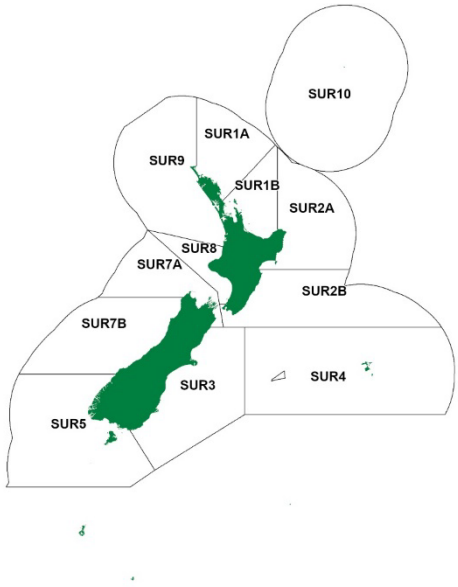
# KINA (SUR)

(*Evechinus chloroticus*)
Kina




## 1. FISHERY SUMMARY

South Island kina was introduced into the Quota Management System in October 2002. North Island kina was introduced into the Quota Management System from October 2003. Five Quota Management Areas based on the FMAs 3, 4, 5, 7A (Marlborough Sounds) and 7B (west coast) were created in the South Island and seven Quota Management Areas based on the FMAs 1A (Auckland-North), 1B (Auckland-South), 2A (Central (East-North)), 2B (Central (East-South)), 8, 9 and 10 were created in the North Island. Current allowances, TACCs and TACs are summarised in Table 1. The historical landings and TACC values for the main SUR stocks are depicted in Figure 1.

**Table 1: Current Total allowable catches (TAC, t) allowances for customary fishing, recreational fishing, and other sources of mortality (t) and Total Allowable Commercial Catches (TACC, t) for kina.**

| | TAC | Customary | Recreational | Other Mortality | TACC |
|---|---|---|---|---|---|
| **SUR 1A** | 172 | 65 | 65 | 2 | 40 |
| **SUR 1B** | 324 | 90 | 90 | 4 | 140 |
| **SUR 2A** | 204 | 60 | 60 | 4 | 80 |
| **SUR 2B** | 102 | 35 | 35 | 2 | 30 |
| **SUR 3** | 42 | 10 | 10 | 1 | 21 |
| **SUR 4** | 255 | 20 | 7 | 3 | 225 |
| **SUR 5** | 480 | 10 | 10 | 5 | 455 |
| **SUR 7A** | 238 | 80 | 20 | 3 | 135 |
| **SUR 7B** | 26 | 10 | 5 | 1 | 10 |
| **SUR 8** | 26 | 12 | 12 | 1 | 1 |
| **SUR 9** | 33 | 11 | 11 | 1 | 10 |
| **SUR 10** | 0 | 0 | 0 | 0 | 0 |

### 1.1 Commercial fisheries

Most kina are found in waters less than 10 m deep and are harvested by breath-hold diving, although some is taken by target dredge in SUR 7A (Marlborough Sounds). There is no minimum legal size for kina. Almost all roe harvested in this fishery is consumed on the domestic market. In 1988–89, competitive TACCs were established in the more important FMAs but not in east Northland (SUR 1) or at the Chatham Islands (SUR 4), both of which developed into productive fisheries in the 1990s (Table 2). On 1 October 1992 the Ministry of Fisheries placed a moratorium on the issue of permits to commercially harvest kina. The kina fishery has evolved considerably since the imposition of the moratorium. Where present, the competitive TACCs were either not caught or were exceeded, both by wide margins. Much of the increase in catch observed in SUR 5 in the early 1990s can be attributed to

an experimental fishery developed in SUR 5, between Puysegur Point and Breaksea Island. The short-lived Kina Development Programme harvested kina from Dusky Sound in 1993 under special permit. In recent years landings have fluctuated around the TACCs for SUR 1A, 1B, 5 and 7A. Landings have generally remained well below the TACCs in other FMAs but increased to 17 t (TACC 20 t) in SUR 3 in 2019–20, and have exceeded 170 t in 2016–17, 2017–18 and 2019–20 in SUR 4 (TACC 225 t).

**Table 2: Total reported landings (t greenweight) of kina (SUR) by FMA and fishing year by all methods and target species. [Continued on next page]**

| | SUR 1 | | SUR 1A | | SUR 1B | | SUR 2 | | SUR 2A | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1983 | 66.2 | – | – | – | – | – | 33.0 | – | – | – |
| 1984 | 81.4 | – | – | – | – | – | 180.3 | – | – | – |
| 1985 | 64.5 | – | – | – | – | – | 83.8 | – | – | – |
| 1986 | 72.0 | – | – | – | – | – | 139.1 | – | – | – |
| 1987 | 52.1 | – | – | – | – | – | 142.6 | – | – | – |
| 1988 | 22.1 | – | – | – | – | – | 154.1 | – | – | – |
| 1989 | 35.5 | – | – | – | – | – | 92.8 | – | – | – |
| 1990 | 10.0 | – | – | – | – | – | 282.4 | – | – | – |
| 1991 | 71.5 | – | – | – | – | – | 87.2 | – | – | – |
| 1992 | 78.7 | – | – | – | – | – | 37.3 | – | – | – |
| 1993 | 89.7 | – | – | – | – | – | 170.4 | – | – | – |
| 1994 | 150.7 | – | – | – | – | – | 176.7 | – | – | – |
| 1995 | 155.9 | – | – | – | – | – | 129.7 | – | – | – |
| 1996 | 174.5 | – | – | – | – | – | 41.2 | – | – | – |
| 1997 | 161.6 | – | – | – | – | – | 49.9 | – | – | – |
| 1998 | 134.8 | – | – | – | – | – | 36.5 | – | – | – |
| 1999 | 201.4 | – | – | – | – | – | 20.2 | – | – | – |
| 2000 | 297.4 | – | – | – | – | – | 14.5 | – | – | – |
| 2001 | 184.5 | – | – | – | – | – | 11.4 | – | – | – |
| 2001–02 | 237.0 | – | – | – | – | – | 3.0 | – | – | – |
| 2002–03 | 211.2 | – | – | – | – | – | 30.4 | – | – | – |
| 2003–04 | 1.7 | – | 26.9 | 40 | 111.0 | 140 | 0 | – | 14.5 | 80 |
| 2004–05 | – | – | 20.9 | 40 | 131.1 | 140 | – | – | | 6.5 |
| 2005–06 | – | – | 41.0 | 40 | 138.6 | 140 | – | – | | 22.1 |
| 2006–07 | – | – | 37.1 | 40 | 147.3 | 140 | – | – | | 13.8 |
| 2007–08 | – | – | 31.7 | 40 | 140.4 | 140 | – | – | | 18.0 |
| 2008–09 | – | – | 30.5 | 40 | 130.6 | 140 | – | – | | 19.8 |
| 2009–10 | – | – | 40.8 | 40 | 129.9 | 140 | – | – | | 0.1 |
| 2010–11 | – | – | 31.7 | 40 | 122.1 | 140 | – | – | | 4.1 |
| 2011–12 | – | – | 37.9 | 40 | 134.2 | 140 | – | – | | 5.9 |
| 2012–13 | – | – | 38.7 | 40 | 145.4 | 140 | – | – | | 10.6 |
| 2013–14 | – | – | 43.4 | 40 | 139.3 | 140 | – | – | | 10.1 |
| 2014–15 | – | – | 39.7 | 40 | 147.5 | 140 | – | – | | 18.8 |
| 2015–16 | – | – | 40.9 | 40 | 131.6 | 140 | – | – | | 17.8 |
| 2016–17 | – | – | 39.6 | 40 | 142.7 | 140 | – | – | | 9.3 |
| 2017–18 | – | – | 38.7 | 40 | 136.2 | 140 | – | – | | 21.8 |
| 2018–19 | – | – | 36.5 | 40 | 133.3 | 140 | – | – | | 13.4 |
| 2019–20 | – | – | 35.1 | 40 | 143.7 | 140 | – | – | | 13.4 |
| 2020–21 | – | – | 41.9 | 40 | 150.6 | 140 | – | – | | 7.0 |
| 2021–22 | – | – | 34.8 | 40 | 129.6 | 140 | – | – | | 12.0 |
| 2022–23 | – | – | 35.6 | 40 | 137.8 | 140 | – | – | | 1.3 |

