Species that constitute a minor bycatch of trawl fisheries are often difficult to manage using TACCs and ITQs. Skates are widely and thinly distributed and would be difficult for trawlers to avoid after the quota had been caught. A certain level of incidental bycatch is therefore inevitable. However, skates are relatively hardy and frequently survive being caught in trawls (though mortality would depend on the length of the tow and the weight of fish in the cod end). Skates returned to the sea alive probably have a greater chance of survival than most other fishes.

A data-informed qualitative risk assessment was completed on all chondrichthyans (sharks, skates, rays, and chimaeras) at the New Zealand scale in 2014 (Ford et al 2015). Rough skate was ranked number one (highest) in terms of risk of the eleven QMS chondrichthyan species. Data were described as existing but poor for the purposes of the assessment, and consensus over this risk score was achieved by the expert panel. This risk assessment does not replace a stock assessment for this species but may influence research priorities across species.

### 4.3 Future research considerations

- Work to determine the extent of current misidentification of RSK and SSK in commercial fisheries (the study of Beentjes 2005 was conducted not long after RSK and SSK were required to be reported separately under the QMS).
- Investigate alternative stratum combinations in compiling the WCSI *Kaharoa* survey index with a view to understanding the high variability of survey biomass results from the current series and identifying strata with consistent biomass estimates with lower interannual variability. This may be informed by spatio-temporal modelling of survey data (e.g., VAST, or INLA).
- Improve our understanding of stock structure, particularly in relation to the links between Tasman Bay and Golden Bay and the west coast of South Island—nothing is known about the stock structure or movement patterns of rough skates.
- Investigate currently available maturity information (largely for males), to determine whether more information on female maturity should be collected from trawl surveys.
- Improve species catch information. Reliable catch information at species level limits our current determination of a stable reference period for RSK 7, as well as estimation of relative exploitation rate for all stocks; but trend in effort could be used to infer historical catches or relative fishing mortality to identify stable periods.
- Explore the estimation of catches based on models using species mix data from landings or observer data (or onboard cameras in more recent years), particularly where the TACC may be limiting landings. This would be particularly useful for estimating relative exploitation rate.
- Explore the development of standardised CPUE series (potentially using spatio-temporal models including survey data where appropriate, updating Mormede (2023)) where these is sufficient confidence in species reporting.

## 5. STATUS OF THE STOCKS

No estimates of current and reference biomass are available for RSK 1, RSK 7, RSK 8, and RSK 10.

