



Fishery characterisation for prawn killer, *Ibacus alticrenatus*, (Bate, 1888) (Scyllaridae), 1989–90 to 2012–13

New Zealand Fisheries Assessment Report 2015/05

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EXECUTIVE SUMMARY

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Records of prawn killer landings in New Zealand waters go back as far as 1991. Landings reported in the Plenary Report have been sporadic, ranging from no reported landings at all to a maximum of 50 tonnes, but usually under five tonnes. Low economic value and a lack of established markets may result in a significant amount of unreported discarding, but it is also possible that years with higher landings are a result of the scampi fleet fishing in shallower waters than usual.

Prawn killer entered the QMS on 1 October 2007. Since then, landings have been well within limits with the exception of the west coast South Island in the 2007–08 fishing year when the TACC was exceeded by 200 kg (a 20% over-run). Nearly all prawn killer are caught as bycatch of scampi target fisheries and for this reason management areas for prawn killer are identical to those for scampi. A number of these areas have no reported landings of prawn killer.

This project identified three main areas where prawn killer are caught: Bay of Plenty, Hawke Bay/Wairarapa, and the west coast of the South Island. The majority of the catch has come from the Bay of Plenty fishery, followed by the Hawke Bay/Wairarapa fishery, and then the west coast South Island. The west coast South Island fishery is the only area where a variety of target fisheries catch prawn killer, elsewhere they are caught almost exclusively in scampi target fisheries. In all areas, bottom trawl catches dominate, and midwater trawl catches are minor.

There is no apparent seasonality of catch in any of the areas other than on the west coast of the South Island, related mainly to catches in the hake spawning fishery in winter and spring.

Prawn killer biology is poorly understood and nearly all of the available information comes from the east coast of Australia. Length frequency data is limited but maximum observed carapace lengths in New Zealand are 46 and 52 mm for males and females respectively. No information is available on age or reproductive condition for New Zealand prawn killer.

Monitoring of prawn killer stocks will require more data from research and commercial sources. The most likely candidates are research trawl surveys for scampi in Bay of Plenty and Hawke Bay/Wairarapa, and observer coverage of commercial scampi fisheries in the same areas. With limited length frequency data and no data on ageing it is not possible to develop a catch-at-length or catch-at-age history. Low and sporadic commercial catches of prawn killer mean that CPUE analyses were not possible.

1. INTRODUCTION

Many of New Zealand's fish species caught in middle depth fisheries, other than those for hoki, hake, ling, and southern blue whiting, are not routinely monitored or assessed. Eighteen species were selected under the 10 year Research Programme for Deepwater Fisheries (Ministry of Fisheries 2010) to be assessed under a 3 to 4 year rotating schedule. There were five species selected for characterisation in 2013–14: black cardinal fish (*Epigonus telescopus*), gemfish (*Rexea solandri*), lookdown dory (*Cyttus traversi*), prawn killer (*Ibacus alticrenatus*), and ribaldo (*Mora moro*).

To date, no characterizations or assessments have been carried out on prawn killer in New Zealand waters.

Prawn killer are caught in small quantities on inshore research trawl surveys of the west coast South Island and scampi surveys of the Bay of Plenty and Hawke Bay and Wairarapa regions. They are a very occasional catch in middle depth and deepwater surveys for species such as hoki, hake, ling, orange roughy, and dory species all around New Zealand.

This report summarises the analyses carried out under Ministry of Fisheries (now Ministry for Primary Industries) Project DEE201007PRK, Objectives 1–6: To characterise the New Zealand prawn killer fisheries in PRK1–9 by analysis of commercial catch and effort data up to 2011–12 including:

- Characterise the fisheries by analysis of commercial catch and effort data up to 2011–12.
- Carry out standardised CPUE analyses for the major fisheries (Fishstocks) where appropriate.
- Review the indices from CPUE analyses, trawl surveys and Observer logbooks to determine trends.
- Review stock structure using data accessed above and any other relevant biological or fishery information.
- Assess availability and utility of developing a series of age frequency distributions from otoliths.
- To make recommendations on future data requirements and methods for monitoring the stocks.

The project was to cover up to the 2011–12 fishing years, but commercial catch and effort data for the 2012–13 fishing year were available and so were included.

The report contains sections of text and tables that can be transferred to the Ministry for Primary Industries Plenary Report as appropriate. Tables and figures are provided in three appendices: A, fishery-independent research survey data; B, Ministry for Primary Industries' observer programme data; and C, commercial fishery characterisation.

2. FISHERY SUMMARY

2.1 Commercial fisheries

Prawn killer are a scyllarid lobster, a group of decapod crustaceans also known as slipper lobsters (Haddy et al. (2007). They are most often reported in depths of 80–300 m around the New Zealand coast, as well as being found from the North West Cape in Western Australia, around the south coast to northern Queensland. While *Ibacus brucei* has been reported from the Kermadec Islands, *I. alticrenatus* is the only species of slipper lobster found around the main islands of New Zealand. In New Zealand they are caught almost entirely as bycatch in bottom trawl fisheries targeting scampi (*Metanephrops challengeri*), mainly in the Bay of Plenty region and to a lesser extent in the Hawke Bay and Wairarapa region. The fishery is currently managed as 11 separate Fishstocks, based on the same QMAs as scampi (Figure 1). Records by current QMAs are available from the 1990–91 fishing year onwards (Table 1). Annual catches peaked in 1992–93 at 49.12 t, most of which (42.24 t) came from PRK 1. Landings from PRK 1 have always accounted for the greatest landings of prawn killers with the next most important QMA being PRK 2, though landings from here are considerably lower with the largest landing being 8.09 t in the 2002–03 fishing year. Reported landings have been either nil or just a few kilograms in most other QMAs in most years, with no reported landings ever from PRK 5 and 6A. The fluctuating landings from PRK 1, where a target fishery for scampi has been operating for a number of years would suggest that actual catches are not landed and unreported discarding is common. TACCs for all QMAs have been in place since the species entered the Quota Management System (QMS) on 1 October 2007. Since then reported landings have ranged from 0.896 to 7.51 t (Table 1), considerably lower than the overall TACC of 36 t. The only QMA where the TACC has been exceeded is PRK 7 by 200 kg (a 20% overrun) in the 2007–2008 fishing year.

There have been no previous characterizations of New Zealand prawn killer fisheries and there are no biological data available from which to investigate stock separation. Based on analyses of commercial catch and effort data, this study found three main areas where they are caught: Bay of Plenty, Hawke Bay/Wairarapa, and the west coast of the South Island (Figure 2).

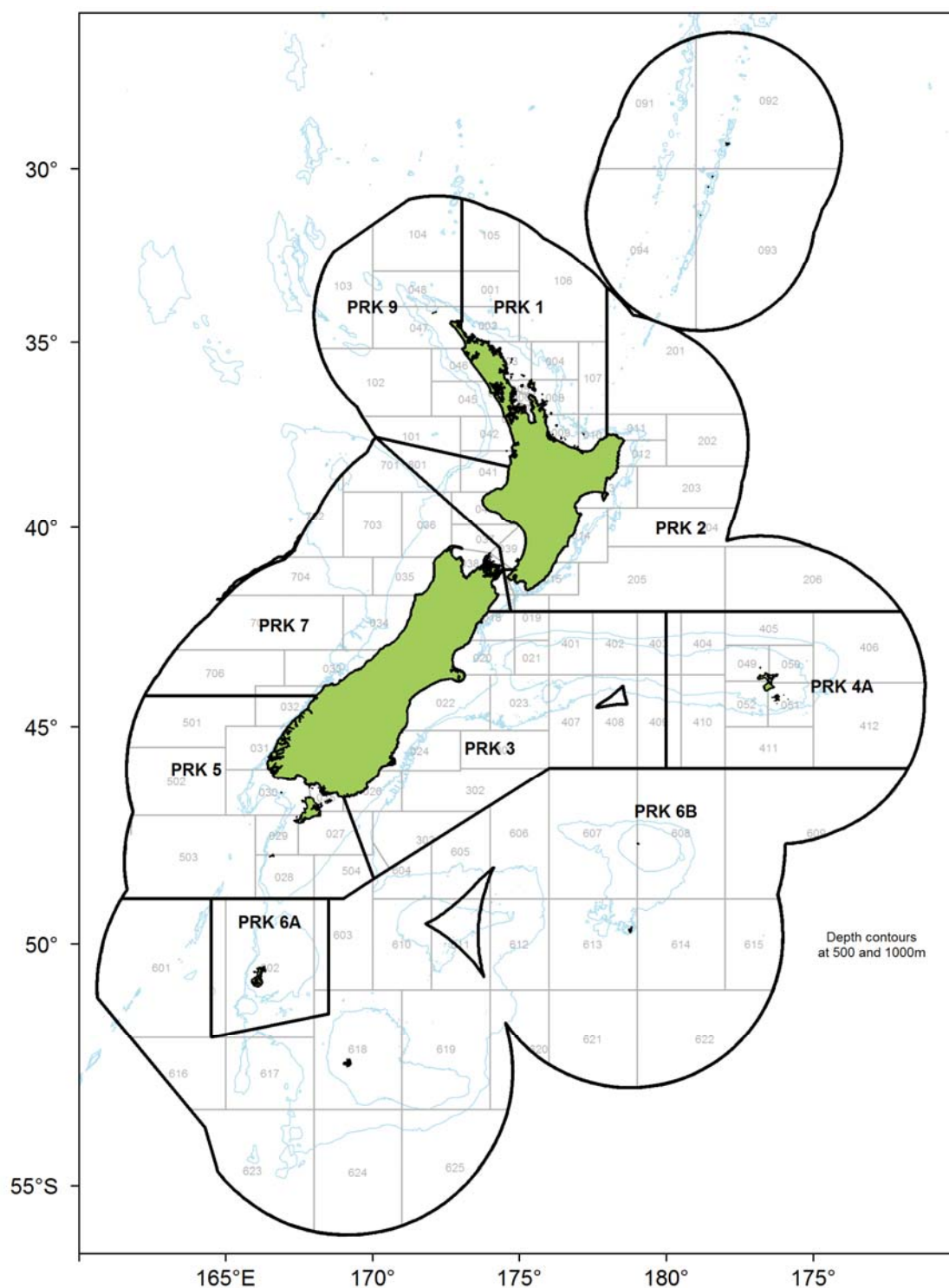


Figure 1: Map showing the Quota Management Areas (QMAs) for PRK 1–10, including statistical areas, and the 500 m and 1000 m depth contours.

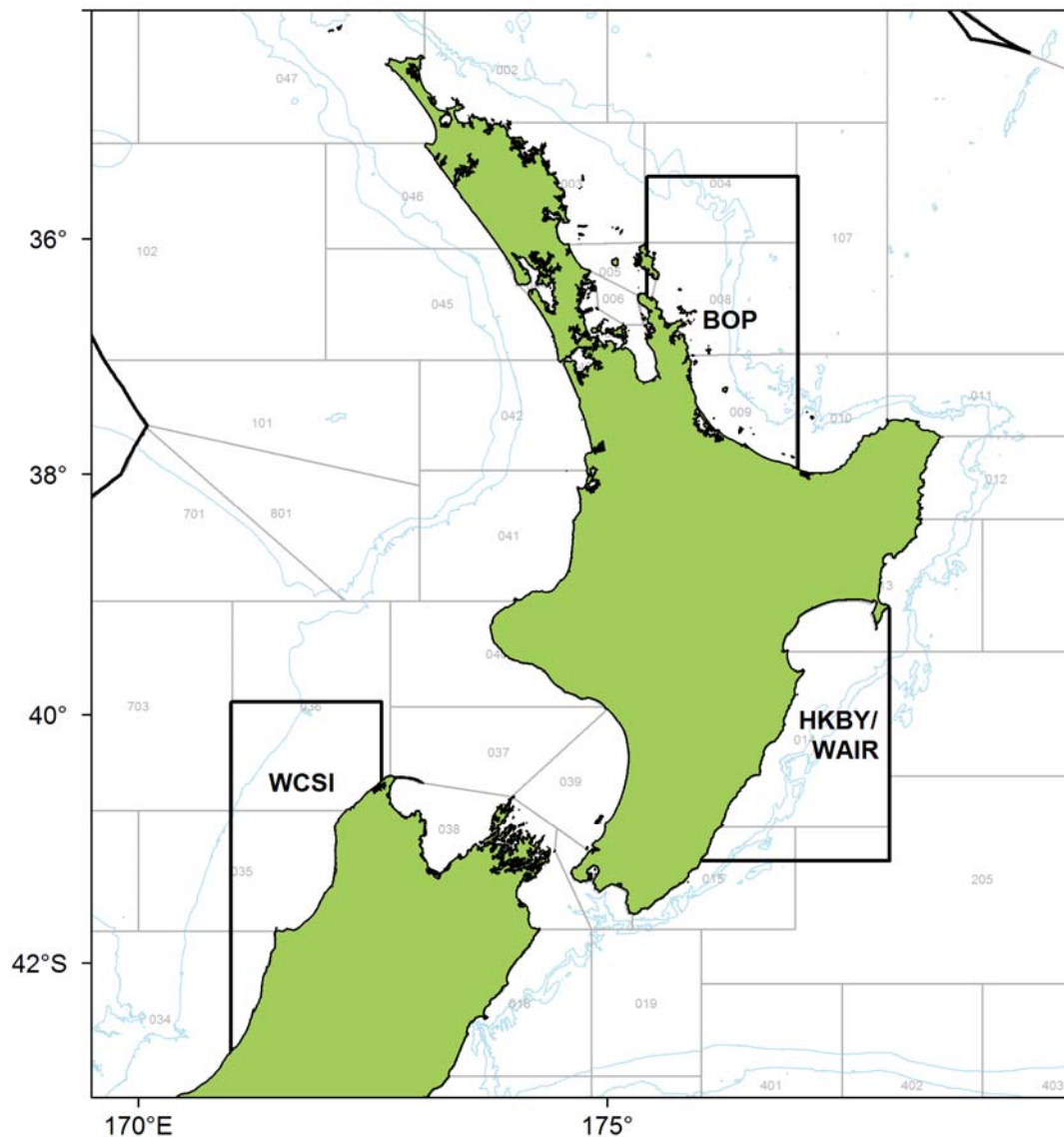


Figure 2: Map showing the New Zealand EEZ, including statistical areas, the 500 m and 1000 m depth contours, and the fishery areas used in this analysis: BOP (Bay of Plenty); HKBY/WAIR (Hawke Bay/Wairarapa); and WCSI (west coast South Island).

Table 1: Reported landings (t) of prawn killer and TACC by QMA for fishing years 1990–91 to 2012–13.
Source: Ministry for Primary Industries May 2014 Plenary (Ministry for Primary Industries, 2014). –, no data.

| Fishstock | PRK 1 | | PRK 2 | | PRK 3 | | PRK 4A | | PRK 5 | | PRK 6A | |
|-----------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|
| | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1990–91 | 11.59 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1991–92 | 3.34 | - | 0.48 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1992–93 | 42.24 | - | 6.86 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1993–94 | 10.95 | - | 0.03 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1994–95 | 0.52 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1995–96 | 1.78 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1996–97 | 23.13 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1997–98 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1998–99 | 0 | - | 0.19 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1999–00 | 0.08 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2000–01 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2001–02 | 6.05 | - | 0.37 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2002–03 | 20.99 | - | 8.09 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2003–04 | 24.35 | - | 0.57 | - | 0.01 | - | 0.01 | - | 0 | - | 0 | - |
| 2004–05 | 3.25 | - | 1.15 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2005–06 | 2.25 | - | 0.20 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2006–07 | 4.6 | - | 0.10 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2007–08 | 5.36 | 24.5 | 0.92 | 3.5 | 0.01 | 1 | 0.02 | 1 | 0 | 1 | 0 | 1 |
| 2008–09 | 0.22 | 24.5 | 0.08 | 3.5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 2009–10 | 0.75 | 24.5 | 0.03 | 3.5 | 0.001 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 2010–11 | 3.55 | 24.5 | 0.08 | 3.5 | 0 | 1 | 0.002 | 1 | 0 | 1 | 0 | 1 |
| 2011–12 | 0.42 | 24.5 | 0.17 | 3.5 | 0 | 1 | 0.001 | 1 | 0 | 1 | 0 | 1 |
| 2012–13 | 0.26 | 24.5 | 0.02 | 3.5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

| Fishstock | PRK 6B | | PRK 7 | | PRK 8 | | PRK 9 | | TOTAL | |
|-----------|----------|------|----------|------|----------|------|----------|------|----------|------|
| | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1990–91 | 0 | - | 0 | - | 0 | - | 0 | - | 11.58 | - |
| 1991–92 | 0 | - | 0 | - | 0 | - | 0 | - | 3.82 | - |
| 1992–93 | 0.02 | - | 0 | - | 0 | - | 0 | - | 49.12 | - |
| 1993–94 | 0 | - | 0 | - | 0 | - | 0 | - | 10.98 | - |
| 1994–95 | 0 | - | 0 | - | 0 | - | 0 | - | 0.52 | - |
| 1995–96 | 0 | - | 0 | - | 0 | - | 0 | - | 1.78 | - |
| 1996–97 | 0 | - | 0 | - | 0 | - | 0 | - | 23.13 | - |
| 1997–98 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 1998–99 | 0 | - | 0 | - | 0 | - | 0 | - | 0.19 | - |
| 1999–00 | 0 | - | 0 | - | 0 | - | 0 | - | 0.08 | - |
| 2000–01 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| 2001–02 | 0 | - | 0 | - | 0 | - | 0 | - | 6.42 | - |
| 2002–03 | 0 | - | 0 | - | 0 | - | 0 | - | 29.08 | - |
| 2003–04 | 0 | - | 0 | - | 0 | - | 0 | - | 24.94 | - |
| 2004–05 | 0 | - | 0 | - | 0 | - | 0 | - | 4.40 | - |
| 2005–06 | 0 | - | 0.01 | - | 0 | - | 0.01 | - | 2.47 | - |
| 2006–07 | 0 | - | 0.03 | - | 0 | - | 0 | - | 4.73 | - |
| 2007–08 | 0 | 1 | 1.2 | 1 | 0 | 1 | 0 | 1 | 7.51 | 36 |
| 2008–09 | 0 | 1 | 0.88 | 1 | 0 | 1 | 0 | 1 | 1.18 | 36 |
| 2009–10 | 0 | 1 | 0.48 | 1 | 0 | 1 | 0 | 1 | 1.27 | 36 |
| 2010–11 | 0 | 1 | 0.69 | 1 | 0.008 | 1 | 0 | 1 | 4.33 | 36 |
| 2011–12 | 0 | 1 | 0.73 | 1 | 0.004 | 1 | 0 | 1 | 1.32 | 36 |
| 2012–13 | 0 | 1 | 0.60 | 1 | 0.006 | 1 | 0.01 | 1 | 0.896 | 36 |

In PRK 1, almost 100% of catches are taken in the scampi target bottom trawl fishery. Almost all of the catch is taken from Statistical Areas 004, 008, and 009 (Bay of Plenty). In PRK 2 almost all of the catch is again taken by bottom trawls targeting scampi, mainly in statistical area 014 and to a lesser extent Statistical Area 015 (Hawke Bay/Wairarapa). The limited catches from the west coast South Island (PRK 7) are restricted to Statistical Areas 034–036 and are mainly caught by bottom trawling and midwater trawling on the bottom (within five metres of the seabed). A wider variety of target fisheries catch prawn killer here, including hake (*Merluccius australis*), barracouta (*Thyrsites atun*), and tarakihi (*Nemadactylus macropterus*). Only 3% of the catch is from the scampi target fishery in PRK 7.

2.2 Recreational fisheries

Given the depth, location, and habitat of prawn killer the recreational catch of prawn killer is likely to be negligible if not zero.

2.3 Maori customary fisheries

Given the depth, location, and habitat of prawn killer the customary catch of prawn killer is likely to be negligible if not zero.

2.4 Illegal and misreported catch

There is no quantitative information on the current level of illegal and misreported catch for prawn killer. Trips in the Bay of Plenty targeting scampi that are observed by Ministry for Primary Industries observers sometimes report a few hundred kilos of prawn killer and scampi fisheries have been operating in this area for a number of years. Combined with the fluctuating reported landings of prawn killer it is possible that much of the catch is discarded and not reported. However, prawn killer come under Schedule 6 of the Fisheries Act (1996), meaning that they can be discarded back into the sea if they are likely to survive. They are then reported using destination code 'X' and the vessel is not required to own quota for the discarded species. Given this, there is little incentive for a vessel to misreport prawn killer catches that have been discarded. The low value of the species means that there is also little incentive to illegally land prawn killer.

2.5 Other sources of mortality

There is no quantitative information of non-fishing sources of mortality of prawn killer.

2.6 Regulations affecting the fishery

Current and historical limits on catch in prawn killer fisheries are described in Section 2.1. Trawl codend minimum mesh-size regulations that currently apply are 60 mm for Sub-Antarctic (FMA 6) fisheries and FMA 5 south of 48° S; and 100 mm elsewhere. From 1 October 1977, the trawl codend mesh-size change took effect at the boundary between the Snares and Auckland Islands fisheries (the old EEZ area F/E boundary), which was at 48° 30'S. The management area boundary was changed on 1 October 1983 to 49° S (now the FMA 5/6 boundary) but the codend mesh size change was set at latitude 48° S to allow for targeting of squid around the Snares Islands (Hurst 1988). Trawl vessels targeting scampi, the fishery which catches the majority of prawn killer, are allowed to use nets with 80 mm mesh in the body of the trawl and 55 mm in the codend. Since 1 October 2007 (when prawn killer entered the QMS) the same mesh size has also been permitted for vessels targeting prawn killer. This study found only four individual fishing events from one vessel on one trip where prawn killer was the stated target species. This was in the 1992–93 fishing year and all fishing events were bottom trawls in Statistical Area 014.

Prawn killer are listed on Schedule 6 of the Fisheries Act, which states “a commercial fisher may return any prawn killer to the waters from which it was taken if (a) that prawn killer is likely to survive on return; and (b) the return takes place as soon as practicable after the prawn killer is taken”.

Protection of bycatch species in multi-species fisheries is mainly through the QMS. Catch of protected species such as seabirds and fur seals is monitored through the Ministry for Primary Industries

Observer Programme and all trawl vessels have been required to deploy seabird mitigation devices to minimise interactions with trawl warps since April 2006 (Ministry of Fisheries 2009).

3. BIOLOGY

3.1 Distribution

Prawn killer have been recorded in research bottom trawls in depths of 25–1401 m but most often in depths of 100–400 m. Research and commercial trawls show that they are found around much of New Zealand but mostly in the Bay of Plenty, east coast North Island, and to a lesser extent, the Mernoo Bank/north-west Chatham Rise and the west coast South Island. They appear to be extremely rare in the Sub-Antarctic and the west coast of the North Island, and totally absent from the Southland region. It should be noted that aside from scampi surveys in Bay of Plenty, Hawke Bay, Wairarapa, and Auckland Islands, the trawl gear used in surveys is likely to be too heavy to sample prawn killer efficiently. The phyllosoma larval stage of prawn killer lasts for several months (Haddy et al. 2007) which would suggest that there is potential for widespread dispersal of prawn killer. The apparent lack of prawn killer in more southern areas may be due to other factors such as temperature, food availability, competition, and habitat.

3.2 Spawning

Atkinson & Boustead (1982) report that prawn killer are thought to reach sexual maturity at around 25 mm carapace length (CL). O'Driscoll et al. (2003) found a strong overlap between the distribution of prawn killer less than 25 mm CL (presumably juveniles) and those more than 25 mm CL (presumably adults), suggesting that there is no evidence of discrete adult and juvenile breeding areas. Haddy et al. (2007) report the L_{50} of female prawn killer from the east coast of Australia as 39 mm CL (they give no L_{50} for males). While this may be specific to the Australian east coast, applied to New Zealand waters it still appears from length frequency data that juvenile and mature prawn killer are found in the same survey depth strata from trawl surveys of the Bay of Plenty and Hawke Bay/Wairarapa regions.

There is no information about gonad stages from research trawl surveys and there are no biological records from the observer programme for prawn killer in New Zealand. Haddy et al. (2007) report that in Australian waters, females produce between 1700 and 14 800 eggs ranging in diameter from 0.9 to 1.29 mm. Females incubate the eggs on their pleopods for three to four months before hatching. This occurs from April to October, peaking in July. After hatching, larvae pass through seven phyllosoma stages over a period of four to six months before metamorphosing into a puerulus stage, after which they moult into a post-puerulus stage before a final moult into the adult form.

3.3 Stocks and spatial distribution

There is no biological information on which to base prawn killer stocks. Based on the distribution of commercial and research trawl catches in New Zealand it appears that there may be separate stocks for the Bay of Plenty, Hawke Bay/Wairarapa, and possibly the west coast South Island. Catches in other areas are non-existent to minimal. The fishery areas in which there are regular catches are contained within discrete QMAs, so the current management boundaries are probably adequate.