| | SUR 2B | | SUR 3 | | SUR 4 | | SUR 5 | | SUR 7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fishing year | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1983 | – | – | 4.8 | – | 11.3 | – | 0.5 | – | 26.3 | – |
| 1984 | – | – | 14.4 | – | 4.0 | – | 0.9 | – | 55.1 | – |
| 1985 | – | – | 4.0 | – | 7.4 | – | 4.6 | – | 99.6 | – |
| 1986 | – | – | 6.2 | – | 52.7 | – | 0.2 | – | 86.6 | – |
| 1987 | – | – | 2.4 | – | 28.4 | – | 4.3 | – | 52.6 | – |
| 1988 | – | – | 1.7 | – | 76.5 | – | 2.3 | – | 175.6 | – |
| 1989 | – | – | 0.8 | – | 216.6 | – | 19 | – | 6.2 | – |
| 1990 | – | – | 4.1 | – | 190.0 | – | 13.4 | – | 41.5 | – |
| 1991 | – | – | 21.3 | – | 35.3 | – | 166.9 | – | 56.3 | – |
| 1992 | – | – | 15.8 | – | 192.9 | – | 272.2 | – | 114.4 | – |
| 1993 | – | – | 9.9 | – | 21.8 | – | *530.3 | – | 210.2 | – |
| 1994 | – | – | 8.8 | – | 55.3 | – | 327.2 | – | 98.2 | – |
| 1995 | – | – | 7.1 | – | 100.7 | – | 342.9 | – | 149 | – |
| 1996 | – | – | 6.0 | – | 99.5 | – | 446.4 | – | 142.2 | – |
| 1997 | – | – | 5.4 | – | 225.7 | – | 171.6 | – | 121.7 | – |
| 1998 | – | – | 3.8 | – | 303.1 | – | 91.2 | – | 144.7 | – |
| 1999 | – | – | 38.4 | – | 168.2 | – | 120.6 | – | 113.9 | – |
| 2000 | – | – | 50.4 | – | 396.5 | – | 106.3 | – | 87.9 | – |
| 2001 | – | – | 11.2 | – | 472.6 | – | 69.8 | – | 80.1 | – |
| 2001–02 | – | – | 5.2 | – | 368.0 | – | 184.9 | – | 31.7 | – |

**Table 2 [Continued]:**

| | SUR 2B | | SUR 3 | | SUR 4 | | SUR 5 | | SUR 7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Fishing year** | **Landings** | **TACC** | **Landings** | **TACC** | **Landings** | **TACC** | **Landings** | **TACC** | **Landings** | **TACC** |
| 2002–03 | – | – | 0.3 | 21 | 167.3 | 225 | 132.5 | 245 | 1.3 | – |
| 2003–04 | 4.6 | 30 | 0.3 | 21 | 114.8 | 225 | 199.1 | 245 | 0 | – |
| 2004–05 | 1.4 | 30 | 0.5 | 21 | 91.7 | 225 | 350.4 | 455 | – | – |
| 2005–06 | 0.2 | 30 | < 0.1 | 21 | 70.2 | 225 | 473 | 455 | – | – |
| 2006–07 | < 0.1 | 30 | 3.2 | 21 | 108.3 | 225 | 423 | 455 | – | – |
| 2007–08 | 0.2 | 30 | 2.1 | 21 | 147.4 | 225 | 276.2 | 455 | – | – |
| 2008–09 | < 0.1 | 30 | 4.2 | 21 | 135.6 | 225 | 294.9 | 455 | – | – |
| 2009–10 | 0.3 | 30 | 5.1 | 21 | 89.7 | 225 | 320.4 | 455 | – | – |
| 2010–11 | < 0.1 | 30 | 5.2 | 21 | 134.9 | 225 | 339.2 | 455 | – | – |
| 2011–12 | 1.1 | 30 | 4.3 | 21 | 137.7 | 225 | 402 | 455 | – | – |
| 2012–13 | 0 | 30 | 4.8 | 21 | 76.2 | 225 | 474.8 | 455 | – | – |
| 2013–14 | 3.8 | 30 | 0.4 | 21 | 101.2 | 225 | 462.8 | 455 | – | – |
| 2014–15 | 2.3 | 30 | 0.2 | 21 | 75.2 | 225 | 458.4 | 455 | – | – |
| 2015–16 | 2.5 | 30 | 4.1 | 21 | 116.3 | 225 | 453.1 | 455 | – | – |
| 2016–17 | 13.4 | 30 | 8.6 | 21 | 220.0 | 225 | 460.1 | 455 | – | – |
| 2017–18 | 7.9 | 30 | < 0.1 | 21 | 189.4 | 225 | 421.6 | 455 | – | – |
| 2018–19 | 13.2 | 30 | 2.3 | 21 | 94.8 | 225 | 466.7 | 455 | – | – |
| 2019–20 | 7.8 | 30 | 17.6 | 21 | 173.4 | 225 | 439.5 | 455 | – | – |
| 2020–21 | 25.4 | 30 | 16.1 | 21 | 141.8 | 225 | 464.1 | 455 | – | – |
| 2021–22 | 18.2 | 30 | 17.9 | 21 | 119.3 | 225 | 442.8 | 455 | – | – |
| 2022–23 | 14.8 | 30 | 13.9 | 21 | 163.7 | 225 | 398.5 | 455 | – | – |

| | SUR 7A | | SUR 7B | | SUR 8 & 9 | | Total | |
|---|---|---|---|---|---|---|---|---|
| **Fishing year** | **Landings** | **TACC** | **Landings** | **TACC** | **Landings** | **TACC** | **Landings** | **TACC** |
| 1983 | – | – | – | – | 3.6 | – | 157 | |
| 1984 | – | – | – | – | 0.3 | – | 342 | |
| 1985 | – | – | – | – | 0.9 | – | 275 | |
| 1986 | – | – | – | – | 2 | – | 360 | |
| 1987 | – | – | – | – | 0.1 | – | 283 | |
| 1988 | – | – | – | – | – | – | 432 | |
| 1989 | – | – | – | – | 1.5 | – | 372 | |
| 1990 | – | – | – | – | 6.5 | – | 548 | |
| 1991 | – | – | – | – | 4.4 | – | 443 | |
| 1992 | – | – | – | – | 5 | – | 717 | |
| 1993 | – | – | – | – | – | – | 1 032 | |
| 1994 | – | – | – | – | 2.3 | – | 820 | |
| 1995 | – | – | – | – | 89.5 | – | 975 | |
| 1996 | – | – | – | – | 0.1 | – | 910 | |
| 1997 | – | – | – | – | 0.2 | – | 736 | |
| 1998 | – | – | – | – | 1.4 | – | 716 | |
| 1999 | – | – | – | – | 0.5 | – | 663 | |
| 2000 | – | – | – | – | 0.1 | – | 956 | |
| 2001 | – | – | – | – | 3.1 | – | 832 | |
| 2001–02 | – | – | – | – | – | – | 829.7 | |
| 2002–03 | 63.2 | 135 | 0 | 10 | 0.9 | – | 607.4 | 636 |
| 2003–04 | 85.4 | 135 | 0 | 10 | 3.8 | 11 | 562.3 | 937 |
| 2004–05 | 101.3 | 135 | - | 10 | 0.9 | 11 | 704.7 | 1 147 |
| 2005–06 | 72.1 | 135 | 5.3 | 10 | 4.0 | 11 | 826.5 | 1 147 |
| 2006–07 | 117.3 | 135 | 9.2 | 10 | 8.6 | 11 | 868 | 1 147 |
| 2007–08 | 134.6 | 135 | 6.5 | 10 | 5.8 | 11 | 762.9 | 1 147 |
| 2008–09 | 128.7 | 135 | 6.1 | 10 | 3.4 | 11 | 753.8 | 1 147 |
| 2009–10 | 119.7 | 135 | 3.5 | 10 | 2.3 | 11 | 711.9 | 1 147 |
| 2010–11 | 97.4 | 135 | 7.2 | 10 | 2.5 | 11 | 741.9 | 1 147 |
| 2011–12 | 131.6 | 135 | 6 | 10 | 8.2 | 11 | 862.1 | 1 147 |
| 2012–13 | 115.5 | 135 | 5 | 10 | 4.0 | 11 | 875 | 1 147 |
| 2013–14 | 126.3 | 135 | 0 | 10 | 9.1 | 11 | 896 | 1 147 |
| 2014–15 | 142.8 | 135 | 0 | 10 | 7.9 | 11 | 885 | 1 147 |
| 2015–16 | 134.0 | 135 | 2.5 | 10 | 2.5 | 11 | 901 | 1 147 |
| 2016–17 | 138.6 | 135 | 0 | 10 | 10.3 | 11 | 952 | 1 147 |
| 2017–18 | 121.3 | 135 | 0 | 10 | 10.1 | 11 | 947 | 1 147 |
| 2018–19 | 131.0 | 135 | 0 | 10 | 4.8 | 11 | 891.5 | 1 147 |
| 2019–20 | 136.1 | 135 | 0 | 10 | 5.9 | 11 | 972.5 | 1 147 |
| 2020–21 | 141.6 | 135 | 0 | 10 | 1.2 | 11 | 989.9 | 1 147 |
| 2021–22 | 114.3 | 135 | 0 | 10 | 3.0 | 11 | 891.8 | 1 147 |
| 2022–23 | 138.6 | 135 | 0 | 10 | 0.1 | 11 | 903.3 | 1 147 |

Data from 1989 and 1990 are combined from the FSU and CELR databases. – indicates no recorded catch. Data for the period 1983 to 1999 are from Andrew (2001) and have been groomed. Catch estimates for 2000 and 2001 are taken directly from MFish. * includes 133 t caught in Dusky Sound experimental fishery. Catches from SUR 6, 8, and 9 have been pooled because too few permit holders recorded catches in these FMAs to report them singly.