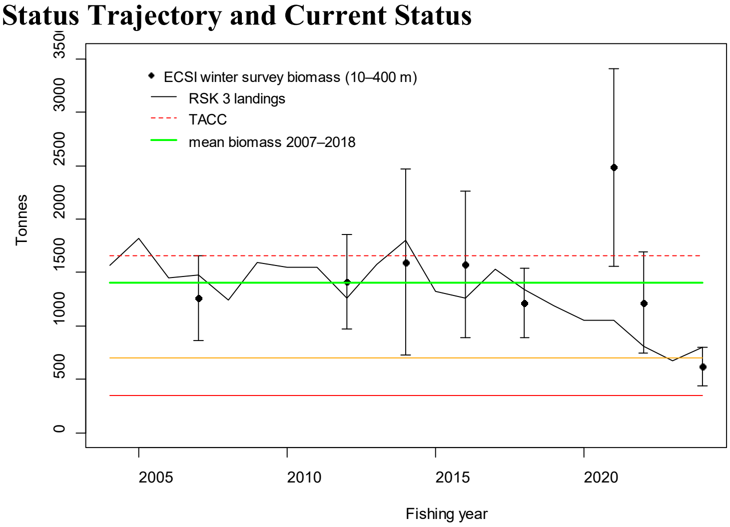
- **RSK 3**

**Stock Structure Assumptions**
For the purposes of this summary RSK 3 is considered to be a single management unit.

| **Stock Status** | | |
|---|---|---|
| Most Recent Assessment Plenary Publication Year | 2025 | |
| Intrinsic Productivity Level | Medium | |
| Catch in most recent year of assessment | Year: 2023–24 | Catch: 797 t |
| Assessment Runs Presented | Abundance index based on ECSI research trawl survey (10–400 m) | |
| Reference Points | Interim Target: $B_{MSY}$ proxy based on geometric mean survey index for the period 2007 to 2018 (a period with high yield when both catch and survey index were stable)<br>Soft Limit: 50% $B_{MSY}$ proxy<br>Hard Limit: 25% $B_{MSY}$ proxy<br>Overfishing threshold: $F_{MSY}$ proxy based on mean relative exploitation rate for the period 2007 to 2018 | |

| | |
|---|---|
| Status in relation to Target | Unlikely (< 40%) to be at or above the target |
| Status in relation to Limits | Soft Limit: About as Likely as Not (40-60%) to be below<br>Hard Limit: Unlikely (< 40%) to be below |
| Status in relation to Overfishing | Unknown |

**Historical Stock Status Trajectory and Current Status**




**RSK 3 relative biomass from ECSI *Kaharoa* trawl survey in 10–400 m (black points plus vertical lines showing ± 2 s.e.). Reported QMR/MHR landings, and TACC for RSK 3 are also shown. Green line represents the $B_{MSY}$ proxy of geometric mean survey abundance from 2007 to 2018 (1403 t). Orange line shows soft limit (50% $B_{MSY}$ proxy), and red line shows hard limit (25% $B_{MSY}$ proxy). Reported landings are believed to be inaccurate.**

| **Fishery and Stock Trends** | |
|---|---|
| Recent Trend in Biomass or Proxy | Relative biomass was stable around the target between 2007 and 2018, and declined from 2021 to 2024 to about the level of the soft limit. |
| Recent Trend in Fishing Intensity or Proxy | Unknown |
| Other Abundance Indices | |
| Trends in Other Relevant Indicators or Variables | Catches have been gradually declining since 2015. |

| **Projections and Prognosis** | |
|---|---|
| Stock Projections or Prognosis | Unknown |
| Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits | Soft Limit: Unknown<br>Hard Limit: Unknown |
| Probability of Current Catch or TACC causing Overfishing to continue or to commence | Unknown |

| **Assessment Methodology and Evaluation** | | |
|---|---|---|
| Assessment Type | Level 2 - Partial Quantitative Stock Assessment | |
| Assessment Method | Survey abundance index | |
| Assessment Dates | Latest assessment Plenary publication year: 2025 | Next assessment: 2027 |
| Overall assessment quality rank | 1 – High Quality | |
| Main data inputs (rank) | Survey abundance index | 1 – High Quality |
| Data not used (rank) | N/A | |
| Changes to Model Structure and Assumptions | - | |
| Major Sources of Uncertainty | Recent survey indices variable and stock status designation relies upon a single data point. | |

| Qualifying Comments |
|---|
| Even though the assessment indicates that the stock is About as lLkely as Not to be below the soft limit the Plenary noted that this evaluation is based on a single data point and thought it was premature to put a rebuilding plan in place until the stock status is confirmed by more data. The Plenary noted the low biomass in 2024 was associated with relatively low water temperature in contrast to the high biomass in 2021 which was relatively warm. |