Length frequency data is sparse, having been taken from the first, second, and fourth scampi trawl surveys of the Bay of Plenty and Hawke Bay/Wairarapa regions. They show no obvious differences in length between areas, although the 1993 survey may show a broader distribution of lengths in stratum

0801 compared with stratum 0301 which are the most important areas for biomass for PRK 2 and PRK 1 respectively (see Tables A1 and A2).

There have been no tagging studies of prawn killer in New Zealand waters, nor have there been any morphometric or DNA studies to help discriminate stocks.

3.4 Ageing

There has been no ageing of prawn killer in New Zealand waters nor does there appear to be any from Australian waters.

3.5 Growth curves

Von Bertalanffy growth parameters are not available for prawn killer in New Zealand waters (nor do they appear to be available for prawn killer in Australian waters). Length frequency data from New Zealand is limited to three trawl surveys in 1993, 1994 and 1996 but there is no age data available to construct growth parameters.

3.6 Natural mortality (*M*)

Without ageing information it is not possible to estimate *M*.

3.7 Length-weight relationship

Maximum size and weight reported for prawn killer from the east coast of Australia is 65 mm CL and 140 g in weight (Haddy et al. 2007). The length-weight relationship for both sexes combined reported by Haddy et al. for prawn killer are given in Table 2. No weight data has been recorded in *trawl db* but length frequencies from 2792 prawn killer from three scampi trawl surveys in Bay of Plenty give maximum lengths of 46 and 52 mm for males and females respectively. Using the length-weight relationship in Table 2 would give weights of 53 and 77 g for males and females respectively.

Table 2: Length-weight parameters for prawn killer from the east coast of Australia. Source: Haddy et al. 2007.

| | |
|---|---------|
| Weight (grams) = αL^{β} L= carapace length in cm. | |
| Sexes combined | |
| α | β |
| 0.0007 | 2.9365 |

3.8 Feeding and trophic status

There is no available information on the diet of prawn killer.

4. CURRENT AND ASSOCIATED RESEARCH PROGRAMMES

Ministry for Primary Industries

Recent or ongoing research on or relevant to prawn killer includes: research trawl surveys by R.V. *Kaharoa* every two to three years in the Bay of Plenty and Hawke Bay/Wairarapa regions (since 1993, designed for scampi, see Section 5); and fishery characterisation planned every five years under the Ministry of Fisheries 10-year Research Plan for Deepwater Fisheries (Ministry of Fisheries 2010). Other trawl surveys such as the west coast South Island inshore trawl surveys on R.V. *Kaharoa* and summer Chatham Rise trawl surveys on R.V. *Tangaroa* have caught prawn killer but so infrequently and in such low quantities that the information is of little use. Scampi surveys of the Mernoo Bank and Auckland Island regions have not caught prawn killer.

5. FISHERY INDEPENDENT OBSERVATIONS

5.1 Research survey abundance indices and length frequencies

There are no surveys designed specifically to estimate prawn killer abundance. Trawl surveys carried out by R.V. *Kaharoa* of the Bay of Plenty and Hawke Bay/Wairarapa regions designed for scampi are the only trawl survey time series that have regularly caught prawn killer. Other trawl surveys either catch no prawn killer at all or in quantities and frequencies too low to be of much use beyond records of their distribution.

The surveys of Bay of Plenty and Hawke Bay/Wairarapa have been sporadic and inconsistent in their approach to trawling. They are aimed at estimating scampi (*Metanephrops challengeri*) abundance and have over the years changed from trawl surveys to photographic surveys, and are currently combined trawl and photographic surveys. Not all strata have been sampled in all years and for this reason biomass estimates and length frequency distributions are presented by stratum for each survey (Appendix A, Tables A1–2, Figure A1–2). The presentation of these biomass estimates is intended to be indicative only and not validated indices of abundance.

Relative biomass estimates are typically higher in strata from the Bay of Plenty region (strata 0201–0603, Table A1, Figure A1) compared with the Hawke Bay/Wairarapa regions (strata 0701–0802, Table A2, Figure A1). Note that values of “–” for a stratum in Tables A1–2 mean that that stratum was not sampled on the given survey, but values of zero mean that the stratum was sampled but no prawn killer were caught. Biomass estimates vary considerably from survey to survey and high CVs are common. CVs of 100% are common, meaning that only one tow in a stratum caught prawn killer. Strata in the 200–300 m depth range tend to have the highest biomass estimates followed by the 300–400 m strata. Biomass is very low in the 400–500 and 500–600 m strata.

Length frequency data are available from three surveys of Bay of Plenty and Hawke Bay/Wairarapa in 1993, 1994, and 1996 but not for all strata. The 1996 survey only measured prawn killer from two stations in stratum 0301 and they were not sexed. Distributions appear to be unimodal or patchy in most strata (Figure A2). Most prawn killer in each stratum are 30–40 mm carapace length (CL) and virtually all are between 20 and 50 mm CL. The length range is 14–52 mm. It is possible that there is a broader distribution (with both smaller and larger prawn killer) in the strata that fall within Hawke Bay/Wairarapa (strata 0701–0801) for the 1993 survey compared with the Bay of Plenty (all other strata), although there is a similarly broad range in stratum 0401 (but much lower scaled population numbers). Both regions appear to have similar distributions in 1994, although stratum 0401 is the only Bay of Plenty stratum with length data to compare to Hawke Bay/Wairarapa. As expected, scaled

population numbers are highest in those strata with the highest biomass (200–300 m) as length distributions are similar between strata. It appears that there are larger prawn killer in the 1996 survey with all being between 34 and 45 mm carapace length. However, this survey sampled only two stations from stratum 0301 and may not be representative of the population.

Sex ratios vary considerably among strata. In 1993 the female:male sex ratio ranged from 0.62 in stratum 0501 to 4.49 in stratum 0403, with an overall ratio of 0.84 for all strata surveyed. In 1994 the sex ratios ranged from 0.66 in stratum 0401 to 1.65 in stratum 0701 with an overall ratio of 1.17 for all strata surveyed. No data on sex were collected on any other surveys. The three strata sampled for length and sex in 1994 were also sampled in 1993. Of these, the sex ratio had dropped slightly in stratum 0401 from 0.80 to 0.66, had almost doubled for stratum 0701 from 0.89 to 1.65, and was essentially unchanged in stratum 0702, going from 0.88 to 0.83. With just two years of data it is not possible to comment on any changes in sex ratios or length frequencies in terms of trends.

No ageing material has been collected from prawn killer in New Zealand, and with so few length frequencies taken, and none for almost 20 years, it is not possible to develop a catch-at-age history.

6. FISHERY DEPENDENT OBSERVATIONS

6.1 Observer data

The Ministry for Primary Industries Observer Programme first collected information on prawn killer catches in the 1992 fishing year. To date, catches are all that have been recorded. There have been no biological, length frequency, or other data recorded. All tables and figures related to observer data for prawn killer are in Appendix B, Table B1–7 and Figure B1–5.

The majority of observed tows have come from the Bay of Plenty region with 446 tows (more than half of the total), followed by the west coast South Island (189 tows), Hawke Bay/Wairarapa (122 tows), and 67 tows from the rest of the NZ EEZ (Table B1a). Total observed catch follows the same pattern with more than half coming from Bay of Plenty (11.2 tonnes), followed by the west coast South Island (2.2 t), Hawke Bay/Wairarapa (0.7 t), and the rest of the NZ EEZ (0.1 t) (Table B1b).

The observed catch as a proportion of the commercial catch for each area by fishing year is shown in Table B2. There appear to be some discrepancies in the data, possibly indicating problems with recording as sometimes the observed catch is greater than the reported commercial catch, most noticeably in 2007 for ‘Other’ areas where the ratio of observed catch to commercial catch is 16.2. This is most likely a recording or estimation error. Given the low catches of prawn killer, a mistake in the estimated catch of just a few hundred grams or even a kilo could result in gross differences that as proportions result in major discrepancies.

As a proportion of the total number of observed tows, most came from the Bay of Plenty, with a mean of 0.58 for the study period (range 0–1), followed by ‘Other’ with 0.2 (range 0–1), west coast South Island at 0.15 (range 0–0.65), and Hawke Bay/Wairarapa with 0.13 (range 0–1) (Tables B3a–b).

Observed catches by month and their proportions for each area and fishing year are shown in Table B4–B7. For the Bay of Plenty, Hawke Bay/Wairarapa, and ‘Other’ regions there is no apparent seasonality to the pattern of observed prawn killer catch. For the west coast South Island the majority of the observed catch is taken from July to October (93%, with 46% from September alone). Most of the observed prawn killer catch has come from tows targeting barracouta which are known to spawn in late winter and spring in the area (McGregor 2013).

The representativeness of observer sampling of prawn killer was evaluated by plotting the total groomed and merged landings for each year and area as circles, and overlaying this with the total observed catch for those same cells as crosses (Figure B1). If crosses and circles are aligned, then relative to the total amount of observer coverage in a given year, the level of coverage in that cell was correct. Similarly; if over- or under-sampling occurred, the crosses are either larger or smaller than the circles. Overall, both commercial catches and observer sampling have been sporadic. All areas have had some oversampling in some years relative to other areas, due most likely to there being little to no catch in some areas in a year in which another area just happened to have a few tows observed (e.g. ‘Other’ areas in 2002 and 2003). From 2006–2012 the Bay of Plenty coverage appears to have been about right relative to the other areas. Commercial and observed catches in other regions are very small and it is difficult to tell in recent years for some areas if they have been over or under sampled.

The bubble plots described in the previous two paragraphs were repeated for each fishery area, by year and month to look for seasonality in observer coverage.

Observer coverage by month in the Bay of Plenty fishery was patchy over the years with all months receiving years of over- and under-sampling with no obvious seasonality to coverage (Figure B2). For the Hawke Bay/Wairarapa fishery the majority of months are not sampled which means that any month that is sampled is oversampled relative to the other months in a given year (Figure B3). For the west coast South Island fishery coverage has been reasonable for most months in which prawn killer are caught (predominantly late winter and spring) but with some months in some years being over sampled and others being under-sampled (Figure B4). Coverage by month in the ‘Other’ areas is patchy and inconsistent (Figure B5). Catches here are very low and cover a wide geographic area and the inconsistency of coverage is unlikely to be of any concern.

There is no information on length frequency, gonad development, or any other biological data to present for prawn killer collected by the observer programme.

6.2 Catch and effort data sources

Catch and effort data were requested from the Ministry for Primary Industries catch-effort database *warehouse* as extract 9384. The data consist of all fishing and landing events associated with a set of fishing trips that reported a positive landing of prawn killer in PRK 1–9 between 1 October 1989 and 30 September 2013. Fishing year is labelled as the most recent year (i.e., the 1998–1999 fishing year is referred to as 1999). The fields from the database tables requested are listed in Table C1.

The estimated catches associated with the fishing events were mainly reported on the general Catch Effort Landing Returns (CELR) and the more detailed Trawl Catch Effort and Processing Returns (TCEPR). The green weights associated with landing events were reported on the bottom part of the CELR forms, or where fishing was reported on the TCEPR, on the associated Catch Landing Return (CLR). TCEPR forms record tow-by-tow data and summarise the estimated catch for the top five species (by weight) for individual tows. CELR forms summarise daily catches, which are further stratified by statistical area, method of capture, and target species. Trawl vessels less than 28 m in length can use either CELR or TCEPR forms; trawl vessels over 28 m use TCEPR forms. From 1 October 2007, the Trawl Catch Effort Return (TCER) forms replaced the CELR forms for trawlers, and they summarise tow by tow estimated catches for up to the top eight species.

Information on total harvest levels is provided in the plenary report at the resolution of Quota Management Area. The TCEPR forms report catches at the level of individual fishing events, but the fishers are only required to report the top five species in their catch. This led to concerns (e.g., Phillips 2001) that minor bycatch species may not be well reported at the fishing event level.

The extracted data were groomed and restratified to derive the datasets required for the characterisation using a variation of Starr's (2007) data processing method as implemented by Manning et al. (2004), with refinements by Blackwell et al. (2005), and Manning (2007) and further modified for this study. The method allows catch-effort and landings data collected using different form types that record data with different spatial and temporal resolutions to be combined. It also overcomes the main limitation of the CELR and TCEPR reporting systems (frequent non-reporting of species that make up only a minor component of the catch). The procedure was comprehensively described by Manning et al. (2004) and Starr (2007). The major steps are:

- Step1: The fishing effort and landings data were first groomed separately. Outlier values in key variables that failed a range check were corrected using median imputation. This involved replacing missing or outlier values with a median value calculated over some subset of the data. Where grooming failed to find a replacement, all fishing and landing events associated with the trip were excluded.
- Step 2: The fishing effort within each valid trip was restratified by statistical area, method, and target species.
- Step 3: The greenweight landings for each fish stock for each trip were allocated to the effort strata. The greenweight landings were mapped to the effort strata using the relationship between the statistical area for each effort stratum and the statistical areas contained within each fish stock.
- Step 4: The greenweight landings were allocated to the effort strata using the total estimated catch in each effort stratum as a proportion of the total estimated catch for the trip. If estimated catches were not recorded for the trip although a landing was recorded for the trip, then the total fishing effort in each effort stratum as a proportion of the total fishing effort for the trip was used to allocate the greenweight landings.

The original intent of the merging process was to allow trip level landings data to be mapped to CELR effort strata. However, many species are captured in fisheries reporting using a combination of form types, and some may use TCEPR forms almost exclusively. The grooming and merging process also allows an evaluation of the amount of catch and effort that is not captured using TCEPR forms at the fishing event level. If significant (as is the case for prawn killer in the Hawke Bay/Wairarapa fishery), the best characterisation dataset is probably the merged trip level data. But if the amount of lost catch and effort is predictable, minor, and stable over time and area, the estimated catch at the level of the fishing event provides a much more detailed dataset for characterisation and CPUE analysis.

In this study, the estimated catch of prawn killer was well represented in the landings data for the Bay of Plenty fishery with 93% of the landed catch for the study period. For the Hawke Bay/Wairarapa fishery the estimated catch represented only 57% of the landed catch. The groomed and merged landings are sufficient for the purposes of a general fishery characterization, and can also be used for catch-per-unit-effort analyses although not at the fine scale resolution that is possible when looking at a trawl fishery at the level of individual fishing events. However, CPUE analyses at the fishing event level require accurate estimates of the catch for each fishing event which the data here didn't have for Hawke Bay/Wairarapa. An alternative is to use the daily processed catch for vessels that report on this form type which then allows for CPUE analyses at the resolution of daily catch. Daily processed catch was not attempted in this study because catches in both of the main fishery areas are very low and very sporadic, rendering CPUE useless. Catches in the west coast South Island fishery are even lower than in the Bay of Plenty and the Hawke Bay/Wairarapa fisheries (approximately five tonnes in total for the study period) and also didn't warrant the investigation of an analysis on daily processed catch. The grooming process used for commercial catch and effort data used in this study is described below.

7 DESCRIPTIVE ANALYSIS OF CATCH

Catches by year for the main fishery areas, month, method, and target species are shown in Figure 3. The main fishery is in the Bay of Plenty region, and accounts for most of the total prawn killer catch for the time series. Catches are sometimes made in the Hawke Bay/Wairarapa region but in much lower quantities than the Bay of Plenty. The last six years has seen landings of between 500 and 1200 kg on the west coast South Island whereas prior to that there were no reported landings at all. There is no obvious seasonality in the catch, with all months reporting prawn killer catches in at least some years. They are taken almost entirely by bottom trawl, unsurprising for a ground dwelling crustacean that buries itself in the sediment. They are caught almost exclusively as bycatch of the scampi (*Metanephrops challengeri*) target fishery. There has been no reported target fishing of prawn killer other than four individual fishing events by one vessel on one trip in the 1993 fishing year in statistical area 014.

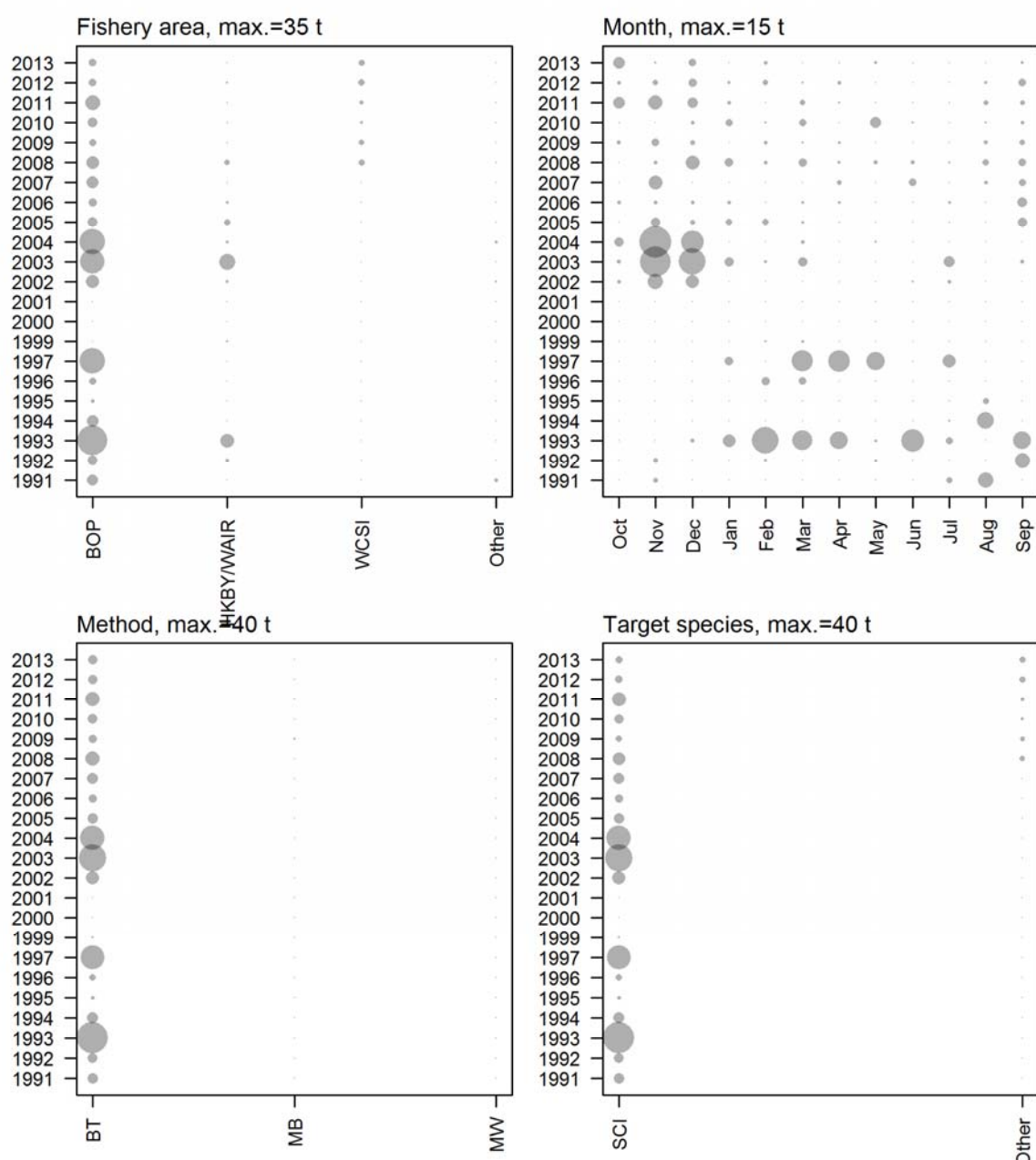


Figure 3: Prawn killer catches (from groomed and merged landings) by year for the fishery areas identified in this study (see Figure 2), month, method, and target species. BT, bottom trawl; MB, midwater trawl on the bottom (within 5 m of the seabed); MW, midwater trawl; Circle size is proportional to maximum catch within each panel. See Table C11 for species codes.

All tables and figures relating to characterisation of commercial prawn killer fisheries are contained in Appendix C (Tables C1–11, Figures C1–35). Table C11 contains a list of species codes used in this report and includes common and scientific names.

The reported plenary landings, catch-effort landings (un-groomed), and TACCs for PRK 1, 2 and 7, from 1991 to 2012–13, are shown in Figure C1 (catches in other QMAs were either non-existent or almost non-existent). The ungroomed catch-effort landings in the raw dataset are almost identical to the reported plenary landings (usually within a few kilograms) for most years in most QMAs, though slightly higher for the last few years in PRK 1 and 7. Since entering the QMS in the 2008 fishing year there have been no over runs of the TACC according to the reported plenary landings, and just one overrun of the ungroomed catch-effort landings in 2012 in PRK 7.

The landings data provide a verified greenweight landed for a fish stock on a trip basis. However, landings data include all final landing events – where a vessel offloads catch to a Licensed Fish Receiver (LFR), and interim landing events, where catch is transferred or retained, and may therefore appear subsequently as a final landing event (SeaFIC 2007). Starr’s procedure separates final and interim landings based on the landing destination code, and only landings with destination codes which indicate a final landing are retained (see table 2 in Starr (2007)).

Table C2 summarises the number of landing events for the major destination codes in the dataset. The weight, number of records, and disposition of each potential landed state is given in Table C3. For PRK 1, 2, and 7 the vast majority of prawn killer by individual landing events every year is landed in New Zealand to LFRs (recorded as “L”) for CLR forms (which most prawn killer landings are reported on). For CELR forms, slightly more is landed than is discarded (“D”) in PRK 1 and 2. There are no reported landings on CELR forms from PRK 7. Unsurprisingly, greenweight landings coded as “L” account for most of the total by weight, followed by “D” and “X”. Landing code “R” (‘retained on board’), described as an interim landing event were dropped from the analysis as per Starr (2007). Fortunately little of the landings were dropped in the grooming process (Figure C2).

Almost all prawn killer is landed green, in all areas examined in this study (Figure C3). There has been one instance of a landing in PRK 2 of ‘OCT’ (other crustacea tails) and a minor amount made into fish meal in PRK 7.

The retained landings were allocated to the effort strata using the relationship between the statistical area for each effort stratum and the statistical areas contained within each fish stock. Difficulties arise with effort strata associated with statistical areas that straddle stock management area boundaries (e.g., Statistical Areas 018, 019, and 027), as the proportion of catches to be allocated to each QMA cannot be determined. This is a significant problem for species such as prawn killer with 11 QMAs as the resulting number of boundary lines increases the likelihood that a statistical area will straddle QMAs. There are two options to address this problem. The first assumes that the catches of the straddling statistical area had been taken from a single fish stock if the trip had only reported to that stock, and excludes all the fishing and landing events from a trip if it had reported to multiple fish stocks (“straddle” method). This may not be ideal if trips often straddle fishstock boundaries. The second option allocates statistical areas to fish stocks based on the location of the centroid of each area (“centroid” method). This method was used here and resulted in a closer relationship between reported plenary landings, merged landings, and estimated catch. Details of the retained landings in unmerged and merged datasets and estimated catches in the groomed and merged datasets, by QMA, are given in Table C4.

The reported landings, retained landings in the unmerged and merged datasets, and estimated catches are shown in Figure C4. In most QMAs in most years the retained landings and merged landings match the reported plenary landings fairly closely. For the estimated catch, there is a reasonably close match with reported plenary landings in most years in PRK 1, but the match is poor in PRK 2 and 7. The reporting rate, defined to be the annual estimated catch as a proportion of the retained landings in the groomed and

merged dataset, was also calculated (Figure C5). The reporting rate fluctuates somewhat over the years for PRK 1 but is reasonable overall but poor in PRK 2 and 7.

Table C5 and Figure C6a–c shows for PRK 1, 2, and 7 for each fishing year the total number of trips, trips that reported zero estimated catch, and the proportion of trips reporting zero estimated catch, for trips that landed prawn killer. The proportion of trips that landed prawn killer when reporting zero estimated catch varies widely in PRK 1 from 0 to 1, with a mean of 0.25 for the study period. In PRK 2, the proportion is high, usually the majority of trips, and in PRK 7 almost all trips report no estimated prawn killer catch.

Catches and retained landings by form type for each fishstock are shown in Figures C7a–c. For PRK 1 and 2 almost all of the catch is reported on TCEPR forms and landings on the corresponding CLR form. Catches in PRK 7 are reported on both TCEPR and TCER forms, in favour slightly of TCEPR forms. Both forms report landings on CLR forms, hence the landings are entirely on this form type.

Catches for each statistical area summed for the study period are shown in Figure C8 and to more precise locations (summed to 0.2 degree spatial squares) are shown in Figure C9. Note that Figure C9, having more precise locality data than just statistical area, is based on estimated catch, which is lower than the landed catch. However, it shows the location of catches at a finer scale than statistical area, and appears to reasonably reflect the general location of highest catches when compared to Figure C9. For PRK 1, catches are concentrated in the Bay of Plenty region, particularly in Statistical Areas 004, 008, and 009. In PRK 2, catches are concentrated in the Hawke Bay and Wairarapa regions, mainly in Statistical Areas 014 and 015. For PRK 7, the main catches are on the west coast of the South Island, particularly in Statistical Areas 034 and 035.