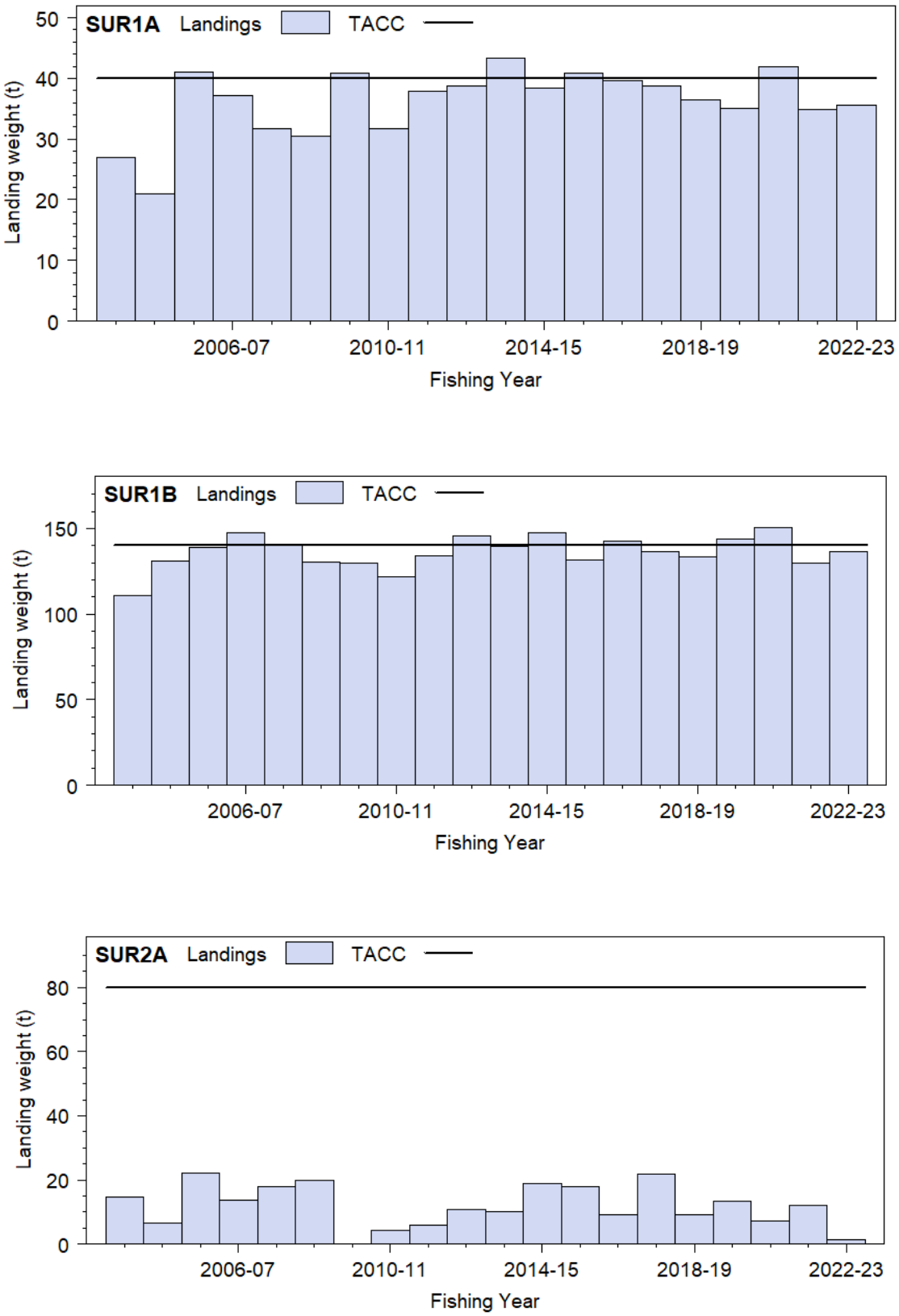



**Figure 1: Reported commercial landings and TACC for the nine main SUR stocks. From top: SUR 1A (Northland), SUR 1B (Hauraki Gulf, Bay of Plenty), and SUR 2A (East Coast). Note that these figures do not show data prior to entry into the QMS for SUR 1A to SURB 2A. [Continued on next two pages]**

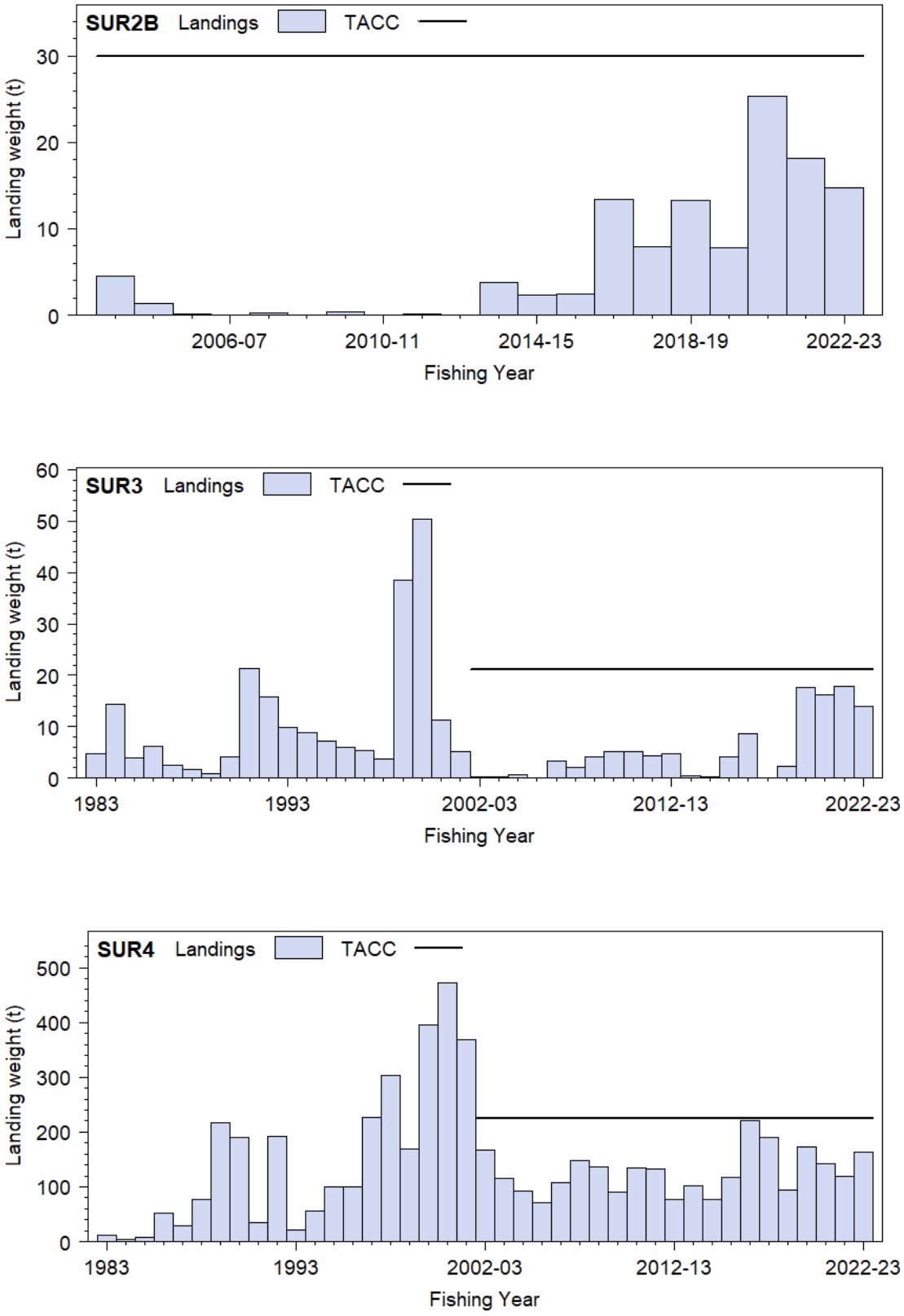



**Figure 1 [Continued]: Reported commercial landings and TACC for the nine main SUR stocks. From top: SUR 2B (Wairarapa, Wellington), SUR 3 (South East Coast), and SUR 4 (South East Chatham Rise). Note that these figures do not show data prior to entry into the QMS for SUR 2B. [Continued next page]**