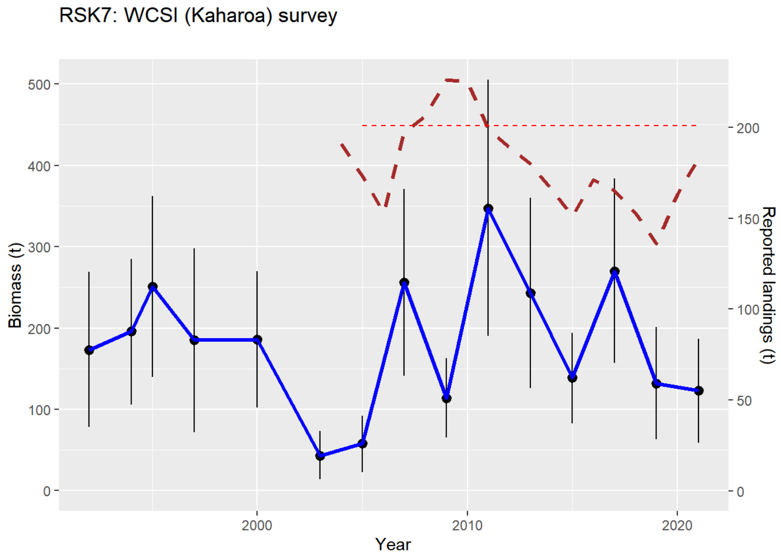
| Fishery Interactions |
|---|
| Rough skate constitute a bycatch of trawl fisheries. Skates are widely distributed and difficult for trawlers to avoid. |

- **RSK 7**

**Stock Structure Assumptions**
For the purposes of this summary RSK 7 is considered to be a single management unit.

| Stock Status | | |
|---|---|---|
| Most Recent Assessment Plenary Publication Year | 2022 | |
| Intrinsic Productivity Level | Medium | |
| Catch in most recent year of assessment | Year: 2020–21 | Catch: 137 t |
| Assessment Runs Presented | Abundance index based on research trawl survey | |
| Reference Points | Target: $B_{MSY}$ proxy<br>Soft Limit: 50% $B_{MSY}$ proxy<br>Hard Limit: 25% $B_{MSY}$ proxy<br>Overfishing threshold: $F_{MSY}$ proxy | |
| Status in relation to Target | Unknown | |
| Status in relation to Limits | Soft Limit: Unknown<br>Hard Limit: Unknown | |
| Status in relation to Overfishing | Unknown | |

**Historical Stock Status Trajectory and Current Status**




**RSK 7 relative biomass from WCSI *Kaharoa* trawl survey (blue line plus vertical lines showing ± 2 s.d. (left axis)), reported QMR/MHR landings (dashed line), and TACC for RSK 3 (red dotted line (right axis)). Reported landings are believed to be inaccurate.**

| Fishery and Stock Trends | |
|---|---|
| Recent Trend in Biomass or Proxy | Relative biomass was stable between 1992 and 2000. Since 2007 abundance estimates have fluctuated, however, |

| | |
|---|---|
| | considering the full survey series, there is no evidence of a long-term trend. |
| Recent Trend in Fishing Intensity or Proxy | Unknown |
| Other Abundance Indices | - |
| Trends in Other Relevant Indicators or Variables | - |

| **Projections and Prognosis** | |
|---|---|
| Stock Projections or Prognosis | Unknown |
| Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits | Soft Limit: Unknown<br>Hard Limit: Unknown |
| Probability of Current Catch or TACC causing Overfishing to continue or to commence | Unknown |

| **Assessment Methodology and Evaluation** | | |
|---|---|---|
| Assessment Type | Level 2 - Partial Quantitative Stock Assessment | |
| Assessment Method | Survey abundance index | |
| Assessment Dates | Latest assessment Plenary publication year: 2022 | Next assessment: Unknown |
| Overall assessment quality rank | 1 – High Quality | |
| Main data inputs (rank) | Survey abundance index | 1 – High Quality |
| Data not used (rank) | N/A | |
| Changes to Model Structure and Assumptions | - | |
| Major Sources of Uncertainty | In the period since RSK entered the QMS abundance estimates have shown large inter-annual fluctuations. The reasons for these fluctuations are unknown. | |
| **Qualifying Comments** | | |
| As there was no period with stable catch and abundance available, it was not possible to determine reference points, nor therefore stock status. | | |

| **Fishery Interactions** |
|---|
| Rough skate constitute a bycatch of trawl fisheries. Skates are widely distributed and difficult for trawlers to avoid. |

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