7.2. Fishery summary

Prawn killer catches for the three main fishery areas within the New Zealand EEZ; Bay of Plenty, Hawke Bay/Wairarapa, and west coast South Island, are given in Table C6a along with all other areas not contained with these three areas (Table C6a, Figure C10 upper left plot). The vast majority of the catch (85%) has come from the Bay of Plenty fishery for the study period of 1991–2013. This has been the most important area throughout the time period aside from 1999 when there were no reported catches from this fishery and in 2001 when no areas reported any prawn killer catches. The Hawke Bay/Wairarapa fishery has comprised 11% of the catch for the time period and catches have fluctuated markedly over time. The west coast South Island has comprised only 3% of the catch for the entire time period but in the last few years has comprised much of the total catch, especially in the 2012 and 2013 fishing years (40% in both years). However, while these are large proportions the total catches are very small (just over three tonnes in both years for all areas combined).

There is no apparent seasonality in the catch with small and large catches present in all months in all years during the study period (Table C6b, Figure C10 upper right plot).

Almost 100% of the catch has been taken by bottom trawl (more than 99%) (Table C6c, Figure C10 lower left plot). Midwater trawl and midwater trawl on the bottom (within 5 m of the sea bed) account for less than 0.5% each. Given that prawn killer are small crustaceans that bury themselves in the sand it is possible that records of midwater trawls (fished more than 5 m off the bottom) or any midwater trawl not fished on the bottom, are errors in reporting.

The vast majority of prawn killer are caught in tows targeting scampi (97%) (Table C6d, Figure C10 lower right plot). For the small proportion of the catch not taken in the scampi target fishery, there are a variety of target species, such as hake, tarakihi, barracouta, silver warehou, and hoki, on the west coast of the South Island. Small amounts have also been taken in tows targeting gurnard and tarakihi in the Hawke Bay/Wairarapa fishery.

The proportion of prawn killer catches by vessel flag nationality by year is shown in Table C6e and in Figure C11 (upper left plot). The majority are taken by New Zealand flagged vessels, (64% for the time period). Vessels with flags of 'Unknown' nationality (presumably small domestic vessels) account for 34% of the catch, with the rest taken by Korean flagged vessels (2%).

A wide range of engine power is seen for vessels catching prawn killer (Figure C11, upper right plot). The majority of the catch however is taken by vessels of between 200 and 500 kilowatts. Most vessels are relatively small at 20–30 m overall length (Figure C11, lower left plot) and 100–200 gross tonnage (Figure C11, lower right plot). The catch by larger, more powerful vessels is only from the west coast South Island.

7.2.1 Bay of Plenty Fishery

The Bay of Plenty fishery accounts for the majority of the total prawn killer catch in New Zealand waters. Catches by month and year are shown in Table C7a and Figure C12 (upper left plot). There is no obvious seasonality to the catch with all months having fluctuating catches throughout the time period.

Catches by statistical area and year are shown in Table C7b and Figure C12 (upper right plot). Statistical Area 008 is the most important with 55% of the catch for the study period, followed by area 009 (32%) and area 004 (12%). Other statistical areas in the fishery account for just 1% of the catch.

The catch in this area is taken entirely by bottom trawl (Table C7c, Figure C12 lower left plot).

The catch is taken almost entirely in the scampi target fishery with other targets accounting for less than 1% of the catch (Table C7d, Figure C12 lower right plot).

By form type, the prawn killer catch is taken almost entirely by vessels reporting on TCEPR forms with the occasional catch by vessels that report on CELR forms (Figure C13, left hand plot). Most of the catch is taken between 350 and 400 m (Figure C13, right hand plot). These are depths in which the scampi target fishery in this area operates, although it also operates deeper as well (down to 500 m) (Tuck 2009).

The proportion of effort strata (trip-vessel-statistical area-month) that reported no prawn killer catch for scampi target tows is shown in Figure C14. Before the 2000 fishing year the proportion is often high, more than 50%. From the early-2000s this drops considerably to less than 20% in some years but appears to be steadily increasing. The period in which few effort strata reported no prawn killer catch may be due to more effort in slightly shallower water by the scampi fleet at this time (Tuck 2009) at depths where prawn killer are more abundant.

Unstandardised catch rates of prawn killer in the scampi target fishery are shown in Figure C15. Overall catch rates are very low (under 15 kg per tow). The periods with the highest catch rates are the early 1990s and the early 2000s, when the scampi fleet was fishing shallower than usual (Tuck 2009) at the depths that prawn killer are expected to be more abundant.

The duration of tows targeting scampi that caught prawn killer has increased slightly from the period 1991 to 2000 (most tows were around 5–7 hours) to 2001 onwards with most tows now around 6–8 hours (Figure C16). The duration of tows appears to be very consistent between years.

The depth of tows targeting scampi and catching prawn killer for each year is shown in Figure C17. The majority of tows in all years are between 350 and 400 m in depth. The early 1990s and early 2000s appear to have more tows in shallower depths, consistent with what is reported by Tuck (2009), and these are years in which more prawn killer has been caught.

Various other fishing effort variables are summarised in Figure C18. Effort width is usually between 40 and 70 m, effort height is usually around 1–1.2 m, most tows are around 2.5 knots in speed and 25–30 km in distance. Most of the vessels are small at 150 gross tonnage and around 25 m in length.

There has been little change in the location of prawn killer catches as reported on TCEPR forms (Figure C19). Catches are mainly concentrated east of the Coromandel Peninsula in a thin ‘corridor’ between the 200 and 500 m contours. Catches are also made in some years north-east of Great Barrier Island.

7.2.2 Hawke Bay/Wairarapa fishery

The Hawke Bay/Wairarapa fishery is the second most important area for prawn killer catches after the Bay of Plenty. However groomed and merged landings here are considerably lower here with less than 20 tonnes in total for the study period, compared with 150 tonnes for the Bay of Plenty. Annual catches are often less than one tonne.

Catches by month and year are shown in Table C8a and Figure C20 (upper left plot). There is no obvious seasonality to the catch with all months having fluctuating catches throughout the time period aside from October which has no reported prawn killer catch in any year.

Catches by statistical area and year are shown in Table C8b and Figure C20 (upper right plot). Statistical Area 014 is by far the most important with 98% of the catch for the study period, and just 2% of the catch coming from Statistical Area 015. Statistical Area 015 did account for nearly half (45%) of the catch in 2007 but total landings from the fishery were only 114 kg in this year.

The catch in this area is taken entirely by bottom trawl (Table C8c, Figure C20 lower left plot).

The catch is taken almost entirely in the scampi target fishery with other targets accounting for less than 1% of the catch (Table C8d, Figure C20 lower right plot). In 2013 74% of the catch was taken in ‘Other’ target fisheries (gurnard and tarakihi).

By form type, the prawn killer catch is taken almost entirely by vessels reporting on TCEPR forms with the occasional catch by vessels that report on CELR and TCER forms (Figure C21, left hand plot). Most of the catch is taken between 300 and 400 m in depth (Figure C21, right hand plot). Tuck (2009) reports that the scampi target fishery in this area (which accounts for most of the prawn killer catch in the area) operates mainly in depths of between 325 and 365 m.

The proportion of effort strata (trip-vessel-statistical area-month) that reported no prawn killer catch for scampi target tows is shown in Figure C22. The proportion is variable, ranging from 0 to 0.5, but is generally under 0.3 since the 2000 fishing year, similar to that seen in the Bay of Plenty fishery.

Unstandardised catch rates of prawn killer in the scampi target fishery are shown in Figure C23. Overall catch rates are very low (around 1–3 kilos per tow). Catch rates appear to have been slightly higher in the early 1990s, which coincided with slightly shallower fishing for tows targeting scampi (see Figure C25).

Similar to the Bay of Plenty fishery, the duration of tows targeting scampi that caught prawn killer has increased slightly from the period 1991 to 2000 (most tows were around 5–7 hours) to 2001 onwards with most tows now around 6–8 hours (Figure C24). The duration of tows appears to be very consistent between years.

The depth of tows targeting scampi and catching prawn killer for each year is shown in Figure C25. The majority of tows in all years are between 325 and 375 m in depth, slightly shallower than is seen in the Bay of Plenty fishery. Tows in the early 1990s appear to be shallower than in the rest of the time period with most being between 300 and 350 m.

Various other fishing effort variables are summarised in Figure C26. Effort width is usually between 50 and 60 m, effort height is usually around 1–1.3 m, most tows are around 2.5–2.8 knots in speed and 25–35 km in distance. Most of the vessels are small at around 120–180 gross tonnage and around 25 m in length. These are similar values to those seen in the Bay of Plenty fishery, quite likely because many vessels fish in both areas.

There has been little change in the location of prawn killer catches as reported on TCEPR and TCER forms (Figure C27). Catches are mainly concentrated south-east of Napier, with some catches in some years off the Wairarapa coast.

7.2.3 West coast South Island

The west coast South Island fishery has been the least important area for prawn killer catches during the time period, accounting for just 5.7 tonnes. However, this has been since the 2006 fishing year when previously there had been no reported landings of prawn killer. This area is discussed here to highlight the possibility that they are starting to be caught, possibly due to a change in the fishing effort of the target fisheries in which they are bycatch.

Catches by month and year are shown in Table C9a and Figure C28 (upper left plot). This is the only area with an apparent seasonality, with most catches being made in winter and spring months from August to October (78%) although catches are made in all months of the year.

Catches by statistical area and year are shown in Table C9b and Figure C28 (upper right plot). Statistical Areas 034 and 035 are the most important with 47% and 40% of the catch respectively and the remaining 13% coming from Statistical Area 036. The importance of each statistical area has fluctuated over the time period.

Almost all of the catch (94%) in this area is taken by bottom trawl (Table C9c, Figure C28 lower left plot). 5% of the catch is taken by midwater trawl on the bottom (within 5 m of the sea bed) and just 1% is taken by midwater trawl. It is possible that catches by midwater trawl are a reporting error as it is unlikely that a ground dwelling crustacean that buries itself in the sediment is going to be caught by this method.

This is the only area where scampi is not the almost exclusive target species and is in fact the minority target with just 3% of the catch and is only reported from two years (Table C9d, Figure C28, lower right plot). There is little fishing for scampi in this area. Most of the catch is taken in tows targeting hake (44%), followed by tarakihi (22%), barracouta (14%), and hoki and silver warehou with 7% each. It is surprising that these fisheries which are mainly using bottom trawl are catching prawn killer as they are unlikely to be using trawls with light enough ground ropes, unlike trawls designed to catch scampi.

By form type, the prawn killer catch is taken by a combination of vessels reporting on TCEPR and TCER forms (Figure C29, left hand plot). Catches are spread relatively evenly across a fairly wide range of depths from about 100–700 m, presumably due to the wide variety of target fisheries in which they are caught in this area (Figure C29, right hand plot).

The proportion of effort strata (trip-vessel-statistical area-month) that reported no prawn killer catch for the main target species is shown in Figure C30. The proportion is surprisingly low, usually less than 20% in all target fisheries.

Unstandardised catch rates of prawn killer for the main target fisheries is shown in Figure C31. Catch rates are variable in all target fisheries but appear higher than in the Bay of Plenty and the Hawke Bay/Wairarapa scampi fisheries. For the hake target fishery, catch rates were in excess of 10 kg per tow in the 2012 fishing year.

Tow duration for the various target species catching prawn killer are shown in Figure C32. A variety of durations are seen among the target fisheries although within each fishery, duration is fairly consistent, but decreasing for barracouta. The longest tow durations are seen in the hake target fishery (often more than ten hours) and shortest in the barracouta target fishery (often less than five hours).

The depth of tows for the various target fisheries catching prawn killer are shown in Figure C33. There are a variety of depths given the variety of target fisheries. The deepest tows are in the hake fishery, with most being around 500–700 m. The shallowest are seen in the tarakihi and barracouta target fisheries (which are more inshore) with most being just under 200 m.

Various other fishing effort variables are summarised in Figure C34. Effort width is usually between 35 and 45 m for most target fisheries, with the scampi fishery being the widest at around 60 m (probably using a double or triple trawl). Effort height is usually around 3–4 m but is lower in the scampi and tarakihi target fisheries at around 1.5 and 2 m respectively. Most tows are around 3.5–4 knots in speed (2.5–3 knots for scampi and tarakihi). The longest distances towed are seen in the hake fishery at around 15–70 km per tow, 20–50 km per tow for the hoki and silver warehou fisheries, and 5–35 km for barracouta. The narrowest range is seen in the tarakihi target fishery with most tows being around 20–25 km in length. Distance towed appears not to have been recorded for the scampi target fishery. A range of vessel sizes are seen in this area with larger vessels targeting barracouta, hoki, hake, and silver warehou (often more than 1000 gross tonnage and more than 50 m in length), and smaller vessels targeting scampi and tarakihi (under 300 gross tonnage and under 30 m in length).

There has been little change in the location of prawn killer catches as reported on TCEPR and TCER forms for years with available locality data (Figure C35). Estimated catches of prawn killer are poor for the west coast South Island, and only those tows where prawn killer were in the top five species in a haul (or top eight for the TCER form) can be shown. The highest catches appear to be made north-west of Farewell Spit. There is little catch south of Cape Foulwind.

Summary

A summary of the main features of each of the main prawn killer fishery areas from this study is given in Table 3.

Prawn killer are caught mainly in the Bay of Plenty, Hawke Bay/Wairarapa, and the west coast of the South Island throughout the year. It is entirely a bycatch fishery, almost exclusively of the scampi target fishery in Bay of Plenty and Hawke Bay/Wairarapa. On the west coast South Island it is a bycatch of a variety of middle depth and inshore target fisheries, mainly hake, tarakihi, barracouta, silver warehou, and hoki, with only a minority of the catch taken in tows targeting scampi. Almost all of the catch is taken by bottom trawl.

The most important area by weight is the Bay of Plenty fishery, followed by the Hawke Bay/Wairarapa fishery. Reported catches from the west coast South Island have only become apparent since the 2006 fishing year. Catches have been very sporadic throughout the time period. It is possible that some of the catch is discarded and not reported, given its low economic value, but it does appear that for the Bay of Plenty fishery, prawn killer catches are dependent on the depth in which the scampi target fishery is operating, with higher prawn killer bycatch in years when the scampi fleet put more effort into shallower depths (the early 1990s and early 2000s). However, the listing of prawn killer under Schedule 6 of the Fisheries Act means that there is little incentive not to report discards so reported catches might be accurate.

Table 3: Summary of features of the main prawn killer fisheries. BT; bottom trawl. Area definitions are given in Figure 2; species codes in Table C11.

| Area | Bay of Plenty | Hawke Bay/ Wairarapa | West coast South Island |
|------------------------------------|--|---|--|
| FMA | 1 | 2 | 7 |
| General characteristics | | | |
| Key fishery areas | East of Coromandel Peninsula North-east of Great Barrier Island | South-east of Napier Wairarapa coast | Upper west coast South Island - |
| Key Statistical Areas | 008, 009 | 014 | 034, 035 |
| Secondary Statistical Areas | 004 | 015 | 036 |
| Season | | | |
| | Year round | Year round | Year round, peak Aug-Oct |
| Gear type | BT | BT | BT |
| Target species | | | |
| Key target species | SCI | SCI | HAK, TAR, BAR |
| Secondary target species | - | - | SWA, HOK, SCI |
| Target PRK as % of total PRK catch | - | - | - |

8. CPUE ANALYSES

Given the highly sporadic nature and very low volume of prawn killer catches, CPUE analyses have not been attempted.

9. SUMMARY AND RECOMMENDATIONS

9.1 Commercial and research data

Reported catches of prawn killer have been made since the 1991 fishing year. Catches are sporadic and in many years there has been no reported catch at all. Landings are low with the largest being 38 t in 1993 but usually under 5 t. No research surveys have been optimized to survey prawn killer and observer sampling is low and variable, and no biological information recorded. There has been no ageing work carried out.

Prawn killer biology is poorly understood and all available information is from the south-east coast of Australia. There is no biological information on which to base stock structure but the distribution of commercial and research catches suggests three stocks; Bay of Plenty, Hawke Bay/Wairarapa, and the west coast of the South Island. The current QMAs for prawn killer are identical to those used for scampi as they are mainly caught in the scampi target fishery. Catches from the three main fisheries are discretely contained within each QMA which would suggest that current management boundaries are adequate.

9.2 Observer Programme sampling

Sampling by the observer programme has been very low and sporadic and has only sampled catch weights. There has been no sampling of individual prawn killer for length frequency or other biological data.

9.3 Status of the stocks

The status of the stocks is not known. Trawl surveys for scampi in the two most important fishery areas have been inconsistent in their sampling of strata as well as sampling of prawn killer when they are caught, and are not suitable for estimating abundance. Catches in commercial fisheries are low and sporadic. Whether this is because of inconsistent and sporadic reporting of catches or because of the occasional anomalies in the operation of target fisheries that catch prawn killer is not known. Either way, there is insufficient data from either fishery-dependent or fishery-independent sources to comment on the status of the stocks.

9.4 Future data needs and research requirements

More knowledge of prawn killer biology is needed. Ongoing surveys of the Bay of Plenty and Hawke Bay/Wairarapa scampi fisheries provide an opportunity for this and it is planned to collect this data on the next survey scheduled for February-March of 2015. It is possible that if all strata are sampled consistently in this time series that it could provide an index of prawn killer abundance. However, it is not currently known if the existing strata adequately cover the species' distribution. If not, an extension of the survey to cover prawn killer distribution might be possible, but is unlikely given the low economic value and lack of markets for the species.

CPUE is not possible from the commercial fishery due to the low and sporadic catches of prawn killer. Expansion of observer coverage of the scampi fleet could help in determining whether the species is being regularly caught (but discarded unreported) or whether years with higher catches are due to increased effort in shallower depths. Again, the low economic value of prawn killer may make this unlikely but could 'piggy back' on the observation of the highly valuable scampi target fishery if it is deemed necessary to expand observer coverage of this fishery.

10. ACKNOWLEDGMENTS

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APPENDIX A: TRAWL SURVEYS

Table A1: Wing spread biomass estimates with CV in brackets (%) of prawn killer by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series for those strata that fall within PRK 1. NB: ‘-’ means stratum not sampled, values of 0 are actual zero values.

| Stratum | KAH9301 | KAH9401 | KAH9501 | KAH9604 | KAH9801 | KAH0001 | KAH0802 | KAH1205 |
|------------------|-------------|--------------|-------------|-------------|--------------|--------------|-------------|-------------|
| 0201 (200–300 m) | - | 177.583 (52) | 16.107 (54) | - | - | - | - | - |
| 0202 (300–400 m) | 0 (0) | 3.577 (81) | 9.327 (50) | - | - | 1.989 (100) | - | 6.529 (81) |
| 0203 (400–500 m) | 0 (0) | 0 (0) | 0 (0) | - | - | 0 (0) | - | 0 (0) |
| 0204 (500–600 m) | 0 (0) | 0 (0) | 0 (0) | - | - | - | - | - |
| 0301 (200–300 m) | 41.643 (21) | 164.114 (76) | 80.711 (6) | 23.095 (63) | 210.041 (22) | - | - | - |
| 0302 (300–400 m) | 0 (0) | 1.938 (91) | 6.031 (63) | 0.005 (100) | 40.32 (38) | 72.998 (100) | 70.507 (71) | 13.885 (96) |
| 0303 (400–500 m) | 0 (0) | 0.383 (100) | 0.574 (100) | 0 (0) | 1.028 (91) | - | 0.186 (100) | 0.191 (100) |
| 0304 (500–600 m) | 0 (0) | 0 (0) | 0.251 (100) | 0 (0) | 0 (0) | - | - | - |
| 0401 (200–300 m) | 8.408 (42) | 25.558 (75) | 4.86 (45) | - | 29.441 (37) | - | - | - |
| 0402 (300–400 m) | 5.071 (71) | 14.358 (59) | 51.732 (32) | - | 20.693 (90) | 42.285 (13) | - | 12.451 (40) |
| 0403 (400–500 m) | 0.07 (100) | 0.836 (100) | 0 (0) | - | 0 (0) | 2.505 (0) | 0 (0) | 0.311 (100) |
| 0404 (500–600 m) | 0.517 (100) | 0 (0) | 0 (0) | - | 0 (0) | - | - | - |
| 0501 (200–300 m) | 23.851 (43) | - | 9.489 (45) | - | - | - | - | - |
| 0502 (300–400 m) | 0.539 (77) | 3.522 (14) | 1.206 (74) | - | - | 57.664 (99) | - | - |
| 0503 (400–500 m) | 0 (0) | - | 0.276 (100) | - | - | 0 (0) | - | - |

Table A2: Wing spread biomass estimates with CV in brackets (%) of prawn killer by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series for those strata that fall within PRK 2. NB: ‘-’ means stratum not sampled, values of 0 are actual zero values.

| Stratum | KAH9301 | KAH9401 | KAH9501 | KAH0002 | KAH0401 | KAH0501 | KAH1205 |
|------------------|-------------|-------------|-------------|-------------|--------------|-------------|---------|
| 0601 (200–300 m) | - | - | 32.794 (52) | - | - | - | - |
| 0602 (300–400 m) | - | - | 32.507 (77) | - | - | - | - |
| 0603 (400–500 m) | - | - | 0.23 (100) | - | - | - | - |
| 0701 (200–300 m) | 36.773 (27) | 50.685 (54) | 27.212 (34) | - | 44.424 (30) | 53.541 (35) | - |
| 0702 (300–400 m) | 11.655 (48) | 9.94 (64) | 4.367 (53) | - | 1.733 (100) | 1.282 (64) | 0 (0) |
| 0703 (400–500 m) | 0.432 (100) | 1.517 (57) | 0 (0) | - | 0 (0) | 0 (0) | 0 (0) |
| 0801 (200–300 m) | 38.511 (30) | 48.248 (39) | 35.047 (29) | - | 31.329 (100) | 85.541 (79) | - |
| 0802 (300–400 m) | 0 (0) | 1.081 (100) | 0 (0) | 0.278 (100) | 0 (0) | 0 (0) | 0 (0) |
| 0803 (400–500 m) | 0 (0) | 0 (0) | 0 (0) | - | 0 (0) | 0 (0) | 0 (0) |

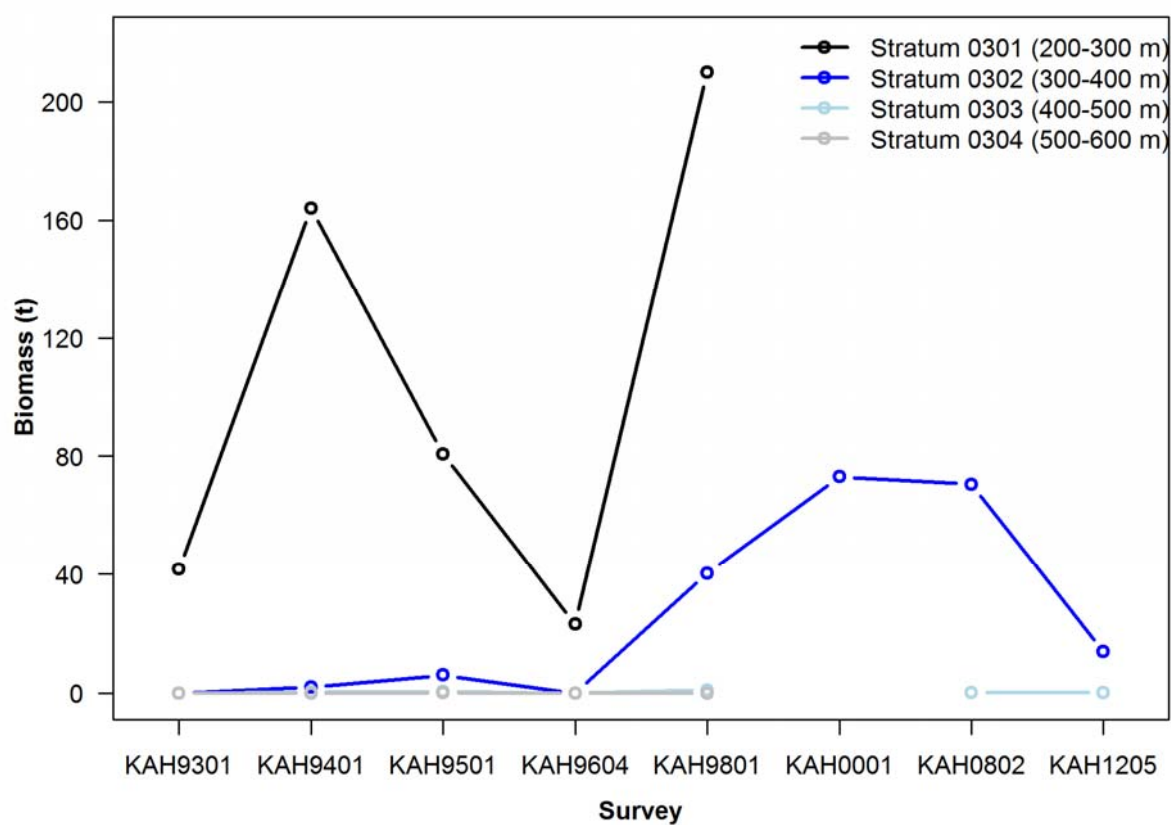
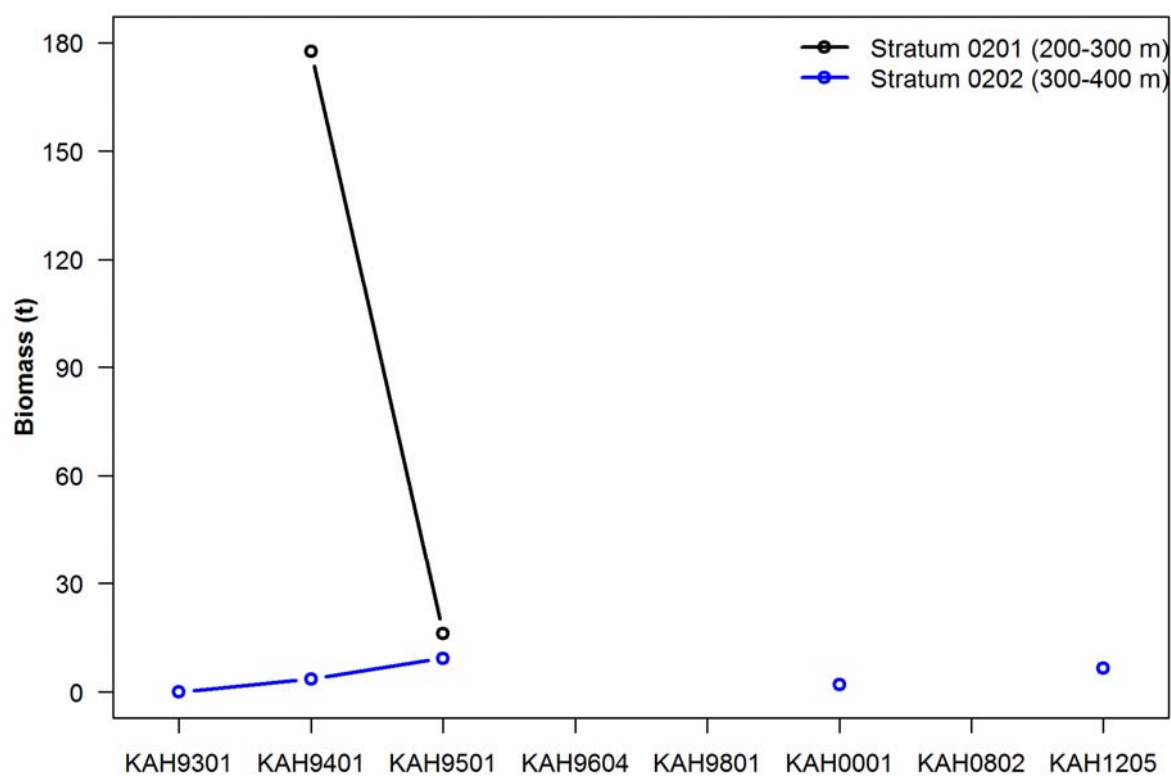


Figure A1: Wingspread biomass estimates by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series.