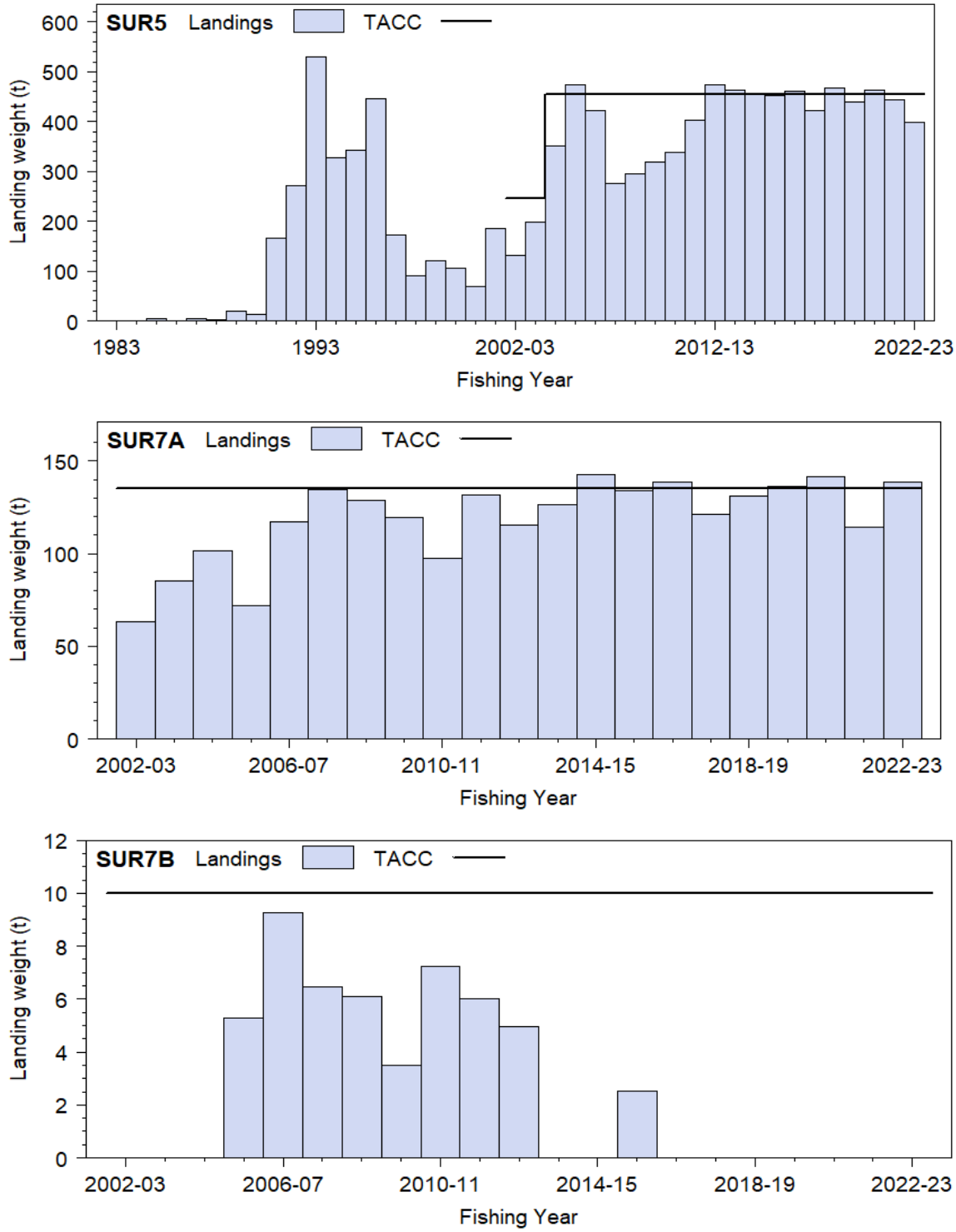



**Figure 1 [Continued]: Reported commercial landings and TACC for the nine main SUR stocks. From top: SUR 5 (Southland), SUR 7A (Challenger Nelson Marlborough) and SUR 7B (Challenger Westland). Note that these figures do not show data prior to entry into the QMS for SUR 7A and SUR 7B.**

## 1.2 Recreational fisheries

Recreational catch was estimated using telephone-diary surveys in 1993–94, 1996 (Fisher & Bradford 1998, Bradford 1998) and 2000 (Boyd & Reilly 2004, Boyd et al 2004) (Table 3). There are no estimates of recreational catch from the Chatham Islands. In many instances, insufficient kina were caught to provide reliable estimates of the error associated with the estimates of total harvest. The harvest estimates provided by these telephone-diary surveys are no longer considered reliable for various reasons. A Recreational Technical Working Group concluded that these harvest estimates 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. In response to these problems and the cost and scale challenges associated with onsite methods, a National Panel Survey was conducted for the first time throughout the 2011–12 fishing year. The panel survey used face-to-face interviews of a random sample of 30 390 New Zealand households to recruit a panel of fishers and non-fishers for a full year. The panel members were contacted regularly about their fishing activities and harvest information collected in standardised phone interviews. The national panel survey was repeated during the 2017–18 and 2022–23 fishing years using very similar methods to produce directly comparable results (Wynne-Jones et al 2019; Heinemann & Gray, in prep). Recreational catch estimates from the three national panel surveys are given in Table 3. Note that national panel survey estimates do not include recreational harvest taken on charter vessel trips or under s111 general approvals.

**Table 3: Estimates of recreational harvest of kina using telephone-diary surveys (1993–94, 1996, and 2000 surveys) and the national panel surveys (2011–12, 2017–18 and 2022–23).**

| Area | Number (thousands) | CV | Catch (t)* |
|---|---|---|---|
| 1993–94 (telephone-diary) | | | |
| East Northland | 109 | 0.60 | 27.1 |
| Hauraki Gulf | 14 | - | 3.5 |
| Bay of Plenty | 648 | 0.49 | 160.9 |
| SUR 1 | 801 | 0.41 | 198.9 |
| SUR 9 | 30 | 0.72 | 7.4 |
| | | | |
| 1996 (telephone-diary) | | | |
| SUR 1 | 316 | 0.24 | 78.5 |
| SUR 2 | 61 | - | 15.1 |
| SUR 3 | 12 | - | 3.0 |
| SUR 5 | 20 | - | 5.0 |
| SUR 7 | 2 | - | 0.5 |
| SUR 8 | 43 | - | 10.7 |
| SUR 9 | 30 | - | 7.4 |
| | | | |
| 2000 (telephone-diary) | | | |
| SUR 1 | 1 793 | 0.35 | 445.2 |
| SUR 2 | 1 026 | 0.57 | 254.7 |
| SUR 3 | 8 | 0.58 | 2.0 |
| SUR 5 | 70 | 1.01 | 17.4 |
| SUR 7 | 2 | 1.01 | 0.5 |
| SUR 8 | 85 | 0.85 | 21.1 |
| SUR 9 | 82 | 0.67 | 20.4 |
| | | | |
| 2011–12 (national panel survey) | | | |
| SUR 1 | 1 997 | 0.87 | - |
| SUR 2 | 107 | 0.32 | - |
| SUR 3 | 12 | 0.59 | - |
| SUR 5 | 10 | 0.73 | - |
| SUR 7 | 12 | 0.67 | - |
| SUR 8 | 60 | 0.43 | - |
| SUR 9 | 58 | 0.62 | - |
| SUR total | 2 257 | 0.77 | - |
| | | | |
| 2017–18 (national panel survey) | | | |
| SUR 1 | 292 | 0.21 | - |
| SUR 2 | 179 | 0.24 | - |
| SUR 3 | 5 | 0.68 | - |
| SUR 5 | 10 | 0.45 | - |
| SUR 7 | 2 | 0.95 | - |
| SUR 8 | 34 | 0.38 | - |
| SUR 9 | 12 | 0.85 | - |
| SUR total | 534 | 0.15 | - |
| | | | |
| 2022–23 (national panel survey) | | | |
| SUR 1 | 130 | 0.45 | - |
| SUR 2 | 233 | 0.59 | - |
| SUR 3 | 24 | 0.47 | - |
| SUR 5 | 16 | 0.72 | - |
| SUR 7 | 9 | 0.81 | - |
| SUR 8 | 69 | 0.55 | - |
| SUR 9 | 74 | 0.93 | - |
| SUR total | 556 | 0.34 | - |

*Data as numbers caught supplied by Ngai Tahu Development Corporation. Catch in kilograms was estimated using the conversion rules described in the paragraph above.

For the early telephone-diary surveys, catches in numbers were converted to catch in tonnes by assuming an average whole weight of 248.3 g per kina based on equal proportions across a size range 60–110 mm Test Diameter (TD) and a test diameter-weight relationship ($W = (6.27\times10^{-4})TD^{2.88}$) from Dusky Sound (unpublished data). These estimates of catch in tonnes should be considered as indicative only and may be very inaccurate. No estimates of mean weight were available to convert catches in numbers from the national panel survey to catch in tonnes.

## 1.3 Customary non-commercial fisheries

There is an important customary non-commercial harvest of kina by Māori for food. Kina form an important fishery for customary non-commercial, but the total annual catch is not known.

Māori customary fishers utilise the provisions under both the recreational fishing regulations and the various customary regulations. Many tangata whenua harvest kina under their recreational allowance and these are not included in records of customary catch. Customary reporting requirements vary around the country. Customary fishing authorisations issued in the South Island and Stewart Island would be under the Fisheries (South Island Customary Fishing) Regulations 1999. Many rohe moana / areas of the coastline in the North Island and Chatham Islands are gazetted under the Fisheries (Kaimoana Customary Fishing) Regulations 1998 which require reporting on authorisations. In the areas not gazetted, customary fishing permits would be issued would be under the Fisheries (Amateur Fishing) Regulations 2013, where there is no requirement to report catch.

The information on Māori customary harvest under the provisions made for customary fishing can be limited (Table 4). These numbers are likely to be an underestimate of customary harvest as only the catch approved and harvested in kilograms and numbers are reported in the table.

**Table 4: Fisheries New Zealand records of customary harvest of kina (approved and reported as weight (kg) and in numbers), since 1998-99. – no data. [Continued on next two pages]**

| | SUR 1A | | | | SUR 1B | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | – | – | – | – | – | – |
| 1999–00 | – | – | – | – | – | – | – | – |
| 2000–01 | – | – | – | – | – | – | – | – |
| 2001–02 | – | – | – | – | – | – | – | – |
| 2002–03 | – | – | – | – | – | – | – | – |
| 2003–04 | – | – | – | – | – | – | 1 200 | 750 |
| 2004–05 | – | – | – | – | – | – | 400 | 210 |
| 2005–06 | – | – | – | – | 1 790 | 1 040 | – | – |
| 2006–07 | 850 | 850 | 7 300 | 7 300 | 12 055 | 9 785 | 6 025 | 5 475 |
| 2007–08 | 2 890 | 2 890 | 6 900 | 6 900 | 11 225 | 9 285 | 12 230 | 10 130 |
| 2008–09 | 3 290 | 3 290 | 1 900 | 1 900 | 11 540 | 8 940 | 10 524 | 9 924 |
| 2009–10 | 1 760 | 1 760 | 1 400 | 1 400 | 11 615 | 8 995 | 9 500 | 7 750 |
| 2010–11 | 3 570 | 3 570 | – | – | 26 582 | 20 142 | 21 890 | 19 050 |
| 2011–12 | 9 575 | 8 775 | 900 | 600 | 4 990 | 2 900 | 1 450 | 1 400 |
| 2012–13 | 9 704 | 9 210 | 2 300 | 2 170 | 4 325 | 3 460 | 400 | 400 |
| 2013–14 | 610 | 610 | 3 900 | 3 900 | 480 | 360 | – | – |
| 2014–15 | – | – | – | – | 16 495 | 15 265 | 2 700 | 2 150 |
| 2015–16 | – | – | – | – | 5 550 | 3 950 | 1 260 | 383 |
| 2016–17 | – | – | – | – | 1 885 | 1 175 | 5 950 | 3 173 |
| 2017–18 | – | – | – | – | 410 | 130 | 8 875 | 5 700 |
| 2018–19 | – | – | – | – | 2 120 | 1 883 | 4 020 | 2 845 |
| 2019–20 | – | – | – | – | 640 | 560 | 380 | 355 |
| 2020–21 | – | – | – | – | 1 370 | 950 | 2000 | 1950 |
| 2021–22 | – | – | – | – | 240 | 180 | – | – |
| 2022–23 | – | – | – | – | – | – | – | – |

| | SUR 2A | | | | SUR 2B | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | 200 | 200 | – | – | – | – |
| 1999–00 | – | – | 2 350 | 460 | – | – | – | – |
| 2000–01 | – | – | – | – | – | – | – | – |
| 2001–02 | – | – | 100 | 80 | – | – | – | – |
| 2002–03 | – | – | – | – | – | – | – | – |
| 2003–04 | – | – | – | – | – | – | 1 350 | 1 350 |
| 2004–05 | – | – | 600 | 440 | – | – | 900 | 900 |
| 2005–06 | – | – | 7 500 | 4 940 | – | – | 200 | 200 |
| 2006–07 | – | – | 55 806 | 41 546 | – | – | – | – |

**Table 4 [Continued]:**

| | SUR 2A | | | | SUR 2B | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 2007–08 | – | – | 60 546 | 46 599 | – | – | – | – |
| 2008–09 | – | – | 54 050 | 46 427 | – | – | 18 055 | 14 940 |
| 2009–10 | – | – | 17 100 | 13 640 | – | – | 2 700 | 1 510 |
| 2010–11 | 1 300 | 1 000 | 71 950 | 66 222 | – | – | – | – |
| 2011–12 | – | – | 102 160 | 87 639 | – | – | – | – |
| 2012–13 | – | – | 127 090 | 101 162 | – | – | – | – |
| 2013–14 | – | – | 132 715 | 98 129 | – | – | – | – |
| 2014–15 | – | – | 63 410 | 52 181 | – | – | 200 | 130 |
| 2015–16 | – | – | 20 030 | 16 072 | – | – | 460 | 420 |
| 2016–17 | 300 | 300 | 50 400 | 33 483 | – | – | – | – |
| 2017–18 | – | – | 11 400 | 5 950 | – | – | – | – |
| 2018–19 | – | – | 32 870 | 12 785 | – | – | – | – |
| 2019–20 | – | – | – | – | – | – | – | – |
| 2020–21 | – | – | – | – | – | – | – | – |
| 2021–22 | – | – | – | – | – | – | – | – |
| 2022–23 | – | – | – | – | – | – | – | – |

| | SUR 3 | | | | SUR 4 | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | – | – | – | – | – | – |
| 1999–00 | – | – | – | – | – | – | – | – |
| 2000–01 | – | – | – | – | – | – | – | – |
| 2001–02 | – | – | 2 070 | 819 | – | – | – | – |
| 2002–03 | – | – | 650 | 150 | – | – | – | – |
| 2003–04 | – | – | – | – | – | – | – | – |
| 2004–05 | – | – | – | – | – | – | – | – |
| 2005–06 | – | – | 1 075 | 401 | – | – | – | – |
| 2006–07 | – | – | 2 020 | 1 417 | – | – | – | – |
| 2007–08 | – | – | 4 880 | 4 134 | – | – | – | – |
| 2008–09 | – | – | 3 099 | 968 | – | – | – | – |
| 2009–10 | – | – | 1 600 | 1 283 | – | – | 460 | 429 |
| 2010–11 | – | – | 17 170 | 16 092 | – | – | – | – |
| 2011–12 | – | – | 3 660 | 2 436 | 17 | 17 | – | – |
| 2012–13 | – | – | 5 600 | 4 629 | – | – | – | – |
| 2013–14 | – | – | 3 850 | 1 160 | – | – | 90 | 88 |
| 2014–15 | – | – | 1 910 | 1 382 | – | – | 40 | 40 |
| 2015–16 | – | – | 3 006 | 2 265 | – | – | 162 | 102 |
| 2016–17 | – | – | 1 805 | 1 570 | – | – | 310 | 310 |
| 2017–18 | – | – | 300 | 192 | 24 | 24 | 125 | 125 |
| 2018–19 | – | – | – | – | 50 | 50 | – | – |
| 2019–20 | – | – | 7 351 | 4 646 | – | – | – | – |
| 2020–21 | – | – | 6 650 | 6 089 | – | – | – | – |
| 2021–22 | – | – | 8 528 | 5 295 | – | – | – | – |
| 2022–23 | | | 630 | 160 | – | – | – | – |

| | SUR 5 | | | | SUR 7A | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | – | – | – | – | – | – |
| 1999–00 | – | – | – | – | – | – | – | – |
| 2000–01 | – | – | 730 | 520 | – | – | – | – |
| 2001–02 | – | – | 4 810 | 4 039 | – | – | – | – |
| 2002–03 | – | – | 3 440 | 2 255 | – | – | – | – |
| 2003–04 | – | – | – | – | – | – | – | – |
| 2004–05 | – | – | – | – | – | – | – | – |
| 2005–06 | – | – | 700 | 700 | – | – | – | – |
| 2006–07 | – | – | 260 | 260 | 50 | 10 | – | – |
| 2007–08 | – | – | 7 715 | 7 715 | – | – | 1 220 | 960 |
| 2008–09 | – | – | 7 450 | 7 125 | – | – | 1 570 | 1 198 |
| 2009–10 | – | – | 2 380 | 1 706 | – | – | 2 170 | 2 040 |
| 2010–11 | – | – | 300 | 300 | – | – | – | – |
| 2011–12 | – | – | 2 659 | 2 659 | – | – | – | – |
| 2012–13 | – | – | 5 680 | 5 680 | – | – | – | – |
| 2013–14 | – | – | 1 000 | 910 | – | – | – | – |
| 2014–15 | – | – | – | – | – | – | – | – |
| 2015–16 | – | – | 3 840 | 3 170 | – | – | – | – |
| 2016–17 | – | – | 2 500 | 2 410 | – | – | – | – |
| 2017–18 | – | – | 2 150 | 2 150 | – | – | – | – |
| 2018–19 | – | – | – | – | – | – | – | – |
| 2019–20 | – | – | 900 | 900 | – | – | – | – |
| 2020–21 | – | – | 3 070 | 2 851 | – | – | – | – |