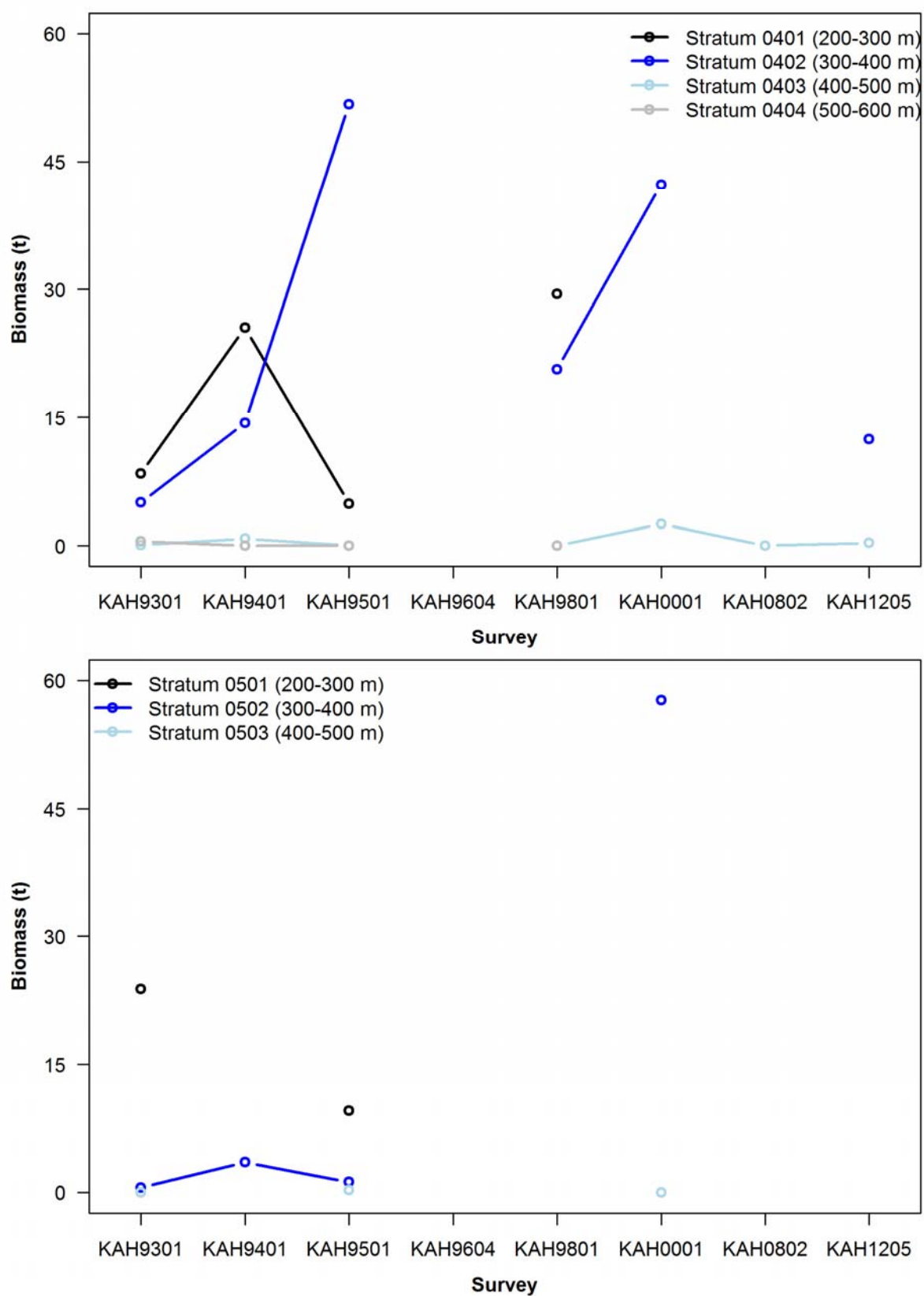


Figure A1 continued: Wingspread biomass estimates by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series.

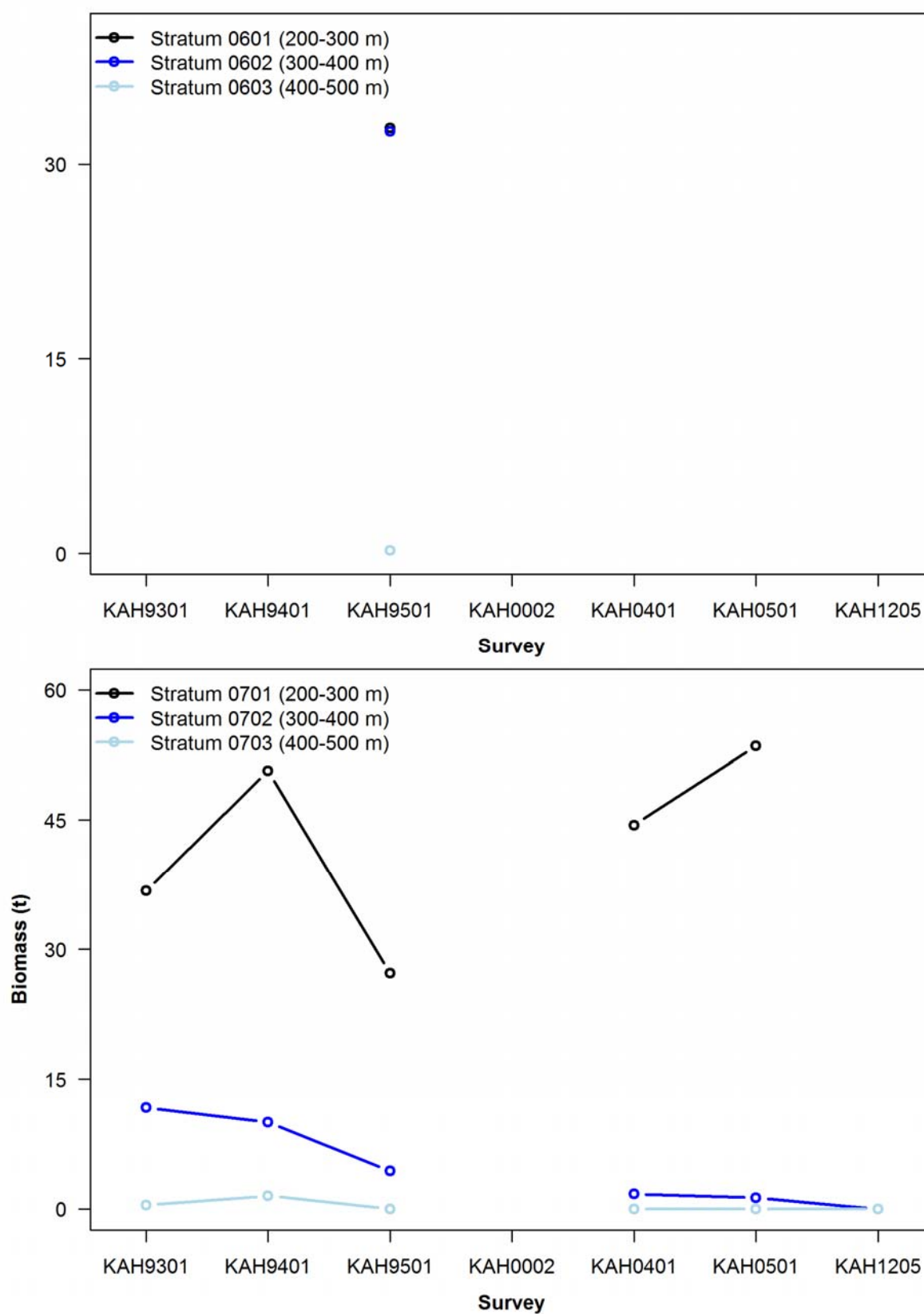


Figure A1 continued: Wingspread biomass estimates by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series.

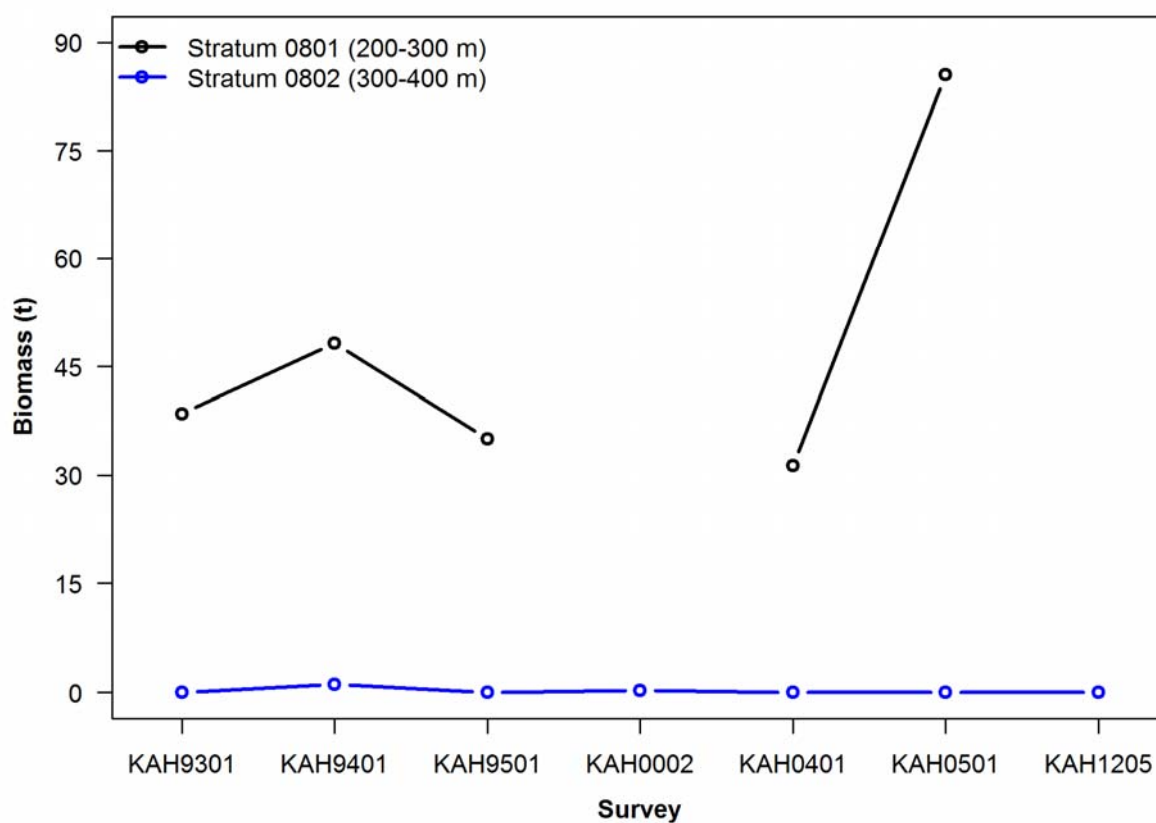


Figure A1 continued: Wingspread biomass estimates by stratum for the Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey time series.

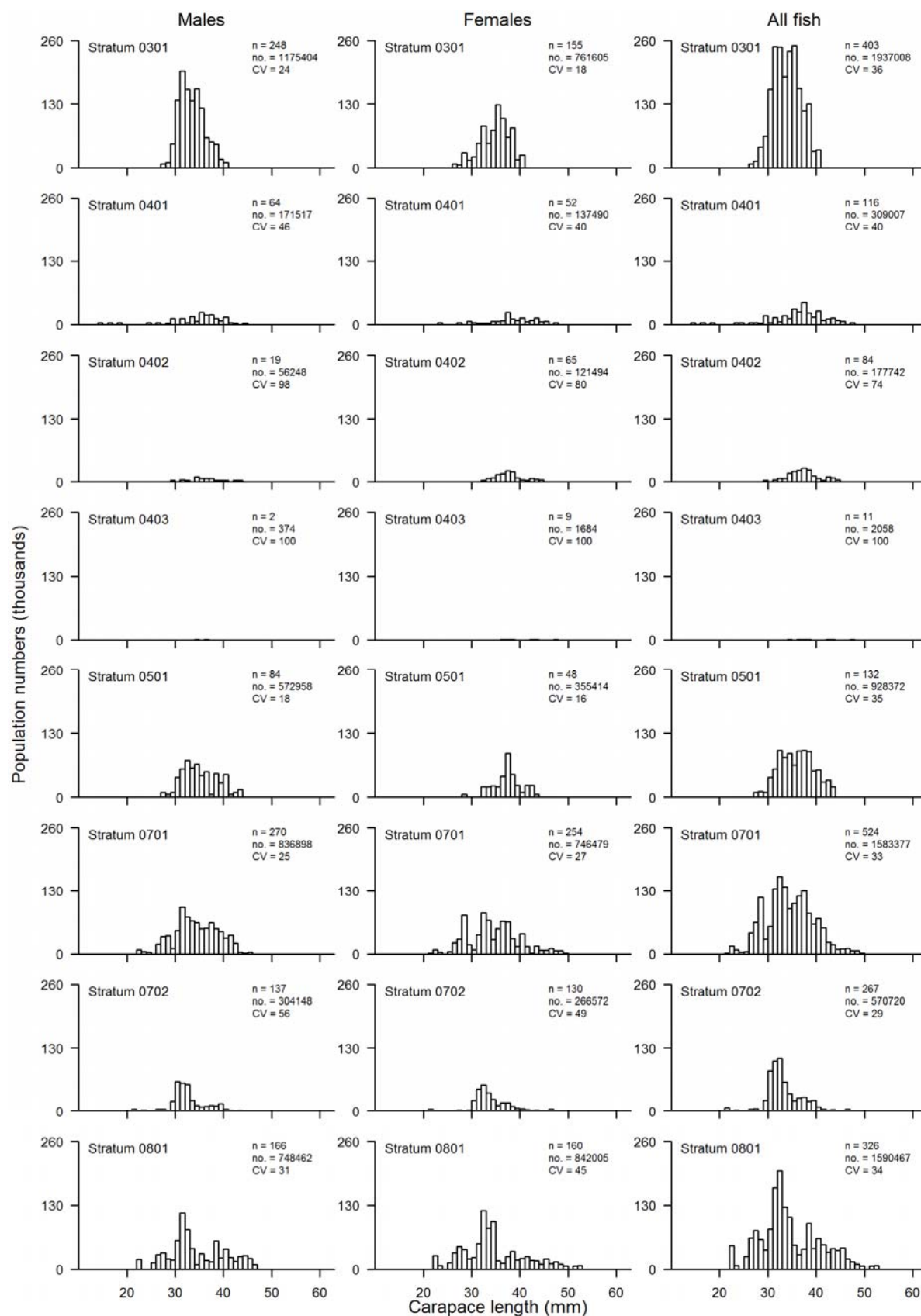


Figure A2: Scaled population length frequencies of prawn killer by stratum for the 1993 Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey (KAH9301). n=number measured, no.=scaled population number, CV=coefficient of variation (%).

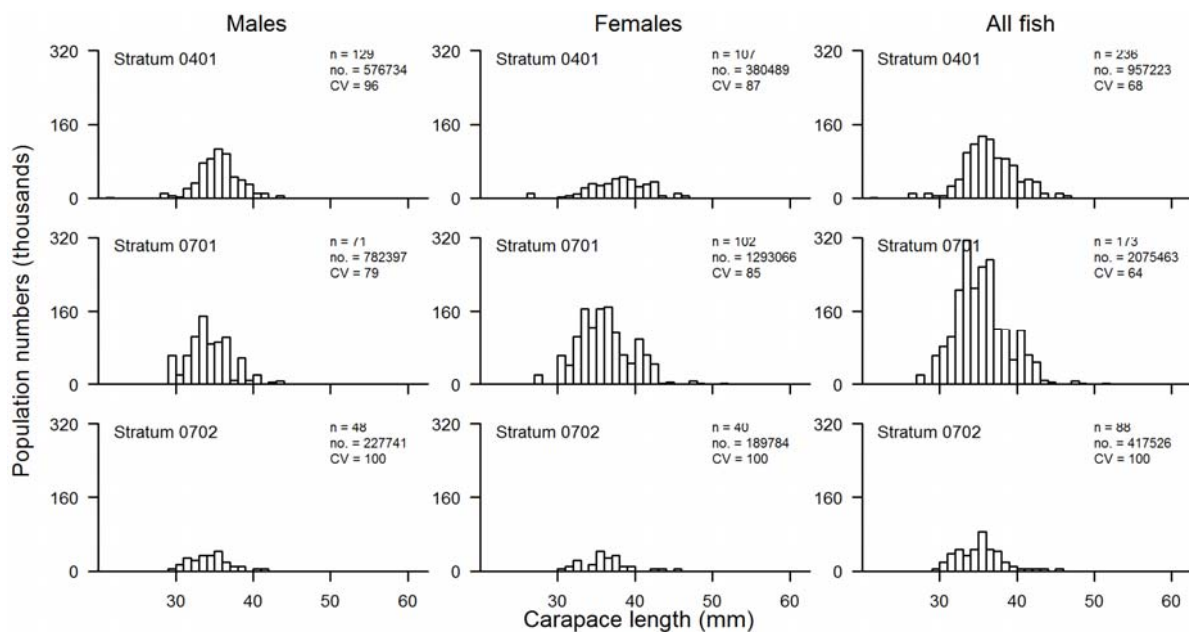


Figure A2 continued: Scaled population length frequencies of prawn killer by stratum for the 1994 Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey (KAH9401). n=number measured, no.=scaled population number, CV=coefficient of variation (%).

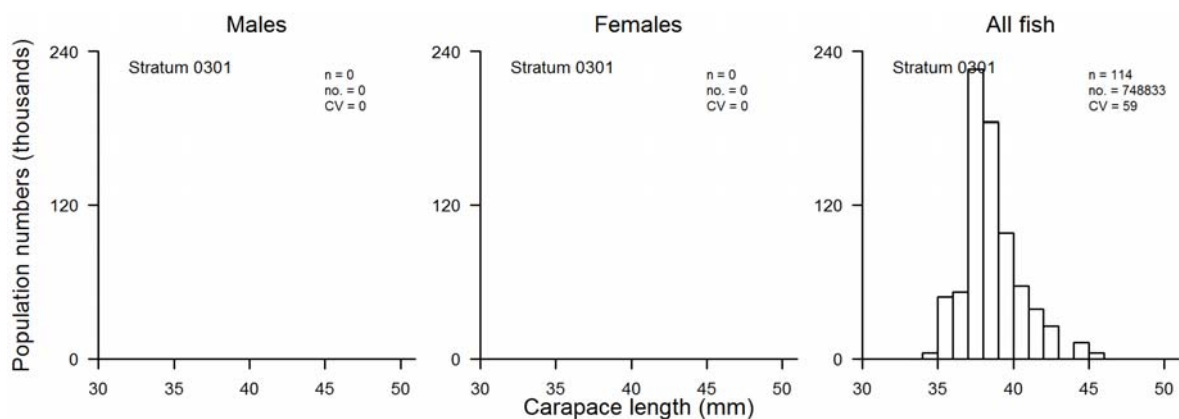


Figure A2 continued: Scaled population length frequencies of prawn killer by stratum for the 1996 Bay of Plenty and Hawke Bay/Wairarapa scampi trawl survey (KAH9604). n=number measured, no.=scaled population number, CV=coefficient of variation (%).

APPENDIX B: OBSERVER DATA FROM THE COMMERCIAL FISHERY

Table B1: Total number of observed tows (a) and observed catches in tonnes (b) sampled for prawn killer, by area, for fishing years 1991 to 2013. Areas are shown in Figure 2. BOP: Bay of Plenty; HKBY/WAIR: Hawke Bay/Wairarapa; WCSI: west coast South Island; Other: all other areas in NZ EEZ.