**Table 4 [Continued]:**

| | SUR 5 | | | | SUR 7A | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 2021–22 | – | – | 50 | 0 | – | – | – | – |
| 2022–23 | – | – | – | – | – | – | – | – |

| | SUR 7B | | | | SUR 8 | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight (kg) | | Numbers | | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | – | – | – | – | – | – |
| 1999–00 | – | – | – | – | – | – | – | – |
| 2000–01 | – | – | – | – | – | – | – | – |
| 2001–02 | – | – | – | – | – | – | – | – |
| 2002–03 | – | – | – | – | – | – | – | – |
| 2003–04 | – | – | – | – | – | – | – | – |
| 2004–05 | – | – | – | – | – | – | – | – |
| 2005–06 | – | – | – | – | – | – | – | – |
| 2006–07 | – | – | 250 | 250 | – | – | – | – |
| 2007–08 | – | – | – | – | – | – | – | – |
| 2008–09 | – | – | – | – | – | – | – | – |
| 2009–10 | – | – | – | – | – | – | – | – |
| 2010–11 | – | – | – | – | – | – | – | – |
| 2011–12 | – | – | – | – | – | – | – | – |
| 2012–13 | – | – | – | – | – | – | 300 | 80 |
| 2013–14 | – | – | – | – | – | – | – | – |
| 2014–15 | – | – | – | – | – | – | – | – |
| 2015–16 | – | – | – | – | – | – | – | – |
| 2016–17 | – | – | 70 | 70 | – | – | – | – |
| 2017–18 | – | – | – | – | – | – | – | – |
| 2018–19 | – | – | – | – | – | – | 300 | 150 |
| 2019–20 | – | – | – | – | – | – | – | – |
| 2020–21 | – | – | – | – | – | – | – | – |
| 2021–22 | – | – | – | – | – | – | – | – |
| 2022–23 | – | – | – | – | – | – | – | – |

| | SUR 9 | | | |
|---|---|---|---|---|
| | Weight (kg) | | Numbers | |
| Fishing year | Approved | Harvested | Approved | Harvested |
| 1998–99 | – | – | – | – |
| 1999–00 | – | – | – | – |
| 2000–01 | – | – | – | – |
| 2001–02 | – | – | – | – |
| 2002–03 | – | – | – | – |
| 2003–04 | – | – | – | – |
| 2004–05 | – | – | – | – |
| 2005–06 | – | – | – | – |
| 2006–07 | – | – | – | – |
| 2007–08 | 50 | 50 | – | – |
| 2008–09 | – | – | 1 400 | 900 |
| 2009–10 | 100 | 80 | – | – |
| 2010–11 | 120 | 120 | – | – |
| 2011–12 | 350 | 320 | – | – |
| 2012–13 | 40 | 40 | 3 150 | 3 150 |
| 2013–14 | 400 | 280 | 500 | 380 |
| 2014–15 | 80 | 80 | – | – |
| 2015–16 | – | – | – | – |
| 2016–17 | – | – | – | – |
| 2017–18 | – | – | – | – |
| 2018–19 | – | – | – | – |
| 2019–20 | – | – | – | – |
| 2020–21 | – | – | – | – |
| 2021–22 | – | – | – | – |
| 2022–23 | – | – | – | – |

There are several types of customary management areas:

- mātaitai reserves – areas closed to commercial fishing, that may have bylaws affecting recreational and customary fishing
- taiāpure – local fisheries of special significance, that may have additional fishing rules
- temporary closures – issued under sections 186A or 186B of the Fisheries Act 1996

There are many of them in place around New Zealand which allow for the management of kina. Locations are listed in Table 5.

## 1.4 Illegal catch

There are qualitative data to suggest significant illegal, unreported, unregulated (IUU) activity in this fishery.

**Table 5: Locations of the customary management areas relevant to kina.**

| | Mātaitai reserves | Taiāpure | Temporary closures | Bylaw |
|---|---|---|---|---|
| **SUR 1A** | Te Puna | Waikare Inlet | Marsden Bank and Mair Bank | |
| **SUR 1B** | Te Maunga o Mauao<br>Te Rae o Kohi<br>Raukokere<br>Te Kopa o Rongokānapa | Maketu | | |
| **SUR 2A** | Te Kopa o Rongokānapa<br>Hakihea<br>Horokaka<br>Toka Tāmure<br>Te Hoe<br>Moremore (a)<br>Moremore (b) | | Tangoiro/Waihirere<br>Motuoroi<br>Te Rāhui o Moremore | |
| **SUR 2B** | | Porangahau<br>Palliser Bay (a)<br>Palliser Bay (b) | Waimārama | |
| **SUR 3** | Te Waha o te Marangai<br>Mangamaunu<br>Kahutara<br>Oaro (freshwater and marine)<br>Tutaeputaputa<br>Lyttelton Harbour/Whakaraupō<br>Rāpaki Bay<br>Koukourārata<br>Wairewa/Lake Forsyth<br>Te Kaio<br>Ōpihi<br>Waitarakao<br>Te Ahi Tarakihi<br>Tuhawaiki<br>Waihao<br>Moeraki<br>Waikouaiti<br>Otakou<br>Puna-wai-Toriki<br>Tautuku<br>Waikawa Harbour/Tumu Toka | Te Taumanu o Te Waka a Māui<br>Oaro-Haumuri<br>Akaroa Harbour<br>East Otago | Waiopuka | Moeraki (Tapuiri) |
| **SUR 5** | Ōtara<br>Motupōhue (Bluff Hill)<br>Ōmāui<br>Oreti<br>Waitutu<br>Pikomamaku<br>Te Whaka a Te Wera<br>Kaihoka<br>Horomamae | | | |
| **SUR 7A** | Te Tai Tapu (West Coast Kaihoka)<br>Te Tai Tapu (West Coast – Anatori) | Whakapuaka (Delaware Bay) | | |
| **SUR 7B** | Tauneke<br>Ōkahu<br>Okuru/Mussel Point<br>Popotai Taumaka<br>Tauparikaka<br>Paringa<br>Mahitahi/Bruce Bay<br>Manakaiaua/Hunts Beach<br>Okarito Lagoon<br>Mikonui | | Ōkahu<br>Popotai Taumaka | |
| **SUR 8** | | | Western Taranaki | |
| **SUR 9** | Marokopa<br>Aotea Harbour | Kawhia Aotea | | |

### 1.5 Other sources of mortality

Although there is no minimum legal size for kina, some incidental mortality is likely because roe quality (recovery rate and colour) is commonly assessed by opening 'test' kina underwater. These animals are not subsequently landed. There are no estimates of the magnitude to this incidental mortality.

## 2. BIOLOGY

The biology and ecology of kina has been extensively studied; this literature has most recently been reviewed by Barker (2001). *Evechinus chloroticus* is found throughout New Zealand and the sub-Antarctic Islands. Kina has an annual reproductive cycle which culminates in spawning between November and March (Dix 1970b, Walker 1984, McShane et al 1994a, 1996, Lamare & Stewart 1998, Lamare 1998). Size at maturity appears to vary considerably and may be as small as 30 mm and as large as 75 mm TD (Dix 1970b, Barker et al 1998). In Dusky Sound, kina are reproductively mature at 50–60 mm TD (McShane et al 1996). Within these seemingly consistent patterns in the seasonality of the reproductive cycle there are many differences in the gonad size at small spatial scales.

Settlement is likely to vary between years and appears to differ among locations and habitats (Dix 1972, Walker 1984). Laboratory work has shown that kina larval mortality increased with increasing concentrations of suspended sediment at realistic concentrations (Phillips & Shima 2006). In the field, but not in the laboratory, development abnormalities were found associated with suspended sediment concentrations; this suggests the importance of other environmental factors associated with terrestrial runoff (Schwarz et al 2006). Juvenile settlement and mortality have also been observed to increase with sediment at realistic concentrations in a size-specific manner in the laboratory; this agrees with juvenile patterns of distribution observed in the field (Walker 2007). Few small kina were observed in any of the surveys in Dusky Sound (McShane et al 1993). These results suggest that the productivity of stocks in Fiordland may be low and that recruitment over-fishing is a real possibility.

There is relatively little information available on the interactions between kina and its predators and competitors. Although a wide range of fish and invertebrates eat kina, there is limited evidence that these species control or limit populations of kina in Fiordland. Work in a marine reserve, where large predators such as reef fishes and crayfish are abundant, indicates that predators can control numbers of kina surviving the transition from crevice-bound to open substratum grazing (Cole & Keuskamp 1998, Babcock et al 1999). Babcock et al (1999) have drawn a direct link between the increases in snapper and crayfish populations and the long-term decline in kina populations in the Leigh Marine Reserve. There is, however, no evidence that high kina densities limit rock lobster populations (Andrew & MacDiarmid 1991). It is likely, however, that changes in the abundance of kina, and the consequent changes in habitat representation, are part of a complex set of interacting processes, including but not exclusively, increased predation.

Awareness of kina barrens (areas dominated by kina and devoid of macroalgae after overgrazing of kelp forests) has increased in recent years. Many complex and interacting forces are in play in the formation and maintenance of these barrens. In some places (e.g. northern New Zealand, Shears & Babcock 2002, 2003) reduction due to fishing of kina predators such as rock lobster and snapper are thought to have caused an increase in kina densities and subsequent desctruction of kelp forests. In other areas (e.g. Queen Charlotte Sound) other factors such as water quality, temperature and sedimentation are thought to have been a major contributor to the loss of kelp forests (Urlich & Handley 2020). In either case a new equilibrium is reached and the barrens can be maintained by relatively low densities of typically small, malnourished kina of no commercial value due to poor roe recovery.

A kina barrens workshop was convened by FNZ in March 2023, in which an (unpublished) research prioritation exercise highlighted the following research needs: (1) a national assessment of kina populations and barrens, and complete review of current and past initiatives and research, (2) long-term programmes for monitoring coastel reef ecosystems, (3) research activities informed by engagement

with tangata whenua and incorporation of mātauranga Māori, and (4) harvest strategy standards to set more appropriate catch limits for key kina predators.

Kina compete with a range of invertebrate herbivores, including paua. There is no published evidence that high densities of kina limit paua populations in Fiordland. McShane (1997) reported that paua are abundant in Dusky Sound, and in Chalky and Preservation Inlets, but are rare in the fjords. Lamare & Mladenov (2000) estimate that kina grow 8–10 mm in their first year of life. Growth rates will vary considerably depending on local conditions, but kina may take 8–9 years to reach 100 mm TD, and very large individuals may reach ages of more than 20 years (Lamare & Mladenov 2000).

## 3. STOCKS AND AREAS

There appear to be few genetic differences in kina populations from Leigh (North Auckland) and Stewart Island (Mladenov et al 1997), which suggests that there is some mixing among populations. There is no direct evidence that populations of kina at the Chatham Islands differ genetically from those on the mainland, nor is there evidence that "populations" of kina at the Chatham Islands are dependent on the dispersal of larvae from the mainland.

## 4. STOCK ASSESSMENT

Although there is a wealth of information on the biology and ecology of this species (see Barker 2001 for reviews), there is relatively little that can be used to assess the status of exploited stocks. There have been no assessments of sustainable yield nor are there estimates of biomass or trends in relative abundance for any Fishstock (Annala 1995).

### 4.1 Estimates of fishery parameters and abundance

Andrew (2001) reported catch rates from both dive and dredge fisheries but advised caution in the interpretation of catch rate information for sedentary invertebrates, like kina, gathered at broad spatial scales.

Miller & Abraham (2011) conducted a characterisation of the kina fishery around the country. In their report, the kina catch and effort data for dive and dredge fisheries are summarised for the 20 fishing years 1989–90 to 2008–09. In SUR 5, a voluntary logbook scheme to collect fine-scale data has been operating since the 2004–05 fishing year. As part of this scheme, one fishing company has recorded their catch in Paua Statistical Areas, using the same format as the Paua Catch Effort Landing Return (PCELR) forms. Kina harvest recorded in fine-scale Paua Statistical Areas accounted for 68% of all kina harvested in SUR 5 over that period, with the harvest from SUR 5 accounting for 46.6% of the national harvest between 2004–05 and 2008–09.

Indices of relative abundance using timed swims have been reported for Ariel Reef in SUR 2 (Anderson & Stewart 1993), Chatham Islands (Schiel et al 1995, Naylor & Andrew 2002), and D'Urville Island and Arapawa Island in SUR 7 (McShane et al 1994a). Numerous surveys of kina have been done over the last 30 years in fished areas, mostly by university-based researchers (e.g., Dix 1970a, Choat & Schiel 1982, Schiel et al 1995, Cole & Keuskamp 1998, Babcock et al 1999, Wing et al 2001). Naylor & Andrew (2002) reported a range of densities for kina around Chatham Island from 0.17 $m^{-2}$ (northwest Chatham Island) to 1.6 $m^{-2}$ (south east Chatham Island). These were generally lower than estimates made in the mid-1990s by Schiel et al (1995) (0.2 $m^{-2}$ to 6 $m^{-2}$). By contrast, even lower kina densities of around 0.1 $m^{-2}$ were reported by McShane et al (1994a) for both Arapawa Island and D' Urville Island. Dix (1970a) reported much higher mean densities of kina ranging from 2.2 $m^{-2}$ in Queen Charlotte Sound to 6 $m^{-2}$ at Kaikōura.

Neubauer (unpublished) conducted an updated characterisation of the commercial kina fishery for SUR 1A and SUR 1B. The characterisation was focused on data for the fishing years 1989–99 to 2020–21. These data include catch estimates, effort data, and landings information. Overall, catch levels in SUR 1A and SUR 1B have remained relatively stable from 2003–04 to 2020–21, constrained by the 40

tonne TACC in SUR 1A and 140 tonne TACC in SUR 1B. In most recent years the TACC was caught in both SUR 1A and SUR 1B. Catch records prior to the QMS introduction in 2003 are considered to be less reliable, and available data suggest significant reporting issues prior to the QMS introduction. Effort, in terms of the number of records, has increased since the introduction of the QMS in 2003 in SUR 1A, peaking in the 2006–07 fishing year, before declining again to more consistent levels in recent years. In SUR 1B, the number of records declined significantly post QMS introduction, and has stabilised in recent years. For all years, effort was higher in SUR 1B than in SUR 1A.

### 4.2 Biomass estimates

McShane & Naylor (1993) reported biomass estimates of 2500 t and 500 t respectively for D'Urville Island and Arapaoa Island (SUR 7), presumably based on an expansion of density estimates reported in McShane et al (1994a) by an area estimate; however, the methods are not detailed.

Anderson et al (2023) estimated kina biomass in the Kura Te Au/Tory Channel portion of SUR 7A based on a stratified random sample survey using diver and camera transects, and incorporating mātauranga Māori at the design stage to identify the best location and timing for the survey. The survey was carried out in early summer, just prior to kina spawning, so as to assess roe quality at its annual peak. High-resolution bathymetry data (2x2 m) provided an accurate measure of the survey area for scaling up of sample density measurements. Within a total area of 4.5 $km^2$ and a depth range of 0–18 m, they reported estimates of 596 t greenweight with a CV of 19%, and 63 t of kina roe (in three condition categories) with a CV of 21%.

Biomass was estimated for Dusky Sound and Chalky Inlet (SUR 5) prior to Dusky Sound being opened as an experimental fishery in May 1993 (McShane & Naylor 1991, 1993). Productivity and biomass was to be estimated by depletion methods but this was unsuccessful because only 133 t of the projected 1000 t was caught (McShane et al 1994b) and this catch was insufficient to cause a measurable change in the estimated biomass of kina.

### 4.3 Yield estimates and projections

*MCY* has not been estimated for any SUR fishstock. Within SUR 5, an *MCY* estimate of sustainable yield within Dusky Sound and Chalky Inlet was reported in Annala (1995). This estimate used Method 1 of Annala (1995) for new fisheries based on surveys done by McShane & Naylor (1991, 1993) and an estimate of a reference fishing mortality derived from McShane et al (1994a). The estimated annual sustainable yield of 275 t for these two areas has never been harvested because they are closed to commercial fishing except under special permit.

*CAY* has not been estimated for any SUR fishstock.

## 5. STATUS OF THE STOCKS

For all Fishstocks there is insufficient information to estimate current stock status.

## 6. FOR FURTHER INFORMATION

Anderson, O; Stewart, R (1993) Gisborne kina survey. (Unpublished report held in the NIWA library, Wellington.) 2 p.

Anderson, O F; Olsen, L; Marriott, P; Stead, J; Olmedo-Rojas, P (2023) Biomass survey and condition index for kina (*Evechinus chloroticus*) in SUR 7A. *New Zealand Fisheries Assessment Report 2023/60*. 20 p.

Andrew, N L (1986) The interaction between diet and density in influencing reproductive output in the echinoid *Evechinus chloroticus* (Val.). *Journal of Experimental Marine Biology and Ecology* 97: 63–79.

Andrew, N L (2001) Sea urchin fisheries: their status and management with special reference to the New Zealand kina fishery. (Unpublished report to the Ministry of Fisheries and Te Ohu Kai Moana , available at http://www.doc.govt.nz/documents/science-and-technical/casn266.pdf) 124 p.

Andrew, N L; Choat, J H (1985) Habitat related differences in the survivorship and growth of juvenile sea urchins. *Marine Ecology Progress Series* 27: 155–161.

Andrew, N L; MacDiarmid, A B (1991) Interrelations among sea urchins (*Evechinus chloroticus*) and spiny lobsters (*Jasus edwardsii*) in northern New Zealand. *Marine Ecology Progress Series* 70: 211–222.

Annala, J H (1995) Report from the Fishery Assessment Plenary, May 1995. Stock assessments and yield estimates. 277 p.

Babcock, R C; Kelly, S; Shears, N T; Walker, J W; Willis, T J (1999) Changes in community structure in temperate marine reserves. *Marine Ecology Progress Series* 189: 125–134.

Barker, M F (2001) The ecology of *Evechinus chloroticus*. In: Lawrence, J. (ed.). Edible Sea Urchins: Biology and Ecology. Elsevier Science, Amsterdam. 245–260 p.

Barker, M F; Keogh, J A; Lawrence, J M; Lawrence, A L (1998) Feeding rate, absorption efficiencies, growth, and enhancement of gonad production in the New Zealand sea urchin *Evechinus chloroticus* Valenciennes (Echinoidea: Echinometridae) fed prepared and natural diets. *Journal of Shellfish Research* 17: 1583–1590.