(a) Tows

| Fishing year | BOP | HKBY/WAIR | WCSI | Other | Total |
|--------------|-----|-----------|------|-------|-------|
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | 0 | 1 | 0 | 0 | 1 |
| 1994 | - | - | - | - | - |
| 1995 | 3 | 0 | 0 | 0 | 3 |
| 1996 | 28 | 5 | 0 | 0 | 33 |
| 1997 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 36 | 1 | 0 | 2 | 39 |
| 1999 | 13 | 0 | 0 | 0 | 13 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 0 | 0 | 1 | 2 | 3 |
| 2003 | 0 | 0 | 0 | 3 | 3 |
| 2004 | 1 | 0 | 0 | 0 | 1 |
| 2005 | 0 | 0 | 0 | 3 | 3 |
| 2006 | 26 | 6 | 2 | 2 | 36 |
| 2007 | 84 | 0 | 30 | 15 | 129 |
| 2008 | 69 | 41 | 29 | 11 | 150 |
| 2009 | 21 | 1 | 8 | 0 | 30 |
| 2010 | 43 | 1 | 32 | 5 | 81 |
| 2011 | 95 | 13 | 7 | 3 | 118 |
| 2012 | 26 | 45 | 34 | 5 | 110 |
| 2013 | 1 | 8 | 46 | 16 | 71 |
| Total | 446 | 122 | 189 | 67 | 824 |

| (b) Catches (t) | | | | | |
|------------------------|--------|-----------|-------|-------|--------|
| Year | BOP | HKBY/WAIR | WCSI | Other | Total |
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | 0.000 | 0.020 | 0.000 | 0.000 | 0.020 |
| 1994 | - | - | - | - | - |
| 1995 | 0.135 | 0.000 | 0.000 | 0.000 | 0.135 |
| 1996 | 0.073 | 0.014 | 0.000 | 0.000 | 0.087 |
| 1997 | - | - | - | - | - |
| 1998 | 3.002 | 0.001 | 0.000 | 0.041 | 3.044 |
| 1999 | 0.116 | 0.000 | 0.000 | 0.000 | 0.116 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 |
| 2003 | 0.000 | 0.000 | 0.000 | 0.003 | 0.003 |
| 2004 | 0.100 | 0.000 | 0.000 | 0.000 | 0.100 |
| 2005 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 |
| 2006 | 0.108 | 0.009 | 0.002 | 0.002 | 0.121 |
| 2007 | 1.024 | 0.000 | 0.036 | 0.015 | 1.075 |
| 2008 | 2.284 | 0.265 | 0.337 | 0.027 | 2.913 |
| 2009 | 0.528 | 0.008 | 0.116 | 0.000 | 0.652 |
| 2010 | 0.283 | 0.001 | 0.199 | 0.005 | 0.488 |
| 2011 | 3.285 | 0.040 | 0.134 | 0.004 | 3.463 |
| 2012 | 0.224 | 0.256 | 1.015 | 0.005 | 1.500 |
| 2013 | 0.001 | 0.050 | 0.371 | 0.016 | 0.438 |
| Total | 11.163 | 0.664 | 2.211 | 0.124 | 14.162 |

Table B2: Observed catch as a proportion of the commercial catch by area and fishing year. Areas are shown in Figure 2. BOP: Bay of Plenty; HKBY/WAIR: Hawke Bay /Wairarapa; WCSI: west coast South Island; Other: all other areas in NZ EEZ.

| Year | BOP | HKBYWAIR | WCSI | Other | Total |
|-------|-------|----------|-------|--------|-------|
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | 0.000 | <0.01 | 0.000 | 0.000 | <0.01 |
| 1994 | - | - | - | - | - |
| 1995 | 0.260 | - | - | - | 0.260 |
| 1996 | 0.040 | - | - | - | 0.050 |
| 1997 | - | - | - | - | - |
| 1998 | - | - | - | - | - |
| 1999 | - | - | - | - | - |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | - | - | - | - | - |
| 2003 | - | - | - | - | - |
| 2004 | - | - | - | - | - |
| 2005 | - | - | - | - | - |
| 2006 | 0.050 | 0.040 | 0.140 | - | 0.050 |
| 2007 | 0.220 | 0.000 | 1.500 | 16.150 | 0.220 |
| 2008 | 0.430 | 0.280 | 0.300 | 0.290 | 0.390 |
| 2009 | 0.320 | 0.100 | 0.130 | 0.000 | 0.250 |
| 2010 | 0.080 | 0.010 | 0.530 | 0.330 | 0.130 |
| 2011 | 0.460 | 0.450 | 0.230 | 0.160 | 0.440 |
| 2012 | 0.120 | 1.470 | 0.740 | 0.140 | 0.440 |
| 2013 | 0.000 | 2.150 | 0.280 | 0.400 | 0.130 |
| Total | 0.070 | 0.040 | 0.390 | 0.110 | 0.080 |

Table B3: Proportion of observed tows (a) and proportion of observed catches (b) sampled for prawn killer, by area, for fishing years 1991 to 2013. Areas are shown in Figure 2. BOP: Bay of Plenty; HKBY/WAIR: Hawke Bay/Wairarapa; WCSI: west coast South Island; Other: all other areas in NZ EEZ.

| a) Proportion of tows | | | | | |
|------------------------------|------|-----------|------|-------|-------|
| Fishing year | BOP | HKBY/WAIR | WCSI | Other | Total |
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | 0.00 | 1.00 | 0.00 | 0.00 | 1 |
| 1994 | - | - | - | - | - |
| 1995 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1996 | 0.85 | 0.15 | 0.00 | 0.00 | 1 |
| 1997 | - | - | - | - | - |
| 1998 | 0.92 | 0.03 | 0.00 | 0.05 | 1 |
| 1999 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 0.00 | 0.00 | 0.33 | 0.67 | 1 |
| 2003 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2004 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2005 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2006 | 0.72 | 0.17 | 0.06 | 0.06 | 1 |
| 2007 | 0.65 | 0.00 | 0.23 | 0.12 | 1 |
| 2008 | 0.46 | 0.27 | 0.19 | 0.07 | 1 |
| 2009 | 0.70 | 0.03 | 0.27 | 0.00 | 1 |
| 2010 | 0.53 | 0.01 | 0.40 | 0.06 | 1 |
| 2011 | 0.81 | 0.11 | 0.06 | 0.03 | 1 |
| 2012 | 0.24 | 0.41 | 0.31 | 0.05 | 1 |
| 2013 | 0.01 | 0.11 | 0.65 | 0.23 | 1 |
| Mean | 0.52 | 0.13 | 0.15 | 0.20 | 1 |

b) Proportion of catches

| Fishing year | BOP | HKBY/WAIR | WCSI | Other | Total |
|--------------|------|-----------|------|-------|-------|
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | 0.00 | 1.00 | 0.00 | 0.00 | 1 |
| 1994 | - | - | - | - | - |
| 1995 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1996 | 0.84 | 0.16 | 0.00 | 0.00 | 1 |
| 1997 | - | - | - | - | - |
| 1998 | 0.99 | 0.00 | 0.00 | 0.01 | 1 |
| 1999 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 0.00 | 0.00 | 0.33 | 0.67 | 1 |
| 2003 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2004 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2005 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2006 | 0.89 | 0.07 | 0.02 | 0.02 | 1 |
| 2007 | 0.95 | 0.00 | 0.03 | 0.01 | 1 |
| 2008 | 0.78 | 0.09 | 0.12 | 0.01 | 1 |
| 2009 | 0.81 | 0.01 | 0.18 | 0.00 | 1 |
| 2010 | 0.58 | 0.00 | 0.41 | 0.01 | 1 |
| 2011 | 0.95 | 0.01 | 0.04 | 0.00 | 1 |
| 2012 | 0.15 | 0.17 | 0.68 | 0.00 | 1 |
| 2013 | 0.00 | 0.11 | 0.85 | 0.04 | 1 |
| Mean | 0.58 | 0.10 | 0.16 | 0.16 | 1 |

Table B4: Observed catches in tonnes (a) and proportion of observed catches (b) by month for the Bay of Plenty fishery by fishing year.

a)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.135 | 0.000 | 0.000 | 0.135 |
| 1996 | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.067 | 0.000 | 0.000 | 0.000 | 0.000 | 0.073 |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.000 | 0.000 | 3.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.002 |
| 1999 | 0.000 | 0.000 | 0.000 | 0.000 | 0.116 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.116 |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2004 | 0.100 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.100 |
| 2005 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.108 | 0.000 | 0.000 | 0.000 | 0.108 |
| 2007 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.694 | 0.000 | 0.000 | 0.316 | 1.024 |
| 2008 | 0.000 | 2.189 | 0.024 | 0.000 | 0.000 | 0.036 | 0.035 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.284 |
| 2009 | 0.000 | 0.177 | 0.351 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.528 |
| 2010 | 0.000 | 0.000 | 0.119 | 0.000 | 0.000 | 0.000 | 0.006 | 0.141 | 0.017 | 0.000 | 0.000 | 0.000 | 0.283 |
| 2011 | 2.079 | 0.974 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.195 | 0.027 | 0.000 | 0.000 | 3.285 |
| 2012 | 0.000 | 0.000 | 0.000 | 0.003 | 0.217 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.224 |
| 2013 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Total | 2.198 | 3.342 | 3.496 | 0.013 | 0.333 | 0.036 | 0.043 | 0.208 | 1.015 | 0.164 | 0.000 | 0.316 | 11.163 |

b)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1 |
| 1996 | 0.06 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1999 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2004 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2005 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2006 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2007 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.68 | 0.00 | 0.00 | 0.31 | 1 |
| 2008 | 0.00 | 0.96 | 0.01 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2009 | 0.00 | 0.34 | 0.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2010 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.02 | 0.50 | 0.06 | 0.00 | 0.00 | 0.00 | 1 |
| 2011 | 0.63 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 | 1 |
| 2012 | 0.00 | 0.00 | 0.00 | 0.01 | 0.97 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 1 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| Mean | 0.13 | 0.12 | 0.16 | 0.00 | 0.15 | 0.00 | 0.00 | 0.11 | 0.22 | 0.08 | 0.00 | 0.02 | 1 |

Table B5: Observed catches in tonnes (a) and proportion of observed catches (b) by month for the Hawke Bay/Wairarapa fishery by fishing year.

a)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.020 | 0.020 |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1996 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.014 |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| 1999 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2004 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2005 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 | 0.000 | 0.000 | 0.009 |
| 2007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2008 | 0.000 | 0.058 | 0.000 | 0.000 | 0.000 | 0.000 | 0.184 | 0.023 | 0.000 | 0.000 | 0.000 | 0.000 | 0.265 |
| 2009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 |
| 2010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| 2011 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.034 | 0.040 |
| 2012 | 0.252 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.256 |
| 2013 | 0.000 | 0.000 | 0.050 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.050 |
| Total | 0.258 | 0.063 | 0.050 | 0.000 | 0.000 | 0.000 | 0.192 | 0.023 | 0.014 | 0.009 | 0.000 | 0.055 | 0.664 |

b)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1996 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1999 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2004 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2005 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2006 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1 |
| 2007 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2008 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.69 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2009 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2010 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2011 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.85 | 1 |
| 2012 | 0.98 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2013 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| Mean | 0.11 | 0.12 | 0.10 | 0.00 | 0.00 | 0.00 | 0.17 | 0.01 | 0.10 | 0.10 | 0.00 | 0.29 | 1 |

Table B6: Observed catches in tonnes (a) and proportion of observed catches (b) by month for the west coast South Island fishery by fishing year.

a)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 |
| 2007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.014 | 0.004 | 0.000 | 0.003 | 0.005 | 0.010 | 0.000 | 0.036 |
| 2008 | 0.001 | 0.017 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.111 | 0.207 | 0.337 |
| 2009 | 0.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.013 | 0.116 |
| 2010 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.189 | 0.000 | 0.199 |
| 2011 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.134 | 0.134 |
| 2012 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 1.013 | 1.015 |
| 2013 | 0.199 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.005 | 0.008 | 0.017 | 0.141 | 0.371 |
| Total | 0.307 | 0.017 | 0.000 | 0.000 | 0.000 | 0.014 | 0.004 | 0.001 | 0.008 | 0.021 | 0.329 | 1.510 | 2.211 |

b)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 2006 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2007 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.39 | 0.11 | 0.00 | 0.08 | 0.14 | 0.28 | 0.00 | 1 |
| 2008 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.61 | 1 |
| 2009 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.11 | 1 |
| 2010 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.95 | 0.00 | 1 |
| 2011 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1 |
| 2013 | 0.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.05 | 0.38 | 1 |
| Mean | 0.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.00 | 0.01 | 0.13 | 0.18 | 0.46 | 1 |

Table B7: Observed catches in tonnes (a) and proportion of observed catches (b) by month for all other areas in the NZ EEZ by fishing year..

a)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1996 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.000 | 0.001 | 0.040 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.041 |
| 1999 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 |
| 2003 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 |
| 2004 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2005 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.004 |
| 2006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 |
| 2007 | 0.002 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 | 0.003 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.015 |
| 2008 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.024 | 0.027 |
| 2009 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2010 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.005 |
| 2011 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.004 |
| 2012 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.005 |
| 2013 | 0.001 | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.006 | 0.016 |
| Total | 0.007 | 0.006 | 0.045 | 0.002 | 0.004 | 0.004 | 0.008 | 0.001 | 0.006 | 0.004 | 0.003 | 0.034 | 0.124 |

b)

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1996 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1998 | 0.00 | 0.02 | 0.98 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 1999 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2002 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1 |
| 2003 | 0.67 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2004 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2005 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 1 |
| 2006 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1 |
| 2007 | 0.13 | 0.00 | 0.00 | 0.00 | 0.27 | 0.27 | 0.20 | 0.07 | 0.07 | 0.00 | 0.00 | 0.00 | 1 |
| 2008 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.04 | 0.89 | 1 |
| 2009 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2010 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.20 | 0.00 | 1 |
| 2011 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1 |
| 2012 | 0.00 | 0.00 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.40 | 1 |
| 2013 | 0.06 | 0.06 | 0.12 | 0.06 | 0.00 | 0.00 | 0.25 | 0.00 | 0.06 | 0.00 | 0.00 | 0.38 | 1 |
| Mean | 0.10 | 0.10 | 0.16 | 0.02 | 0.02 | 0.02 | 0.04 | 0.01 | 0.15 | 0.13 | 0.04 | 0.20 | 1 |

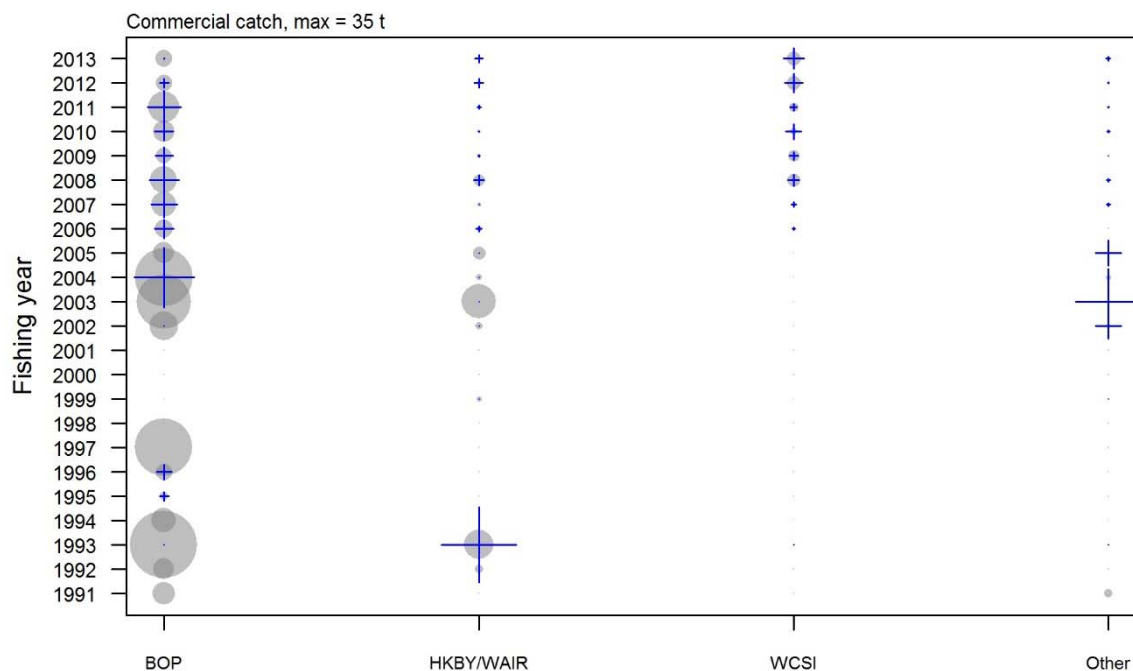


Figure B1: Representativeness of observer sampling of prawn killer catch by fishing year and area. Circles show the commercial prawn killer catch by area within a year; crosses show the observed prawn killer catch for the same cells. Representation is demonstrated by how closely the crosses match the circle diameter. BOP: Bay of Plenty, HKBY/WAIR: Hawke Bay/Wairarapa, WCSI: west coast South Island, Other: all other areas within NZ EEZ.

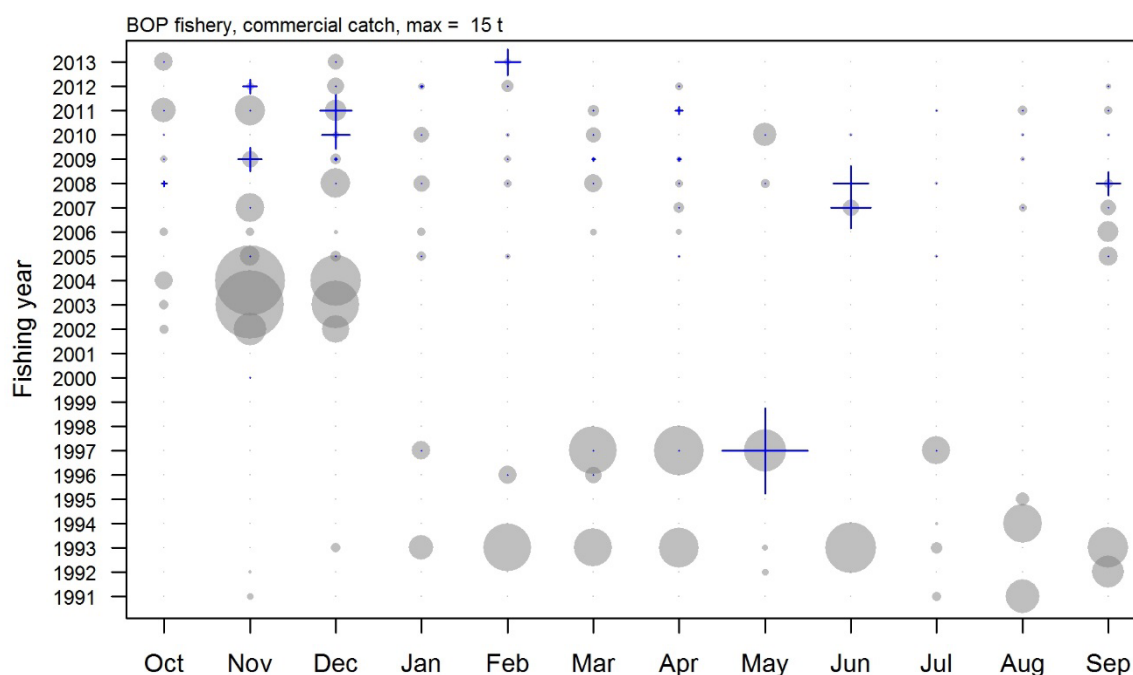


Figure B2: Representativeness of observer sampling of prawn killer catch by fishing year and month for the Bay of Plenty fishery. Circles show the commercial prawn killer catch by month and year; crosses show the observed prawn killer catch for the same cells. Representation is demonstrated by how closely the crosses match the circle diameter.

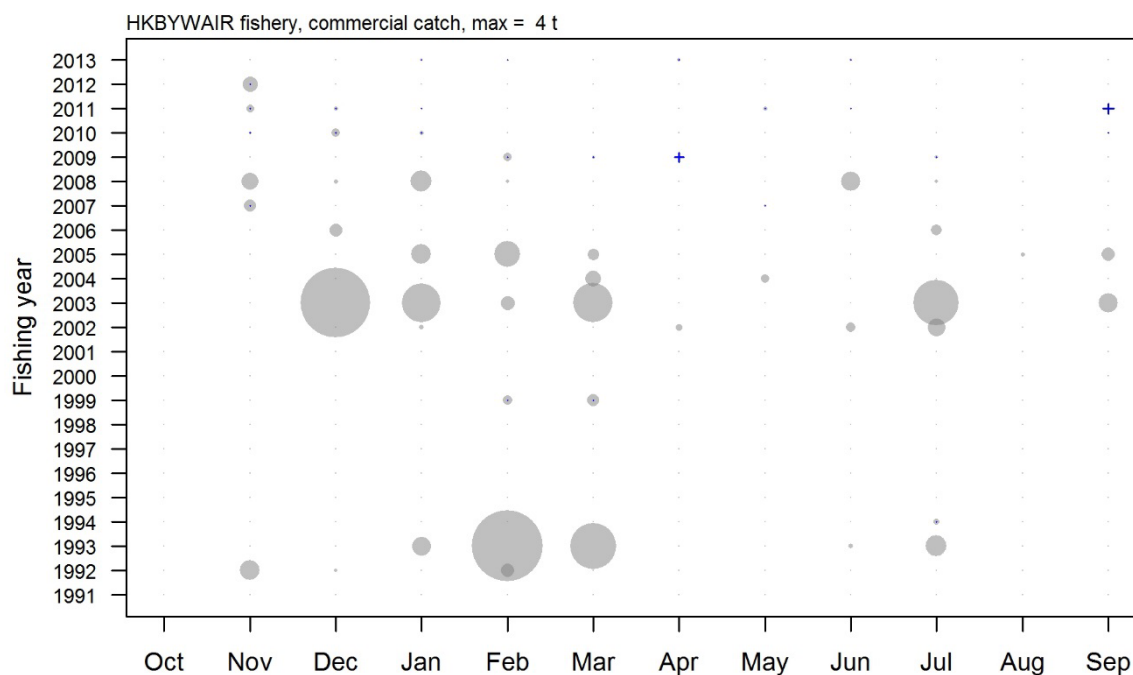


Figure B3: Representativeness of observer sampling of prawn killer catch by fishing year and month for the Hawke Bay/Wairarapa fishery. Circles show the commercial prawn killer catch by month and year; crosses show the observed prawn killer catch for the same cells. Representation is demonstrated by how closely the crosses match the circle diameter.

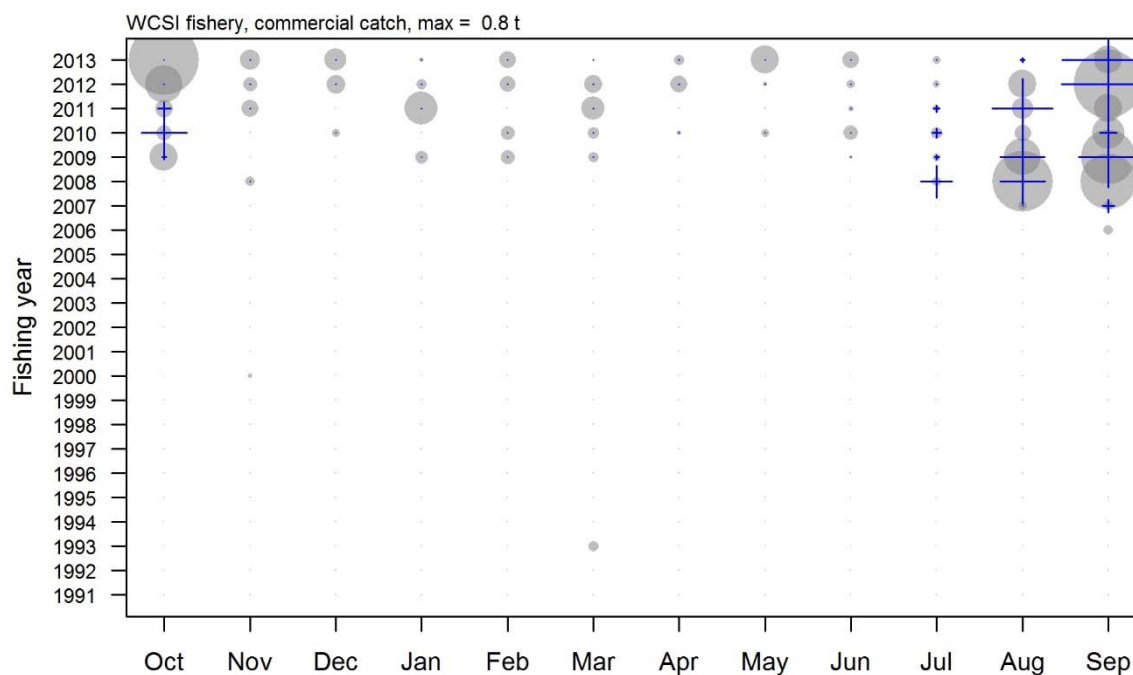


Figure B4: Representativeness of observer sampling of prawn killer catch by fishing year and month for the west coast South Island fishery. Circles show the commercial prawn killer catch by month and year; crosses show the observed prawn killer catch for the same cells. Representation is demonstrated by how closely the crosses match the circle diameter.

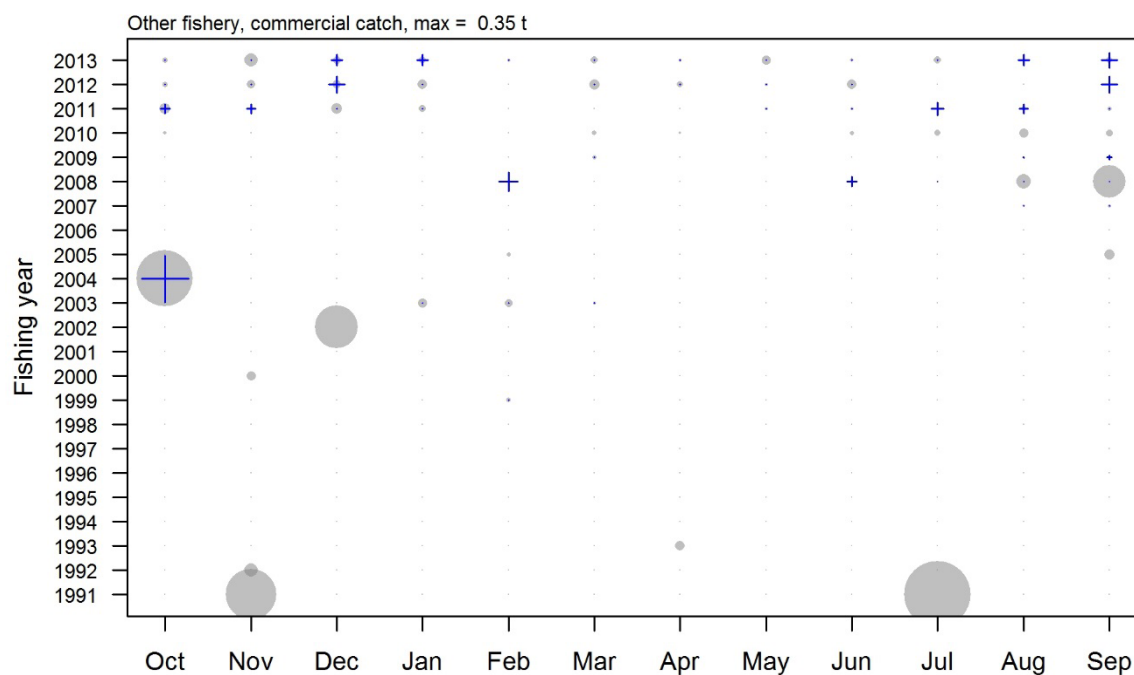


Figure B5: Representativeness of observer sampling of prawn killer catch by fishing year and month for the all other fishery areas combined. Circles show the commercial prawn killer catch by month and year; crosses show the observed prawn killer catch for the same cells. Representation is demonstrated by how closely the crosses match the circle diameter.

APPENDIX C: CHARACTERISATION

Table C1. List of tables and fields requested in the MPI extract 9384.

Fishing_events table

| | | |
|------------------|---------------------------------|-----------------------|
| Event_Key | Effort_total_num | Column_a |
| Version_seqno | Effort_width | Column_b |
| DCF_key | Effort_speed | Column_c |
| Start_datetime | Total_net_length | Column_d |
| End_datetime | Total_hook_num | Display_fishyear |
| Primary_method | Set_end_datetime | Start_stats_area_code |
| Target_species | Haul_start_datetime | Vessel_key |
| Fishing_duration | Start_latitude (full accuracy) | Form_type |
| Catch_weight | Start_longitude (full accuracy) | Trip |
| Effort_depth | End_latitude (full accuracy) | Literal_yn |
| Effort_height | End_longitude (full accuracy) | Interp_yn |
| Effort_num | Pair_trawl_yn | Resrch_yn |
| Effort_num_2 | Bottom_depth | |

Landing_events table

| | | |
|----------------------------------|-----------------------|---------------------|
| Event_Key | Destination_type | Trip_key |
| Version_seqno | Unit_type | Trip_start_datetime |
| DCF_key | Unit_num | Trip_end_datetime |
| Landing_datetime | Unit_weight | Vessel_key |
| Landing_name | Conv_factor | Form_type |
| Species_code | Green_weight | Literal_yn |
| Species_name | Green_weight_type | Interp_yn |
| Fishstock_code (ALL fish stocks) | Processed_weight | Resrch_yn |
| State_code | Processed_weight_type | |
| | Form_type | |

Estimated subcatch table

| | | |
|---------------|---|------------|
| Event_Key | Species_code (ALL species for each fishing event) | Literal_yn |
| Version_seqno | Catch_weight | Interp_yn |
| DCF_key | | Resrch_yn |

Process data table

| | | |
|-----------------------|-------------------|-----------------------|
| Event_Key | Unit_type | Processed_weight_type |
| Version_seqno | Unit_num | Vessel_key |
| DCF_key | Unit_weight | Form_type |
| Spec_prod_action_type | Conv_factor | Trip_key |
| Processed_datetime | Green_weight | Literal_yn |
| Species_code | Green_weight_type | Interp_yn |
| State_code | Processed_weight | Resrch_yn |

Vessel_history table

| |
|------------------------|
| Vessel_key |
| Flag_nationality_code |
| Built_year |
| Engine_kilowatts |
| Gross_tonnes |
| Overall_length_metres |
| History_start_datetime |
| History_end_datetime |

Table C2: Number of landing events by major destination code and form type for PRK 1 for the 1991 to 2013 fishing years. L: landed to NZ; D: discarded; X: discarded under Schedule 6; A: accidental loss; R: retained on board.

| PRK 1 | CLR form | | | | | | CEL form | | Total |
|--------------|----------|----|----|---|---|-------|----------|----|-------|
| | L | D | X | A | R | Other | L | D | |
| Fishing year | | | | | | | | | |
| 1991 | 4 | - | - | - | - | - | - | - | 4 |
| 1992 | 5 | - | - | - | - | - | - | - | 5 |
| 1993 | 19 | - | - | - | 1 | - | 1 | - | 21 |
| 1994 | 9 | - | - | - | - | - | - | - | 9 |
| 1995 | 2 | - | - | - | - | - | - | - | 2 |
| 1996 | 2 | - | - | - | - | - | - | - | 2 |
| 1997 | 11 | - | - | - | - | - | - | - | 11 |
| 1998 | - | - | - | - | - | - | - | - | - |
| 1999 | - | - | - | - | - | - | - | - | - |
| 2000 | 2 | - | - | - | - | - | - | - | 2 |
| 2001 | - | - | - | - | - | - | - | - | - |
| 2002 | 17 | 4 | - | - | - | - | 2 | 1 | 24 |
| 2003 | 4 | 6 | - | - | - | - | 10 | 9 | 29 |
| 2004 | - | 17 | - | - | - | - | - | - | 17 |
| 2005 | 1 | 11 | - | - | - | - | - | - | 12 |
| 2006 | - | 8 | - | - | - | - | - | - | 8 |
| 2007 | - | 5 | - | - | - | - | - | - | 5 |
| 2008 | 14 | 1 | - | 2 | - | 2 | - | - | 19 |
| 2009 | 7 | - | 4 | - | 1 | - | - | - | 12 |
| 2010 | 5 | - | 7 | 1 | - | 1 | - | - | 14 |
| 2011 | 3 | - | 10 | 1 | - | - | - | - | 14 |
| 2012 | 5 | - | 7 | 1 | 1 | - | - | - | 14 |
| 2013 | 2 | - | 3 | - | 1 | - | - | - | 6 |
| Total | 112 | 52 | 31 | 5 | 4 | 3 | 13 | 10 | 230 |

Table C2 continued: Number of landing events by major destination code and form type for PRK 2 for the 1991 to 2013 fishing years. L: landed to NZ; D: discarded under Schedule 6; X: unidentified code; R: retained on board, E: eaten.

| PRK 2 | CLR form | | | | | | CEL form | | | Total |
|--------------|----------|---|---|---|---|--|----------|---|---|-------|
| | L | D | X | R | E | | L | D | R | |
| Fishing year | | | | | | | | | | |
| 1991 | - | - | - | - | - | | - | - | - | - |
| 1992 | 4 | - | - | - | - | | - | - | - | 4 |
| 1993 | 11 | - | - | 1 | - | | 1 | - | - | 13 |
| 1994 | 1 | - | - | - | - | | - | - | - | 1 |
| 1995 | - | - | - | - | - | | - | - | - | - |
| 1996 | - | - | - | - | - | | - | - | - | - |
| 1997 | - | - | - | - | - | | - | - | - | - |
| 1998 | - | - | - | - | - | | - | - | - | - |
| 1999 | 2 | - | - | - | - | | - | - | - | 2 |
| 2000 | - | - | - | - | - | | - | - | - | - |
| 2001 | - | - | - | - | - | | - | - | - | - |

| | | | | | | | | | |
|-------|----|----|---|---|---|----|---|---|-----|
| 2002 | 7 | 1 | - | - | - | - | - | - | 8 |
| 2003 | 7 | 22 | - | - | - | 1 | 5 | - | 44 |
| 2004 | - | 3 | - | - | - | - | - | - | 3 |
| 2005 | 5 | 5 | - | - | 2 | - | - | - | 12 |
| 2006 | 4 | 1 | - | - | - | - | - | - | 5 |
| 2007 | - | 1 | - | - | - | 1 | - | 1 | 3 |
| 2008 | 11 | - | - | - | 1 | - | - | - | 12 |
| 2009 | 4 | - | - | - | - | - | - | - | 4 |
| 2010 | 3 | - | 2 | 1 | - | - | - | - | 6 |
| 2011 | 6 | - | 1 | - | - | - | - | - | 7 |
| 2012 | 1 | - | 2 | - | - | - | - | - | 3 |
| 2013 | 5 | - | 1 | - | - | - | - | - | 6 |
| Total | 71 | 33 | 6 | 2 | 3 | 12 | 5 | 1 | 133 |

Table C2 continued: Number of landing events by major destination code and form type for PRK 7 for the 1991 to 2013 fishing years. E: eaten; L: landed to NZ; X: discarded under Schedule 6; A: accidental loss; R: retained on board.

| PRK 7 | CLR form | | | | | | | Total |
|--------------|-----------------|-----|---|----|---|-------|---|--------------|
| Fishing year | E | L | X | A | R | Other | | |
| 1991 | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - |
| 1993 | - | 2 | - | - | - | - | - | 2 |
| 1994 | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - |
| 1996 | - | - | - | - | - | - | - | - |
| 1997 | - | - | - | - | - | - | - | - |
| 1998 | - | - | - | - | - | - | - | - |
| 1999 | - | - | - | - | - | - | - | - |
| 2000 | - | 1 | - | - | - | - | - | 1 |
| 2001 | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - |
| 2004 | - | - | - | - | - | - | - | - |
| 2005 | - | - | - | - | - | - | - | - |
| 2006 | 1 | - | - | - | - | - | - | 1 |
| 2007 | - | - | - | - | - | 2 | - | 2 |
| 2008 | 10 | 1 | - | 2 | - | 1 | - | 14 |
| 2009 | 13 | 8 | 1 | 2 | - | - | - | 24 |
| 2010 | 7 | 21 | 1 | 3 | - | - | - | 32 |
| 2011 | 9 | 19 | 1 | 1 | - | - | - | 3- |
| 2012 | 11 | 27 | 2 | - | 1 | - | - | 41 |
| 2013 | 2 | 34 | 2 | 7 | - | - | - | 45 |
| Total | 53 | 113 | 7 | 15 | 1 | 3 | - | 192 |

Table C3: Destination codes, total landing weight, number of landings and if the records were kept or discarded for all prawn killer catch for the 1991 to 2013 fishing years for RIB 3–5.

| PRK 1 | | | | |
|-------------------------|------------------------|--------------------|---|---------------|
| Destination code | Greenweight (t) | No. records | Description | Action |
| L | 103.593 | 125 | Landed in New Zealand to a Licensed Fish Receiver | Keep |
| D | 56.589 | 62 | Discarded | Keep |
| A | 4.841 | 5 | Accidental loss | Keep |
| E | 0.118 | 3 | Eaten | Keep |
| X | 11.551 | 31 | Discarded under Schedule 6 | Keep |
| R | 0.212 | 4 | Retained on board | Drop |
| PRK 2 | | | | |
| Destination code | Greenweight (t) | No. records | Description | Action |
| L | 10.272 | 83 | Landed in New Zealand to a Licensed Fish Receiver | Keep |
| D | 9.105 | 38 | Discarded | Keep |
| E | 0.003 | 3 | Eaten | Keep |
| X | 0.078 | 6 | Discarded under Schedule 6 | Keep |
| R | 0.015 | 3 | Retained on board | Drop |
| PRK 7 | | | | |
| Destination code | Greenweight (t) | No. records | Description | Action |
| E | 2.017 | 53 | Eaten | Keep |
| L | 1.64 | 113 | Landed in New Zealand to a Licensed Fish Receiver | Keep |
| A | 1.016 | 15 | Accidental loss | Keep |
| D | 0.04 | 3 | Discarded | Keep |
| X | 1.179 | 7 | Discarded under Schedule 6 | Keep |
| R | 0.09 | 1 | Retained on board | Drop |

Table C4: The reported MHR, annual retained landings in the groomed and unmerged dataset, and retained landings in the groomed and merged dataset, estimated catch, and percentage of estimated catch in the MHR landings for PRK 1 and 2 for the 1991 to 2013 fishing years.

| Year | MHR | PRK 1 | | | | PRK 2 | | | | |
|------|-------|--------------------|-----------------|------------------|-------|-------|--------------------|-----------------|------------------|-------|
| | | Un-merged landings | Merged landings | Merged estimated | | MHR | Un-merged landings | Merged landings | Merged estimated | |
| | | | | Catch | % MHR | | | | Catch | % MHR |
| 1991 | 11.59 | 4 | 4 | 2 | 17 | 0.00 | - | - | - | - |
| 1992 | 3.34 | 3 | 3 | 3 | 90 | 0.48 | 0.48 | 0.48 | 0.3 | 63 |
| 1993 | 42.24 | 33 | 32 | 32 | 76 | 6.86 | 6.86 | 6.38 | 4.78 | 70 |
| 1994 | 10.95 | 5 | 5 | 4 | 37 | 0.03 | 0.03 | 0.03 | 0.06 | 200 |
| 1995 | 0.52 | 1 | 1 | 1 | 192 | 0.00 | - | - | - | - |
| 1996 | 1.78 | 2 | 2 | 2 | 112 | 0.00 | - | - | - | - |
| 1997 | 23.13 | 23 | 23 | 27 | 117 | 0.00 | - | - | - | - |
| 1998 | 0.00 | - | - | - | - | 0.00 | - | - | - | - |
| 1999 | 0.00 | - | - | - | - | 0.19 | 0.19 | 0.19 | 0 | 0 |
| 2000 | 0.08 | - | - | - | - | 0.00 | - | - | - | - |
| 2001 | 0.00 | - | - | - | - | 0.00 | - | - | - | - |
| 2002 | 6.05 | 6 | 6 | 4 | 66 | 0.37 | 0.37 | 0.37 | 0.24 | 65 |
| 2003 | 20.99 | 21 | 21 | 17 | 81 | 8.09 | 8.39 | 8.38 | 4.66 | 58 |
| 2004 | 24.35 | 24 | 24 | 21 | 86 | 0.57 | 0.26 | 0.26 | 0.16 | 28 |
| 2005 | 3.25 | 3 | 3 | 2 | 62 | 1.15 | 1.15 | 1.15 | 0.25 | 22 |
| 2006 | 2.25 | 2 | 2 | 2 | 89 | 0.20 | 0.22 | 0.22 | 0 | 0 |
| 2007 | 4.60 | 5 | 5 | 4 | 87 | 0.10 | 0.11 | 0.11 | 0 | 0 |
| 2008 | 5.36 | 5 | 5 | 4 | 75 | 0.92 | 0.93 | 0.93 | 0.28 | 30 |
| 2009 | 0.22 | 2 | 2 | 1 | 455 | 0.08 | 0.08 | 0.08 | 0.02 | 25 |
| 2010 | 0.75 | 3 | 3 | 4 | 533 | 0.03 | 0.08 | 0.08 | 0 | 0 |
| 2011 | 3.55 | 7 | 7 | 7 | 197 | 0.08 | 0.09 | 0.09 | 0.06 | 75 |
| 2012 | 0.42 | 2 | 2 | 3 | 714 | 0.17 | 0.18 | 0.18 | 0 | 0 |
| 2013 | 0.26 | 2 | 2 | 2 | 769 | 0.02 | 0.02 | 0.02 | 0 | 0 |

Table C4 continued: The reported MHR, annual retained landings in the groomed and unmerged dataset, and retained landings in the groomed and merged dataset, estimated catch, and percentage of estimated catch in the MHR landings for PRK 7 for the 1991 to 2013 fishing years.

| Year | PRK 7 | | | | |
|------|-------|-----------------------|--------------------|---------------------|----------|
| | MHR | Un-merged landings | Merged landings | Merged estimated | |
| | | | | Catch | % MHR |
| 1991 | 0.00 | - | - | - | - |
| 1992 | 0.00 | - | - | - | - |
| 1993 | 0.00 | 0.016 | 0.016 | 0.016 | - |
| 1994 | 0.00 | - | - | - | - |
| 1995 | 0.00 | - | - | - | - |
| 1996 | 0.00 | - | - | - | - |
| 1997 | 0.00 | - | - | - | - |
| 1998 | 0.00 | - | - | - | - |
| 1999 | 0.00 | - | - | - | - |
| 2000 | 0.00 | 0.004 | 0.004 | 0.004 | - |
| 2001 | 0.00 | - | - | - | - |
| 2002 | 0.00 | - | - | - | - |
| 2003 | 0.00 | - | - | - | - |
| 2004 | 0.00 | - | - | - | - |
| 2005 | 0.00 | - | - | - | - |
| 2006 | 0.01 | 0.014 | 0.014 | 0 | 0 |
| 2007 | 0.03 | 0.025 | 0.025 | 0 | 0 |
| 2008 | 1.20 | 1.176 | 1.176 | 0 | 0 |
| 2009 | 0.88 | 0.91 | 0.91 | 0.008 | 1 |
| 2010 | 0.48 | 0.392 | 0.392 | 0.002 | 0 |
| 2011 | 0.69 | 0.602 | 0.602 | 0.159 | 23 |
| 2012 | 0.73 | 1.393 | 1.393 | 0.075 | 10 |
| 2013 | 0.60 | 1.353 | 1.353 | 0.242 | 40 |

Table C5: Total number of trips, number of trips with zero estimated catch, and proportion of trips with zero estimated catch, for PRK 1, 2, and 7 for the 1991 to 2013 fishing years.

| Year | PRK 1 | | | PRK 2 | | | PRK 7 | | |
|------|--------------|------|------------|--------------|------|------------|--------------|------|------------|
| | No. of trips | Zero | Proportion | No. of trips | Zero | Proportion | No. of trips | Zero | Proportion |
| 1991 | 3 | 2 | 0.67 | 0 | 0 | - | 0 | 0 | - |
| 1992 | 5 | 1 | 0.20 | 4 | 2 | 0.50 | 0 | 0 | - |
| 1993 | 16 | 1 | 0.06 | 10 | 3 | 0.30 | 1 | 0 | 0.00 |
| 1994 | 3 | 0 | 0.00 | 1 | 0 | 0.00 | 0 | 0 | - |
| 1995 | 2 | 0 | 0.00 | 0 | 0 | - | 0 | 0 | - |
| 1996 | 2 | 0 | 0.00 | 0 | 0 | - | 0 | 0 | - |
| 1997 | 7 | 1 | 0.14 | 0 | 0 | - | 0 | 0 | - |
| 1998 | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| 1999 | 0 | 0 | - | 2 | 2 | 1.00 | 0 | 0 | - |
| 2000 | 1 | 1 | 1.00 | 0 | 0 | - | 1 | 0 | 0.00 |
| 2001 | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| 2002 | 22 | 11 | 0.50 | 8 | 6 | 0.75 | 0 | 0 | - |
| 2003 | 22 | 9 | 0.41 | 37 | 17 | 0.46 | 0 | 0 | - |
| 2004 | 16 | 2 | 0.13 | 3 | 2 | 0.67 | 0 | 0 | - |
| 2005 | 10 | 5 | 0.50 | 8 | 4 | 0.50 | 0 | 0 | - |
| 2006 | 7 | 2 | 0.29 | 3 | 3 | 1.00 | 1 | 1 | 1.00 |
| 2007 | 5 | 0 | 0.00 | 2 | 2 | 1.00 | 2 | 2 | 1.00 |
| 2008 | 14 | 3 | 0.21 | 10 | 8 | 0.80 | 11 | 11 | 1.00 |
| 2009 | 9 | 4 | 0.44 | 4 | 3 | 0.75 | 24 | 22 | 0.92 |
| 2010 | 12 | 2 | 0.17 | 5 | 5 | 1.00 | 32 | 31 | 0.97 |
| 2011 | 11 | 2 | 0.18 | 7 | 6 | 0.86 | 26 | 21 | 0.81 |
| 2012 | 9 | 1 | 0.11 | 3 | 2 | 0.67 | 34 | 28 | 0.82 |
| 2013 | 4 | 0 | 0.00 | 6 | 6 | 1.00 | 43 | 34 | 0.79 |

Table C6a: Proportion of total catch for each fishery area from groomed and merged data for the 1991 to 2013 fishing years.

| Fishing year | BOP | HKBV/VAIR | WCSI | Other | Total |
|--------------|------|-----------|------|-------|---------|
| 1991 | 0.89 | 0.00 | 0.00 | 0.11 | 4.316 |
| 1992 | 0.87 | 0.13 | 0.00 | 0.00 | 3.751 |
| 1993 | 0.83 | 0.17 | 0.00 | 0.00 | 38.057 |
| 1994 | 0.99 | 0.01 | 0.00 | 0.00 | 4.541 |
| 1995 | 1.00 | 0.00 | 0.00 | 0.00 | 0.518 |
| 1996 | 1.00 | 0.00 | 0.00 | 0.00 | 1.782 |
| 1997 | 1.00 | 0.00 | 0.00 | 0.00 | 23.125 |
| 1999 | 0.00 | 0.99 | 0.00 | 0.01 | 0.192 |
| 2000 | 0.59 | 0.00 | 0.17 | 0.24 | 0.024 |
| 2001 | - | - | - | - | - |
| 2002 | 0.92 | 0.06 | 0.00 | 0.02 | 6.418 |
| 2003 | 0.71 | 0.29 | 0.00 | 0.00 | 29.372 |
| 2004 | 0.98 | 0.01 | 0.00 | 0.01 | 24.082 |
| 2005 | 0.73 | 0.26 | 0.00 | 0.00 | 4.332 |
| 2006 | 0.91 | 0.09 | 0.01 | 0.00 | 2.557 |
| 2007 | 0.97 | 0.02 | 0.01 | 0.00 | 4.789 |
| 2008 | 0.71 | 0.12 | 0.15 | 0.01 | 7.504 |
| 2009 | 0.63 | 0.03 | 0.34 | 0.00 | 2.651 |
| 2010 | 0.88 | 0.02 | 0.10 | 0.00 | 3.832 |
| 2011 | 0.91 | 0.01 | 0.08 | 0.00 | 7.807 |
| 2012 | 0.54 | 0.05 | 0.40 | 0.01 | 3.440 |
| 2013 | 0.59 | 0.01 | 0.40 | 0.01 | 3.345 |
| Total | 0.85 | 0.11 | 0.03 | 0.01 | 176.437 |

Table C6b: Proportion of total catch by month for all fishery areas combined from groomed and merged data for the 1991 to 2013 fishing years.

| Fishing year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total (t) |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|
| 1991 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.80 | 0.00 | 4.316 |
| 1992 | 0.00 | 0.10 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.82 | 3.751 |
| 1993 | 0.00 | 0.00 | 0.01 | 0.06 | 0.29 | 0.16 | 0.13 | 0.00 | 0.21 | 0.02 | 0.00 | 0.13 | 38.057 |
| 1994 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.99 | 0.00 | 4.541 |
| 1995 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.518 |
| 1996 | 0.00 | 0.00 | 0.00 | 0.00 | 0.56 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.782 |
| 1997 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.29 | 0.32 | 0.23 | 0.00 | 0.11 | 0.00 | 0.00 | 23.125 |
| 1998 | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.192 |
| 1999 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.024 |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 2001 | 0.04 | 0.51 | 0.40 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.04 | 0.00 | 0.00 | 6.418 |
| 2002 | 0.01 | 0.47 | 0.36 | 0.04 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.01 | 29.372 |
| 2003 | 0.05 | 0.62 | 0.32 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 24.082 |
| 2004 | 0.00 | 0.29 | 0.08 | 0.14 | 0.15 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.30 | 4.332 |
| 2005 | 0.08 | 0.08 | 0.07 | 0.08 | 0.00 | 0.05 | 0.04 | 0.00 | 0.00 | 0.04 | 0.00 | 0.55 | 2.557 |
| 2006 | 0.00 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.17 | 0.00 | 0.04 | 0.15 | 4.789 |
| 2007 | 0.00 | 0.03 | 0.36 | 0.15 | 0.03 | 0.13 | 0.02 | 0.03 | 0.04 | 0.01 | 0.08 | 0.11 | 7.504 |
| 2008 | 0.11 | 0.30 | 0.13 | 0.01 | 0.09 | 0.03 | 0.03 | 0.00 | 0.00 | 0.01 | 0.11 | 0.18 | 2.651 |
| 2009 | 0.01 | 0.00 | 0.05 | 0.19 | 0.02 | 0.18 | 0.00 | 0.45 | 0.02 | 0.01 | 0.02 | 0.05 | 3.832 |
| 2010 | 0.25 | 0.37 | 0.19 | 0.02 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 7.807 |
| 2011 | 0.07 | 0.12 | 0.27 | 0.05 | 0.13 | 0.02 | 0.06 | 0.00 | 0.01 | 0.00 | 0.04 | 0.24 | 3.440 |
| 2012 | 0.56 | 0.02 | 0.24 | 0.00 | 0.06 | 0.00 | 0.01 | 0.04 | 0.01 | 0.00 | 0.00 | 0.04 | 3.345 |
| 2013 | 0.04 | 0.23 | 0.16 | 0.04 | 0.08 | 0.10 | 0.08 | 0.04 | 0.05 | 0.03 | 0.06 | 0.08 | 176.437 |

Table C6c: Proportion of total catch by method for all fishery areas combined from groomed and merged data for the 1991 to 2013 fishing years. BT; bottom trawl, MB; midwater trawl on the bottom (within 5 m of the sea bed), MW; midwater trawl.