Boyd, R O; Gowing, L; Reilly, J L (2004) 2000–2001 national marine recreational fishing survey: diary results and harvest estimates. (Unpublished New Zealand Fisheries Assessment Research Report for the Ministry of Fisheries Project REC2000-01 held by Fisheries New Zealand, Wellington.) 92 p.

Boyd, R O; Reilly, J L (2004) 1999/2000 National Marine Recreational Fishing Survey: harvest estimates. (Unpublished New Zealand Fisheries Assessment Research Report for the Ministry of Fisheries Project REC9803 held by Fisheries New Zealand, Wellington.) 28 p.

Bradford, E (1998) Harvest estimated from the 1996 national marine recreational surveys. New Zealand Fisheries Assessment Research Document 1998/16: 27p. (Unpublished report held by NIWA library, Wellington).

Brewin, P E; Lamare, M D; Keogh, J A; Mladenov, P V (2000) Reproductive variability over a four-year period in the sea urchin *Evechinus chloroticus* (Echinoidea: Echinodermata) from differing habitats in New Zealand. *Marine Biology* 137: 543–557.

Choat, J H; Schiel, D R (1982) Patterns of distribution and abundance of large brown algae and invertebrate herbivores in subtidal regions of northern New Zealand. *Journal of Experimental Marine Biology and Ecology* 60: 129–162.

Cole, R G; Keuskamp, D (1998) Indirect effects of protection from exploitation: patterns from populations of *Evechinus chloroticus* (Echinoidea) in northeastern New Zealand. *Marine Ecology Progress Series* 173: 215–226.

Dix, T G (1970a) Biology of evechinus chloroticus (*echinoidea: Echinometridae*) from different localities, *New Zealand Journal of Marine and Freshwater Research*, 4:2, 91-116.

Dix, T G (1970b) Biology of *Evechinus chloroticus* (Echinodermata: Echinometridae) from different localities. 3. Reproduction. *New Zealand Journal of Marine and Freshwater Research* 4: 385–405.

Dix, T G (1972) Biology of *Evechinus chloroticus* (Echinoidea: Echinometridae) from different localities.4. Age, growth, and size. *New Zealand Journal of Marine and Freshwater Research* 6: 48–68.

Fisher, D; Bradford, E (1998) National marine recreational fishing survey 1996: catch and effort results by fishing zone. Final Research Report for Ministry of Fisheries Research Project REC9701. 38 p. (Unpublished report held by Fisheries New Zealand, Wellington).

Hartill, B; Davey, N (2015) Mean weight estimates for recreational fisheries in 2011–12. *New Zealand Fisheries Assessment Report 2015/25*.

Heinemann A; Gray, A. (in prep.) National Panel Survey of Recreational Marine Fishers 2022-23.

Lamare, M (1998) Origin and transport of larvae of the sea urchin *Evechinus chloroticus* (Echinodermata: Echinoidea) in a New Zealand fiord. *Marine Ecology Progress Series* 174: 107–121.

Lamare, M; Stewart, B (1998) Mass spawning by the sea urchin *Evechinus chloroticus* (Echinodermata: Echinoidea) in a New Zealand fiord. *Marine Biology 132*(1): 135–140.

Lamare, M D; Mladenov, P V (2000) Modelling somatic growth in the sea urchin *Evechinus chloroticus* (Echinoidea: Echinometridae). *Journal of Experimental Marine Biology and Ecology* 243: 17–43.

MacDiarmid, A B; Breen, P A (1993) Spiny lobster population changes in a marine reserve. *In:* Battershill, C N; Schiel, D R; Jones, G P; Creese, R G; MacDiarmid, A B (eds.). Proceedings of the Second International Temperate Reef Symposium. 47–56. NIWA Marine, Wellington.

McShane, P E (1992) Sea urchins in Dusky Sound-Prospects for a major kina industry in New Zealand. *New Zealand Professional Fisherman* December 92: 34–40.

McShane, P E (1997) A summary of commercial catch data and biological information for kina (*Evechinus chloroticus*). New Zealand Fisheries Assessment Research Document. 1997/16: 7 p. (Unpublished report held by Fisheries New Zealand, Wellington).

McShane, P E; Anderson, O F; Gerring, P K; Stewart, R A; Naylor, J R (1994a) Fisheries biology of kina (*Evechinus chloroticus*). New Zealand Fisheries Assessment Research Document. 1994/17: 34 p. (Unpublished report held by NIWA library, Wellington).

McShane, P; Gerring, P; Anderson, O; Stewart, R (1996) Population differences in the reproductive biology of *Evechinus chloroticus* (Echinoidea: Echinometridae). *New Zealand Journal of Marine and Freshwater Research 30*: 333–339.

McShane, P E; Naylor, J R (1991) A survey of kina populations (*Evechinus chloroticus*) in Dusky Sound and Chalky Inlet, southwest New Zealand. New Zealand Fisheries Assessment Research Document 1991/17 (Unpublished report held in the NIWA library, Wellington) 34 p.

McShane, P E; Naylor, J R (1993) SUR 7 – Prospects for development of a kina fishery. *Seafood New Zealand* 1: 33–34.

McShane, P; Naylor, J; Anderson, O; Gerring, P; Stewart, R (1993) Pre-fishing surveys of kina (*Evechinus chloroticus*) in Dusky Sound, Southwest New Zealand. New Zealand Fisheries Assessment Research Document 93/11. 27 p. (Unpublished report held in NIWA library, Wellington).

McShane, P E; Stewart, R; Anderson, O; Gerring, P K (1994b) Failure of kina fishery leaves bitter taste. *Seafood New Zealand* 2: 35–36.

Mead, S (1996) Fertilization success, sustainable management and commercial development of the New Zealand sea urchin, *Evechinus chloroticus*. Unpublished M.Sc. Thesis, University of Auckland.

Miller, S L; Abraham, E R (2011) Characterisation of New Zealand kina fisheries. *New Zealand Fisheries Assessment Report 2011/7*. 95 p.

Mladenov, P V; Allibone, R M; Wallis, G P (1997) Genetic differentiation in the New Zealand sea urchin *Evechinus chloroticus* (Echinodermata: Echinoidea). *New Zealand Journal of Marine and Freshwater Research* 31: 261–269.

Naylor, R; Andrew, N (2002) Relative abundance and size frequency of kina (*Evechinus chloroticus*) in the Chatham Islands in the 2001–02 fishing year. *New Zealand Fisheries Assessment Report 2002/35*. 8 p.

Phillips, N E; Shima, J (2006) Differential effects of suspended sediments on larval survival and settlement of New Zealand urchins *Evechinus chloroticus* and abalone *Haliotis iris*. *Marine Ecology Progress Series* 314: 149–158.

Schiel, D R (1990) Macroalgal assemblages in New Zealand: structure, interactions and demography. *Hydrobiologia* 192: 59–76.

Schiel, D R; Andrew, N L; Foster, M S (1995) The structure of subtidal algal and invertebrate assemblages at the Chatham Islands, New Zealand. *Marine Biology* 123: 355–367.

Schwarz, A; Cole, R; Budd, R; Taylor, R; Hewitt, J; Hunt, L; Shima, J; Phillips, N (2006) Impacts of terrestrial runoff on the biodiversity of rocky reefs. *New Zealand Aquatic Environment Biodiversity Report* 7 109 p.

Shears, N T; Babcock, R C (2002) Marine reserves demonstrate top-down control of community structure on temperate reefs. *Oecologia 132*: 131–142.

Shears, N T; Babcock, R C (2003) Continuing trophic cascade effects after 25 years of no-take Marine reserve protection. *Marine Ecology Progress Series 246*: 1–16.

Urlich, S C; Handley, S J (2020) From 'clean and green' to 'brown and down': A synthesis of historical changes to biodiversity and marine ecosystems in the Marlborough Sounds, New Zealand. *Ocean & Coastal Management 198*.

Walker, J (2007) Effects of fine sediments on settlement and survival of the sea urchin *Evechinus chloroticus* in northeastern New Zealand. *Marine Ecology Progress Series* 331: 109–118.

Walker, M (1984) Larval life span, larval settlement, and early growth of *Evechinus chloroticus* (Valenciennes). *New Zealand Journal of Marine and Freshwater Research* 18: 393–397.

Wing, S R; Lamare, M D; Vasques, J (2001) Population structure of sea urchins (*Evechinus chloroticus*) along gradients in benthic productivity in the New Zealand fjords. In: Barker, M F (ed.). Proceedings of the 10th International Echinoderm Conference. University of Otago, Dunedin. A.A. Balkema, Rotterdam. Pp 569–576.

Wynne-Jones, J; Gray, A; Heinemann, A; Hill, L; Walton, L (2019) National Panel Survey of Marine Recreational Fishers 2017–2018. *New Zealand Fisheries Assessment Report 2019/24*. 104 p.

Wynne-Jones, J; Gray, A; Hill, L; Heinemann, A (2014) National Panel Survey of Marine Recreational Fishers 2011–12: Harvest Estimates. *New Zealand Fisheries Assessment Report 2014/67*.