| Fishing year | BT | MB | MW | Total |
|--------------|------|-------|-------|---------|
| 1991 | 1 | 0 | 0 | 4.316 |
| 1992 | 1 | 0 | 0 | 3.751 |
| 1993 | 1 | 0 | 0 | 38.057 |
| 1994 | 1 | 0 | 0 | 4.541 |
| 1995 | 1 | 0 | 0 | 0.518 |
| 1996 | 1 | 0 | 0 | 1.782 |
| 1997 | 1 | 0 | 0 | 23.125 |
| 1999 | 1 | 0 | 0 | 0.192 |
| 2000 | 1 | 0 | 0 | 0.024 |
| 2001 | - | - | - | - |
| 2002 | 1 | 0 | 0 | 6.418 |
| 2003 | 1 | 0 | 0 | 29.372 |
| 2004 | 1 | 0 | 0 | 24.082 |
| 2005 | 1 | 0 | 0 | 4.332 |
| 2006 | 1 | 0 | 0 | 2.557 |
| 2007 | 1 | 0 | 0 | 4.790 |
| 2008 | 1 | 0 | 0 | 7.504 |
| 2009 | 0.92 | 0.08 | 0 | 2.651 |
| 2010 | 0.99 | 0.01 | 0 | 3.832 |
| 2011 | 1 | 0 | 0 | 7.807 |
| 2012 | 1 | 0 | 0 | 3.440 |
| 2013 | 0.99 | 0 | 0 | 3.345 |
| Total | 1 | <0.01 | <0.01 | 176.437 |

Table C6d: Proportion of total catch by target species for all fishery areas combined from groomed and merged data for the 1991 to 2013 fishing years.

| Year | SCI | Other | Total |
|-------|------|-------|---------|
| 1991 | 1 | 0 | 4.316 |
| 1992 | 1 | 0 | 3.751 |
| 1993 | 1 | 0 | 38.057 |
| 1994 | 1 | 0 | 4.541 |
| 1995 | 1 | 0 | 0.518 |
| 1996 | 1 | 0 | 1.782 |
| 1997 | 1 | 0 | 23.125 |
| 1999 | 1 | 0 | 0.192 |
| 2000 | 0.83 | 0.17 | 0.024 |
| 2001 | - | - | - |
| 2002 | 1 | 0 | 6.418 |
| 2003 | 1 | 0 | 29.372 |
| 2004 | 1 | 0 | 24.082 |
| 2005 | 1 | 0 | 4.332 |
| 2006 | 0.99 | 0.01 | 2.557 |
| 2007 | 0.99 | 0.01 | 4.789 |
| 2008 | 0.84 | 0.16 | 7.504 |
| 2009 | 0.66 | 0.34 | 2.651 |
| 2010 | 0.9 | 0.1 | 3.832 |
| 2011 | 0.92 | 0.08 | 7.807 |
| 2012 | 0.62 | 0.38 | 3.440 |
| 2013 | 0.61 | 0.39 | 3.345 |
| Total | 0.97 | 0.03 | 176.437 |

Table C6e: Proportion of total catch by flag nationality from groomed and merged data for the 1991 to 2013 fishing years for all fishery areas.

| Fishing year | NZ | Unknown | Korea | Total |
|--------------|------|---------|-------|---------|
| 1991 | 1.00 | 0.00 | 0.00 | 4.316 |
| 1992 | 0.26 | 0.74 | 0.00 | 3.751 |
| 1993 | 0.88 | 0.12 | 0.00 | 38.057 |
| 1994 | 0.00 | 1.00 | 0.00 | 4.541 |
| 1995 | 0.00 | 1.00 | 0.00 | 0.518 |
| 1996 | 1.00 | 0.00 | 0.00 | 1.782 |
| 1997 | 1.00 | 0.00 | 0.00 | 23.125 |
| 1999 | 0.37 | 0.62 | 0.00 | 0.192 |
| 2000 | 0.83 | 0.17 | 0.00 | 0.024 |
| 2001 | - | - | - | - |
| 2002 | 0.53 | 0.47 | 0.00 | 6.418 |
| 2003 | 0.40 | 0.60 | 0.00 | 29.372 |
| 2004 | 0.43 | 0.57 | 0.00 | 24.082 |
| 2005 | 0.72 | 0.28 | 0.00 | 4.332 |
| 2006 | 0.41 | 0.59 | 0.00 | 2.557 |
| 2007 | 0.43 | 0.56 | 0.01 | 4.790 |
| 2008 | 0.69 | 0.16 | 0.14 | 7.504 |
| 2009 | 0.60 | 0.11 | 0.29 | 2.651 |
| 2010 | 0.32 | 0.65 | 0.03 | 3.832 |
| 2011 | 0.69 | 0.29 | 0.02 | 7.807 |
| 2012 | 0.42 | 0.48 | 0.10 | 3.440 |
| 2013 | 0.68 | 0.06 | 0.26 | 3.345 |
| Total | 0.64 | 0.34 | 0.02 | 176.437 |

Table C7a: Proportion of prawn killer catch reported by month from the Bay of Plenty fishery area for the 1991 to 2013 fishing years.

| Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|---------|
| 1991 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.90 | 0.00 | 3.829 |
| 1992 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.95 | 3.256 |
| 1993 | 0.00 | 0.00 | 0.01 | 0.06 | 0.22 | 0.14 | 0.15 | 0.00 | 0.25 | 0.01 | 0.00 | 0.16 | 31.654 |
| 1994 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.99 | 0.00 | 4.511 |
| 1995 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.518 |
| 1996 | 0.00 | 0.00 | 0.00 | 0.00 | 0.56 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.782 |
| 1997 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.29 | 0.32 | 0.23 | 0.00 | 0.11 | 0.00 | 0.00 | 23.125 |
| 1999 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.014 |
| 2002 | 0.04 | 0.55 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.921 |
| 2003 | 0.01 | 0.66 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.987 |
| 2004 | 0.04 | 0.63 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23.599 |
| 2005 | 0.00 | 0.39 | 0.11 | 0.09 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.36 | 3.183 |
| 2006 | 0.09 | 0.09 | 0.03 | 0.09 | 0.00 | 0.06 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 2.325 |
| 2007 | 0.00 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.17 | 0.00 | 0.04 | 0.15 | 4.650 |
| 2008 | 0.00 | 0.00 | 0.51 | 0.14 | 0.04 | 0.18 | 0.03 | 0.05 | 0.00 | 0.01 | 0.00 | 0.04 | 5.364 |
| 2009 | 0.09 | 0.48 | 0.21 | 0.00 | 0.09 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 1.658 |
| 2010 | 0.00 | 0.00 | 0.04 | 0.21 | 0.01 | 0.19 | 0.00 | 0.51 | 0.01 | 0.00 | 0.01 | 0.01 | 3.358 |
| 2011 | 0.27 | 0.39 | 0.21 | 0.00 | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.03 | 7.105 |
| 2012 | 0.00 | 0.10 | 0.46 | 0.08 | 0.22 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 1.863 |
| 2013 | 0.56 | 0.00 | 0.36 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.961 |
| Total | 0.03 | 0.27 | 0.16 | 0.03 | 0.06 | 0.09 | 0.09 | 0.05 | 0.06 | 0.02 | 0.06 | 0.08 | 150.663 |

Table C7b: Proportion of prawn killer catch reported for each statistical area from the Bay of Plenty fishery area for 1991 to 2013 fishing years for all methods.

| Year | 004 | 008 | 009 | Other | Total |
|-------|------|------|------|-------|--------|
| 1991 | 0.88 | 0.01 | 0.00 | 0.11 | 4.316 |
| 1992 | 0.99 | 0.00 | 0.01 | 0.00 | 3.269 |
| 1993 | 0.03 | 0.38 | 0.59 | 0.00 | 31.66 |
| 1994 | 0.07 | 0.46 | 0.47 | 0.00 | 4.511 |
| 1995 | 0.00 | 1.00 | 0.00 | 0.00 | 0.518 |
| 1996 | 0.00 | 1.00 | 0.00 | 0.00 | 1.782 |
| 1997 | 0.00 | 0.84 | 0.16 | 0.00 | 23.125 |
| 1999 | - | - | - | - | - |
| 2000 | 0.44 | 0.27 | 0.00 | 0.29 | 0.02 |
| 2002 | 0.21 | 0.39 | 0.38 | 0.02 | 6.051 |
| 2003 | 0.00 | 0.58 | 0.42 | 0.00 | 20.987 |
| 2004 | 0.04 | 0.61 | 0.34 | 0.01 | 23.802 |
| 2005 | 0.00 | 0.84 | 0.16 | 0.00 | 3.184 |
| 2006 | 0.00 | 0.76 | 0.24 | 0.00 | 2.325 |
| 2007 | 0.03 | 0.95 | 0.03 | 0.00 | 4.65 |
| 2008 | 0.01 | 0.70 | 0.29 | 0.00 | 5.364 |
| 2009 | 0.00 | 0.89 | 0.11 | 0.00 | 1.658 |
| 2010 | 0.65 | 0.30 | 0.05 | 0.00 | 3.358 |
| 2011 | 0.46 | 0.33 | 0.20 | 0.00 | 7.105 |
| 2012 | 0.12 | 0.59 | 0.29 | 0.00 | 1.863 |
| 2013 | 0.68 | 0.19 | 0.13 | 0.00 | 1.961 |
| Total | 0.12 | 0.55 | 0.32 | 0.01 | 151.51 |

Table C7c: Proportion of prawn killer catch reported by gear type from the Bay of Plenty fishery area for the 1991 to 2013 fishing years.

| Year | BT | Total |
|-------|----|---------|
| 1991 | 1 | 3.829 |
| 1992 | 1 | 3.256 |
| 1993 | 1 | 31.654 |
| 1994 | 1 | 4.511 |
| 1995 | 1 | 0.518 |
| 1996 | 1 | 1.782 |
| 1997 | 1 | 23.125 |
| 1999 | 1 | 0.000 |
| 2000 | 1 | 0.014 |
| 2002 | 1 | 5.921 |
| 2003 | 1 | 20.987 |
| 2004 | 1 | 23.599 |
| 2005 | 1 | 3.183 |
| 2006 | 1 | 2.325 |
| 2007 | 1 | 4.650 |
| 2008 | 1 | 5.364 |
| 2009 | 1 | 1.658 |
| 2010 | 1 | 3.358 |
| 2011 | 1 | 7.105 |
| 2012 | 1 | 1.863 |
| 2013 | 1 | 1.961 |
| Total | 1 | 150.663 |

Table C7d: Proportion of prawn killer catch reported by target species from the Bay of Plenty fishery area for the 1991 to 2013 fishing years for all fishing methods.

| Year | SCI | Other | Total |
|-------|-----|-------|---------|
| 1991 | 1 | <0.01 | 3.829 |
| 1992 | 1 | <0.01 | 3.256 |
| 1993 | 1 | <0.01 | 31.654 |
| 1994 | 1 | <0.01 | 4.511 |
| 1995 | 1 | <0.01 | 0.518 |
| 1996 | 1 | <0.01 | 1.782 |
| 1997 | 1 | <0.01 | 23.125 |
| 1999 | - | - | - |
| 2000 | 1 | <0.01 | 0.014 |
| 2002 | 1 | <0.01 | 5.921 |
| 2003 | 1 | <0.01 | 20.987 |
| 2004 | 1 | <0.01 | 23.599 |
| 2005 | 1 | <0.01 | 3.183 |
| 2006 | 1 | <0.01 | 2.325 |
| 2007 | 1 | <0.01 | 4.650 |
| 2008 | 1 | <0.01 | 5.364 |
| 2009 | 1 | <0.01 | 1.658 |
| 2010 | 1 | <0.01 | 3.358 |
| 2011 | 1 | <0.01 | 7.105 |
| 2012 | 1 | <0.01 | 1.863 |
| 2013 | 1 | <0.01 | 1.961 |
| Total | 1 | <0.01 | 150.663 |

Table C8a: Proportion of prawn killer catch reported by month from the Hawke Bay/Wairarapa fishery area for the 1991 to 2013 fishing years.

| Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| 1991 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 1992 | 0.00 | 0.70 | 0.02 | 0.00 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.482 |
| 1993 | 0.00 | 0.00 | 0.00 | 0.04 | 0.62 | 0.27 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 6.327 |
| 1994 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.030 |
| 1995 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 1996 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 1997 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 1998 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 1999 | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 | 0.63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.191 |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 2001 | - | - | - | - | - | - | - | - | - | - | - | - | 0.000 |
| 2002 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.10 | 0.00 | 0.21 | 0.65 | 0.00 | 0.00 | 0.367 |
| 2003 | 0.00 | 0.00 | 0.46 | 0.14 | 0.02 | 0.15 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.04 | 8.374 |
| 2004 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.77 | 0.00 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.260 |
| 2005 | 0.00 | 0.00 | 0.00 | 0.30 | 0.48 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.12 | 1.141 |
| 2006 | 0.00 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.43 | 0.00 | 0.00 | 0.218 |
| 2007 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.114 |
| 2008 | 0.00 | 0.24 | 0.02 | 0.40 | 0.01 | 0.00 | 0.00 | 0.00 | 0.33 | 0.01 | 0.00 | 0.00 | 0.930 |
| 2009 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | 0.08 | 0.07 | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.084 |
| 2010 | 0.00 | 0.06 | 0.74 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.081 |
| 2011 | 0.00 | 0.51 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 | 0.17 | 0.03 | 0.00 | 0.00 | 0.13 | 0.089 |
| 2012 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.174 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.26 | 0.19 | 0.00 | 0.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.018 |
| Total | 0.00 | 0.05 | 0.21 | 0.12 | 0.26 | 0.18 | 0.00 | 0.00 | 0.02 | 0.13 | 0.00 | 0.02 | 18.878 |

Table C8b: Proportion of prawn killer catch reported for each statistical area from the Hawke Bay/Wairarapa fishery area for 1991 to 2013 fishing years for all methods.

| Year | 014 | 015 | Total |
|-------|------|------|--------|
| 1991 | - | - | 0.000 |
| 1992 | 0.99 | 0.01 | 0.482 |
| 1993 | 1.00 | 0.00 | 6.327 |
| 1994 | 1.00 | 0.00 | 0.030 |
| 1995 | - | - | 0.000 |
| 1996 | - | - | 0.000 |
| 1997 | - | - | 0.000 |
| 1998 | - | - | 0.000 |
| 1999 | 0.87 | 0.13 | 0.191 |
| 2000 | - | - | 0.000 |
| 2001 | - | - | 0.000 |
| 2002 | 1.00 | 0.00 | 0.367 |
| 2003 | 0.99 | 0.01 | 8.374 |
| 2004 | 1.00 | 0.00 | 0.260 |
| 2005 | 0.97 | 0.03 | 1.141 |
| 2006 | 0.96 | 0.04 | 0.218 |
| 2007 | 0.55 | 0.45 | 0.114 |
| 2008 | 0.91 | 0.09 | 0.930 |
| 2009 | 0.98 | 0.02 | 0.084 |
| 2010 | 0.89 | 0.11 | 0.081 |
| 2011 | 0.67 | 0.33 | 0.089 |
| 2012 | 0.86 | 0.14 | 0.174 |
| 2013 | 0.74 | 0.26 | 0.018 |
| Total | 0.98 | 0.02 | 18.878 |

Table C8c: Proportion of prawn killer catch reported by gear type from the Hawke Bay/Wairarapa fishery area for the 1991 to 2013 fishing years.

| Year | BT | Total |
|-------|----|-------|
| 1991 | 1 | - |
| 1992 | 1 | 0.482 |
| 1993 | 1 | 6.327 |
| 1994 | 1 | 0.030 |
| 1995 | 1 | - |
| 1996 | 1 | - |
| 1997 | 1 | - |
| 1998 | 1 | - |
| 1999 | 1 | 0.191 |
| 2000 | 1 | - |
| 2001 | 1 | - |
| 2002 | 1 | 0.367 |
| 2003 | 1 | 8.374 |
| 2004 | 1 | 0.260 |
| 2005 | 1 | 1.141 |
| 2006 | 1 | 0.218 |
| 2007 | 1 | 0.114 |
| 2008 | 1 | 0.930 |
| 2009 | 1 | 0.084 |
| 2010 | 1 | 0.081 |
| 2011 | 1 | 0.089 |
| 2012 | 1 | 0.174 |
| 2013 | 1 | 0.018 |
| Total | 1 | 18.88 |

Table C8d: Proportion of prawn killer catch reported by target species from the Hawke Bay/Wairarapa fishery area for the 1991 to 2013 fishing years for all fishing methods.

| Year | SCI | Other | Total |
|-------|------|-------|--------|
| 1991 | - | - | 0.000 |
| 1992 | 1.00 | 0.00 | 0.482 |
| 1993 | 1.00 | 0.00 | 6.327 |
| 1994 | 1.00 | 0.00 | 0.030 |
| 1995 | - | - | 0.000 |
| 1996 | - | - | 0.000 |
| 1997 | - | - | 0.000 |
| 1998 | - | - | 0.000 |
| 1999 | 1.00 | 0.00 | 0.191 |
| 2000 | - | - | 0.000 |
| 2001 | - | - | 0.000 |
| 2002 | 1.00 | 0.00 | 0.367 |
| 2003 | 1.00 | 0.00 | 8.374 |
| 2004 | 1.00 | 0.00 | 0.260 |
| 2005 | 1.00 | 0.00 | 1.141 |
| 2006 | 1.00 | 0.00 | 0.218 |
| 2007 | 0.96 | 0.04 | 0.114 |
| 2008 | 0.99 | 0.01 | 0.930 |
| 2009 | 1.00 | 0.00 | 0.084 |
| 2010 | 1.00 | 0.00 | 0.081 |
| 2011 | 0.80 | 0.20 | 0.089 |
| 2012 | 1.00 | 0.00 | 0.174 |
| 2013 | 0.26 | 0.74 | 0.018 |
| Total | 1.00 | <0.01 | 18.878 |

Table C9a: Proportion of prawn killer catch reported by month from the west coast South Island fishery area for the 2006 to 2013 fishing years.

| Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 2006 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.014 |
| 2007 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.48 | 0.52 | 0.024 |
| 2008 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.53 | 0.45 | 1.114 |
| 2009 | 0.14 | 0.00 | 0.00 | 0.03 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.25 | 0.52 | 0.908 |
| 2010 | 0.10 | 0.00 | 0.03 | 0.00 | 0.08 | 0.05 | 0.01 | 0.02 | 0.09 | 0.06 | 0.11 | 0.45 | 0.378 |
| 2011 | 0.08 | 0.08 | 0.00 | 0.31 | 0.00 | 0.15 | 0.00 | 0.00 | 0.01 | 0.01 | 0.13 | 0.22 | 0.588 |
| 2012 | 0.17 | 0.02 | 0.04 | 0.01 | 0.03 | 0.04 | 0.03 | 0.00 | 0.01 | 0.01 | 0.10 | 0.55 | 1.367 |
| 2013 | 0.59 | 0.05 | 0.06 | 0.00 | 0.03 | 0.00 | 0.01 | 0.10 | 0.03 | 0.01 | 0.00 | 0.10 | 1.322 |
| Total | 0.21 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.01 | 0.02 | 0.02 | 0.01 | 0.19 | 0.38 | 5.714 |

Table C9b: Proportion of prawn killer catch reported for each statistical area from the west coast South Island fishery area for 2006 to 2013 fishing years for all methods.

| Year | 034 | 035 | 036 | Total |
|-------|------|------|------|-------|
| 2006 | 0.89 | 0.09 | 0.02 | 0.014 |
| 2007 | 0.08 | 0.90 | 0.02 | 0.024 |
| 2008 | 0.42 | 0.57 | 0.01 | 1.114 |
| 2009 | 0.57 | 0.42 | 0.02 | 0.908 |
| 2010 | 0.43 | 0.32 | 0.25 | 0.378 |
| 2011 | 0.22 | 0.44 | 0.33 | 0.588 |
| 2012 | 0.50 | 0.34 | 0.16 | 1.367 |
| 2013 | 0.55 | 0.29 | 0.16 | 1.322 |
| Total | 0.47 | 0.40 | 0.13 | 5.714 |

Table C9c: Proportion of prawn killer catch reported by gear type from the west coast South Island fishery area for the 2006 to 2013 fishing years.

| Year | BT | MB | MW | Total |
|-------|------|------|------|-------|
| 2006 | 0.61 | 0.09 | 0.30 | 0.014 |
| 2007 | 0.78 | 0.09 | 0.13 | 0.024 |
| 2008 | 1.00 | 0.00 | 0.00 | 1.114 |
| 2009 | 0.78 | 0.22 | 0.00 | 0.908 |
| 2010 | 0.89 | 0.10 | 0.01 | 0.378 |
| 2011 | 0.95 | 0.03 | 0.02 | 0.588 |
| 2012 | 0.99 | 0.01 | 0.00 | 1.367 |
| 2013 | 0.99 | 0.01 | 0.00 | 1.322 |
| Total | 0.94 | 0.05 | 0.01 | 5.714 |

Table C9d: Proportion of prawn killer catch reported by target species from the west coast South Island fishery area for the 2006 to 2013 fishing years for all fishing methods.

| Year | HAK | TAR | BAR | SWA | HOK | SCI | Other | Total |
|-------|------|------|------|------|------|------|-------|-------|
| 2006 | 0.15 | 0.00 | 0.00 | 0.06 | 0.77 | 0.00 | 0.02 | 0.014 |
| 2007 | 0.00 | 0.00 | 0.00 | 0.23 | 0.36 | 0.00 | 0.41 | 0.024 |
| 2008 | 0.58 | 0.02 | 0.11 | 0.23 | 0.06 | 0.00 | 0.00 | 1.114 |
| 2009 | 0.54 | 0.08 | 0.19 | 0.11 | 0.08 | 0.00 | 0.01 | 0.908 |
| 2010 | 0.20 | 0.33 | 0.07 | 0.09 | 0.14 | 0.00 | 0.16 | 0.378 |
| 2011 | 0.15 | 0.70 | 0.02 | 0.01 | 0.10 | 0.00 | 0.02 | 0.588 |
| 2012 | 0.38 | 0.21 | 0.24 | 0.00 | 0.08 | 0.07 | 0.01 | 1.367 |
| 2013 | 0.51 | 0.25 | 0.12 | 0.00 | 0.02 | 0.05 | 0.05 | 1.322 |
| Total | 0.44 | 0.22 | 0.14 | 0.07 | 0.07 | 0.03 | 0.03 | 5.714 |

Table C11: Species codes used in the report.

| Code | Common name | Scientific name |
|------|----------------|----------------------------------|
| BAR | Barracouta | <i>Thyrsites atun</i> |
| HAK | Hake | <i>Merluccius australis</i> |
| HOK | Hoki | <i>Macruronus novaezelandiae</i> |
| PRK | Prawn killer | <i>Ibacus alticrenatus</i> |
| SCI | Scampi | <i>Metanephrops challengeri</i> |
| SWA | Silver warehou | <i>Seriolella punctata</i> |
| TAR | Tarakihi | <i>Nemadactylus macropterus</i> |

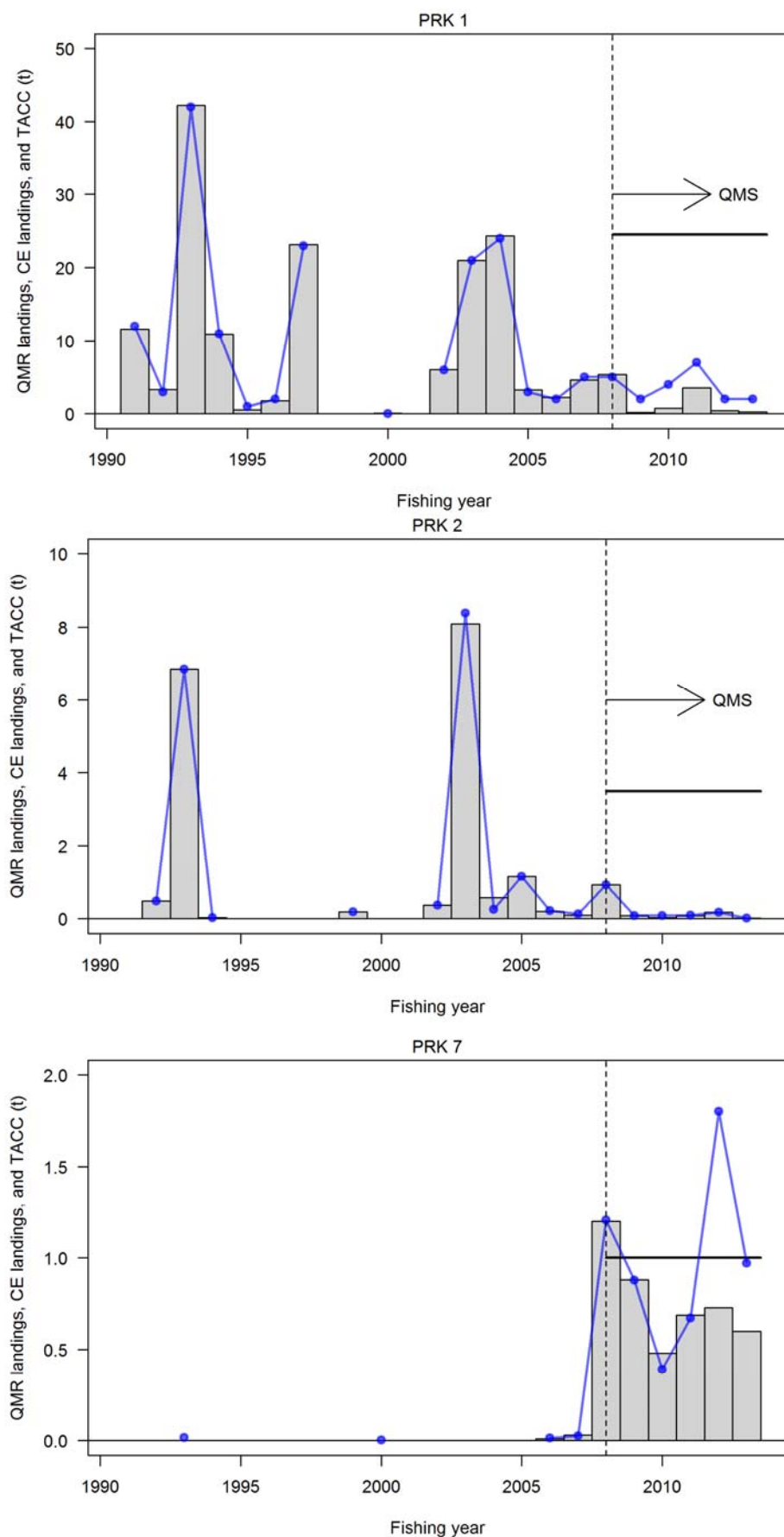


Figure C1: The QMR/MHR landings (gray bars), un-groomed catch effort landings (blue line), and TACC (black line) for PRK 1, 2 and 7.

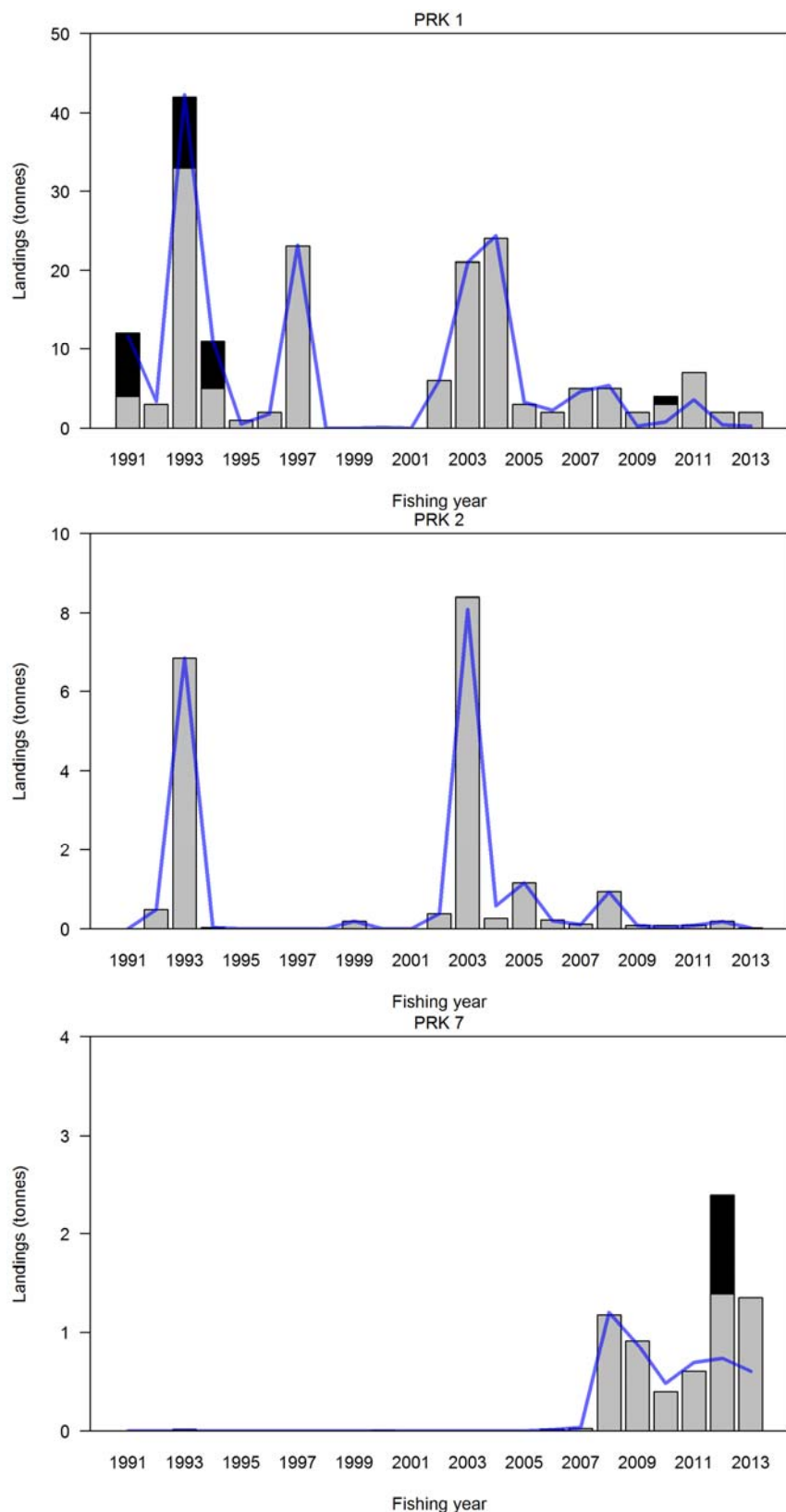


Figure C2: The retained landings (grey bars), interim landings (white bars), and landings dropped during data grooming (black bars), and MHR landings (blue line) for PRK 1, 2 and 7 from the 1991 to 2013 fishing year.

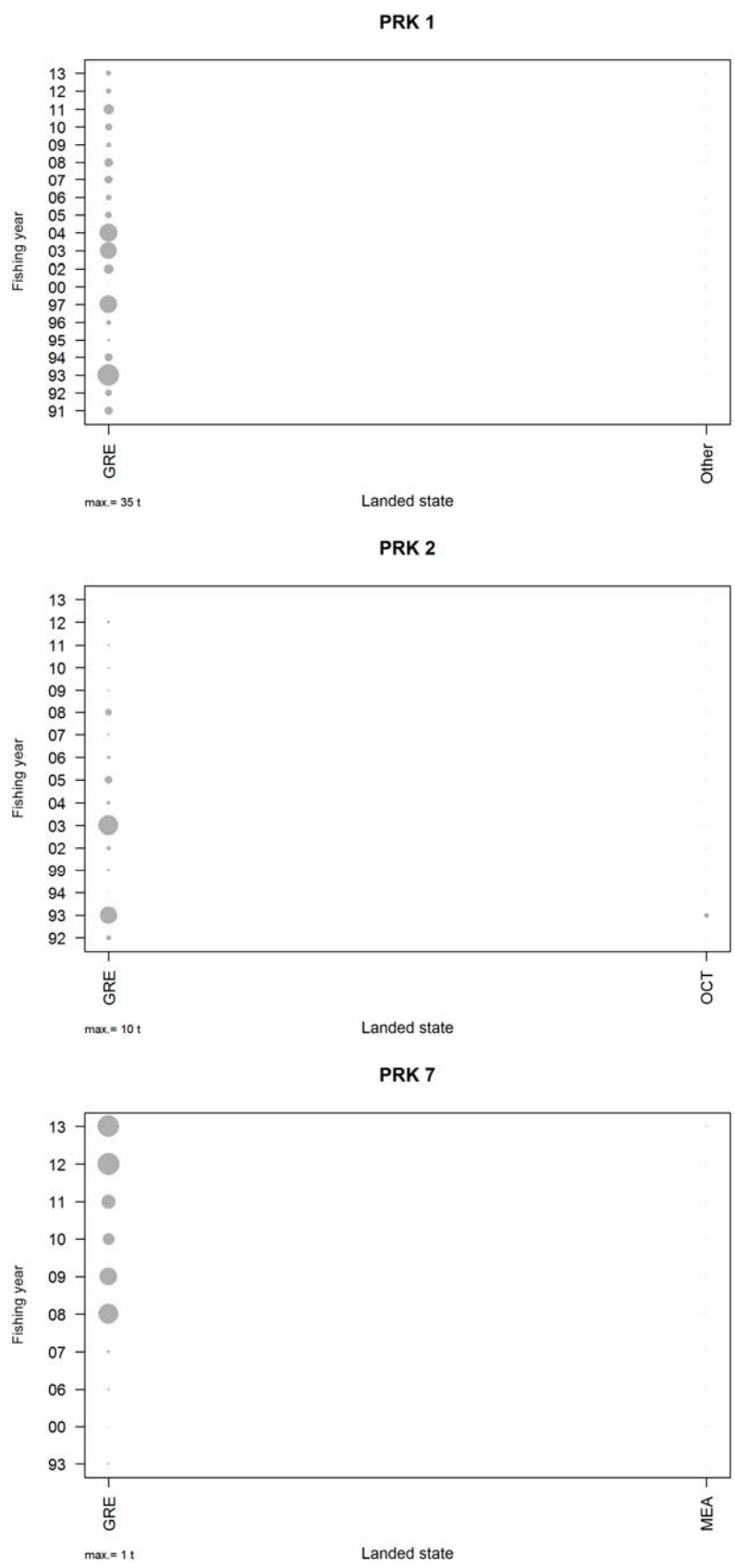


Figure C3: Retained landings (greenweight in tonnes) by processed state for PRK 1, 2 and 7 for the 1991 to 2013 fishing years in the groomed and unmerged dataset. GRE, green; OCT, other crustacea tails; MEA, fish meal.

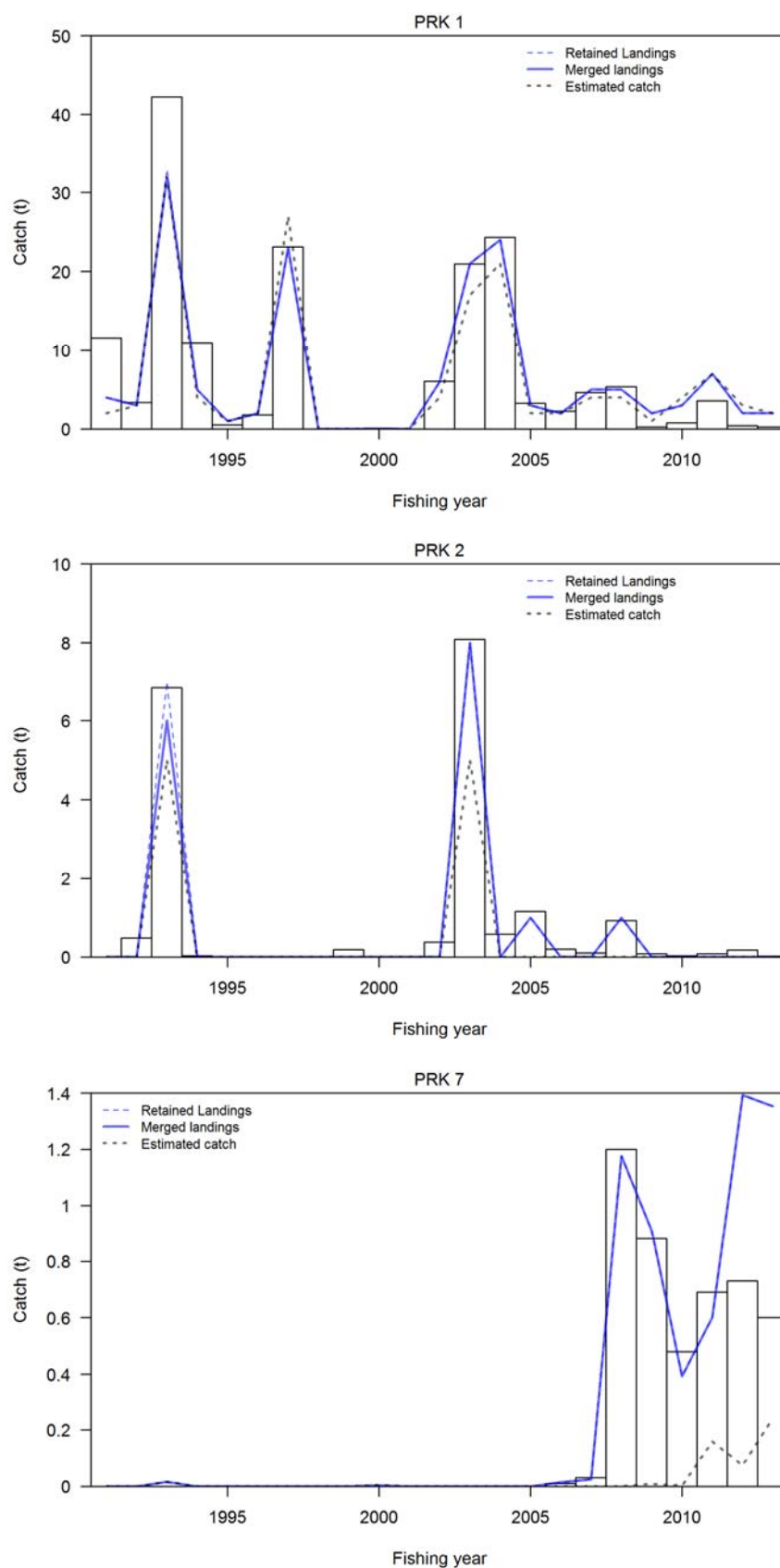


Figure C4: The QMR/MHR landings (white bars), retained landings in the groomed and unmerged dataset (blue dashed line), retained landings in groomed and merged dataset (blue solid line), and estimated catch (dashed grey line), using the centroid method, for PRK1, 2, and 7 for the 1991–2013 fishing years.

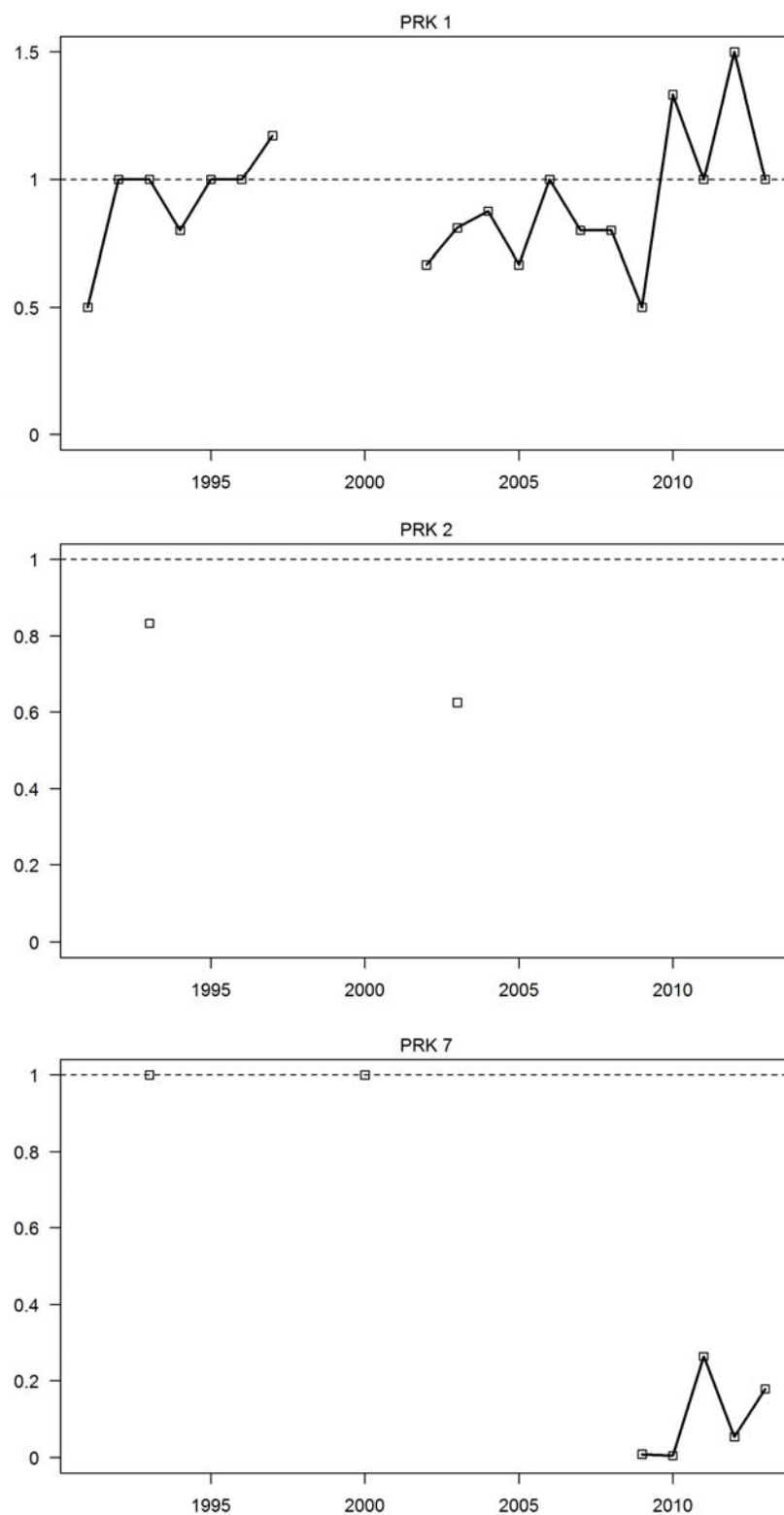


Figure C5: The reporting rate, defined as the ratio of greenweight from estimated catches to retained landings in the groomed and merged dataset, for PRK 1, 2 and 7 for the 1991–2013 fishing years.

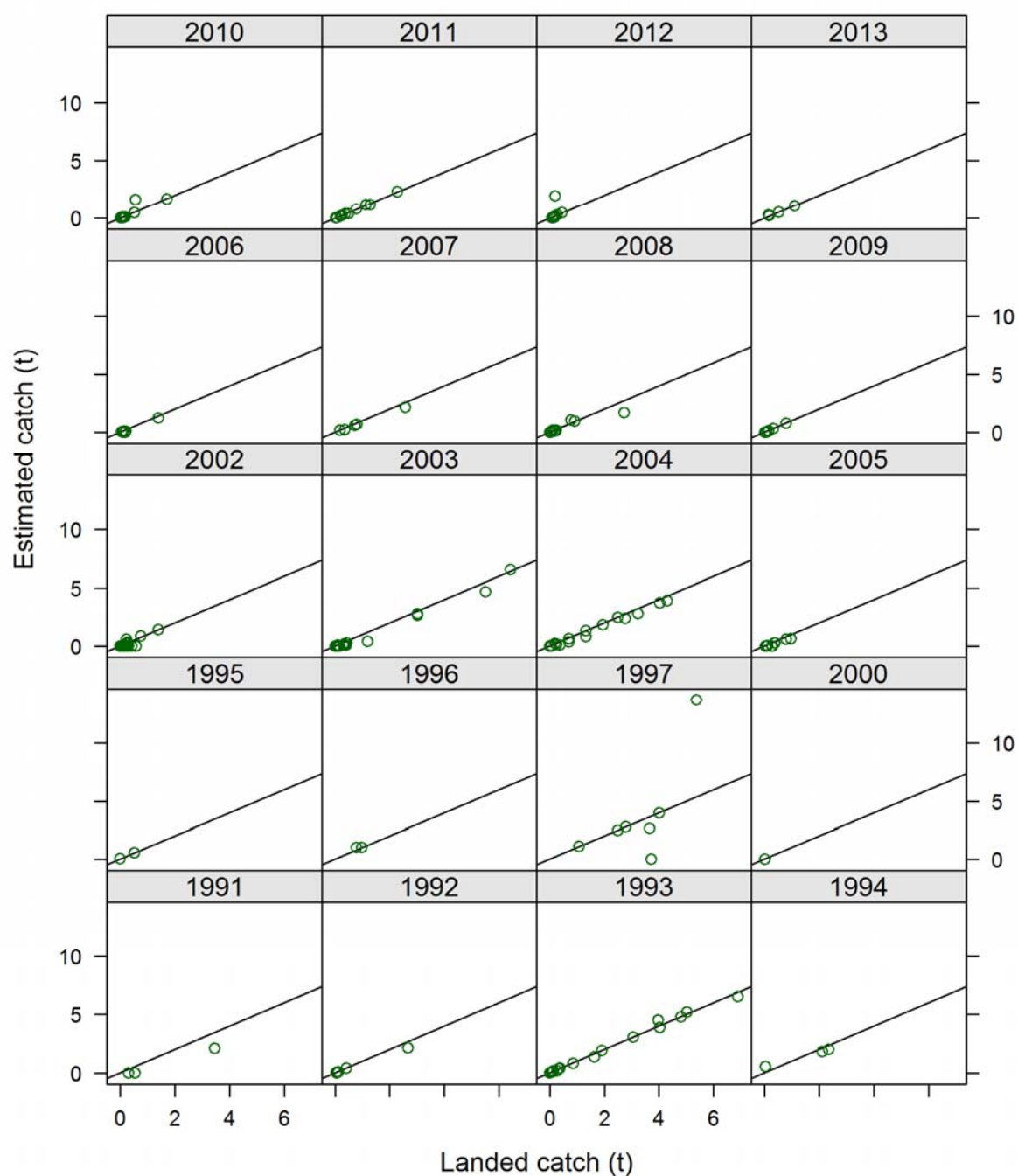


Figure C6a: Estimated catch vs. reported landings on a trip basis in the groomed and merged dataset, for PRK 1 for the 1991–2013 fishing years.

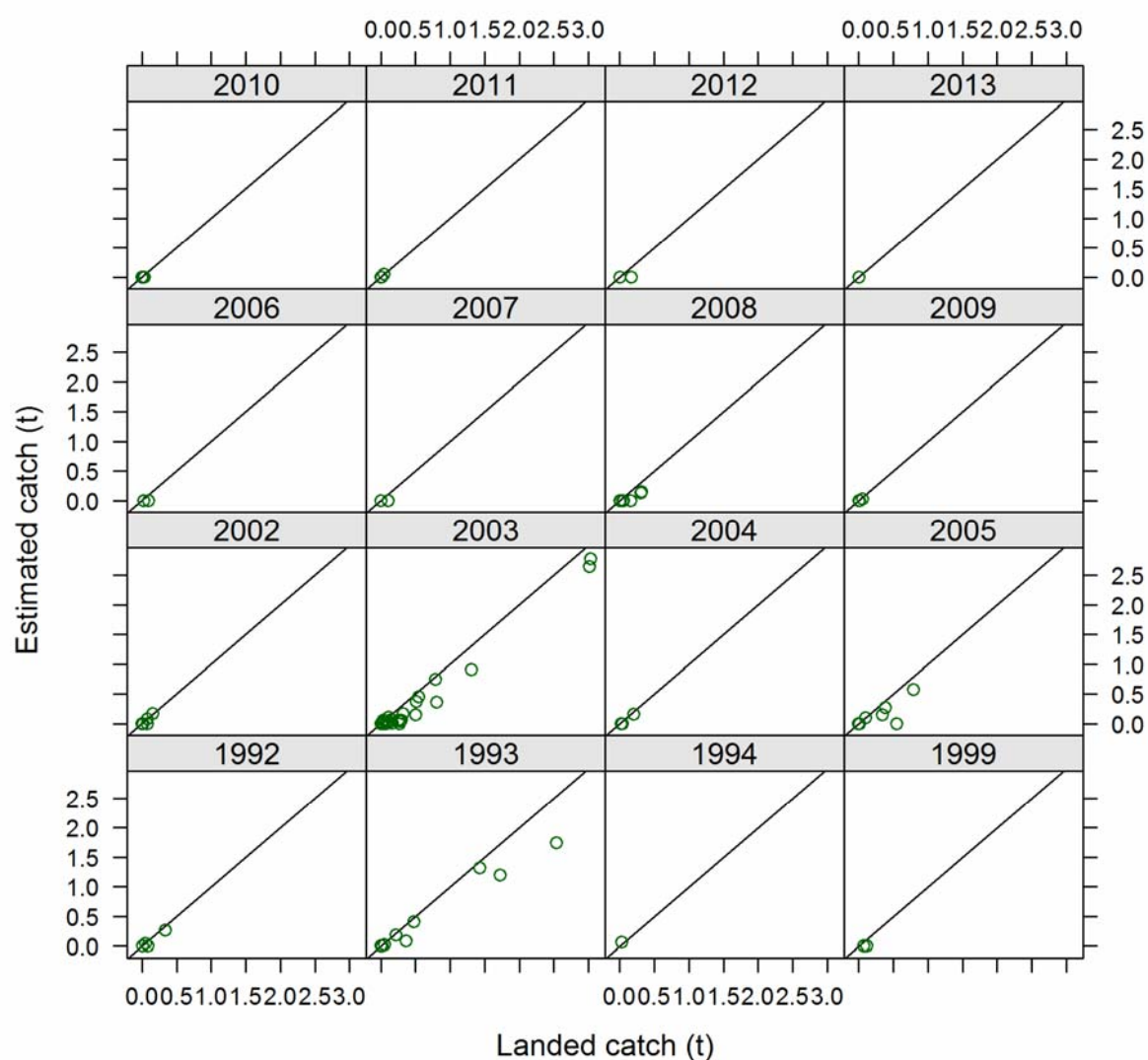


Figure C6b: Estimated catch vs. reported landings on a trip basis in the groomed and merged dataset, for PRK 2 for the 1992–2013 fishing years.

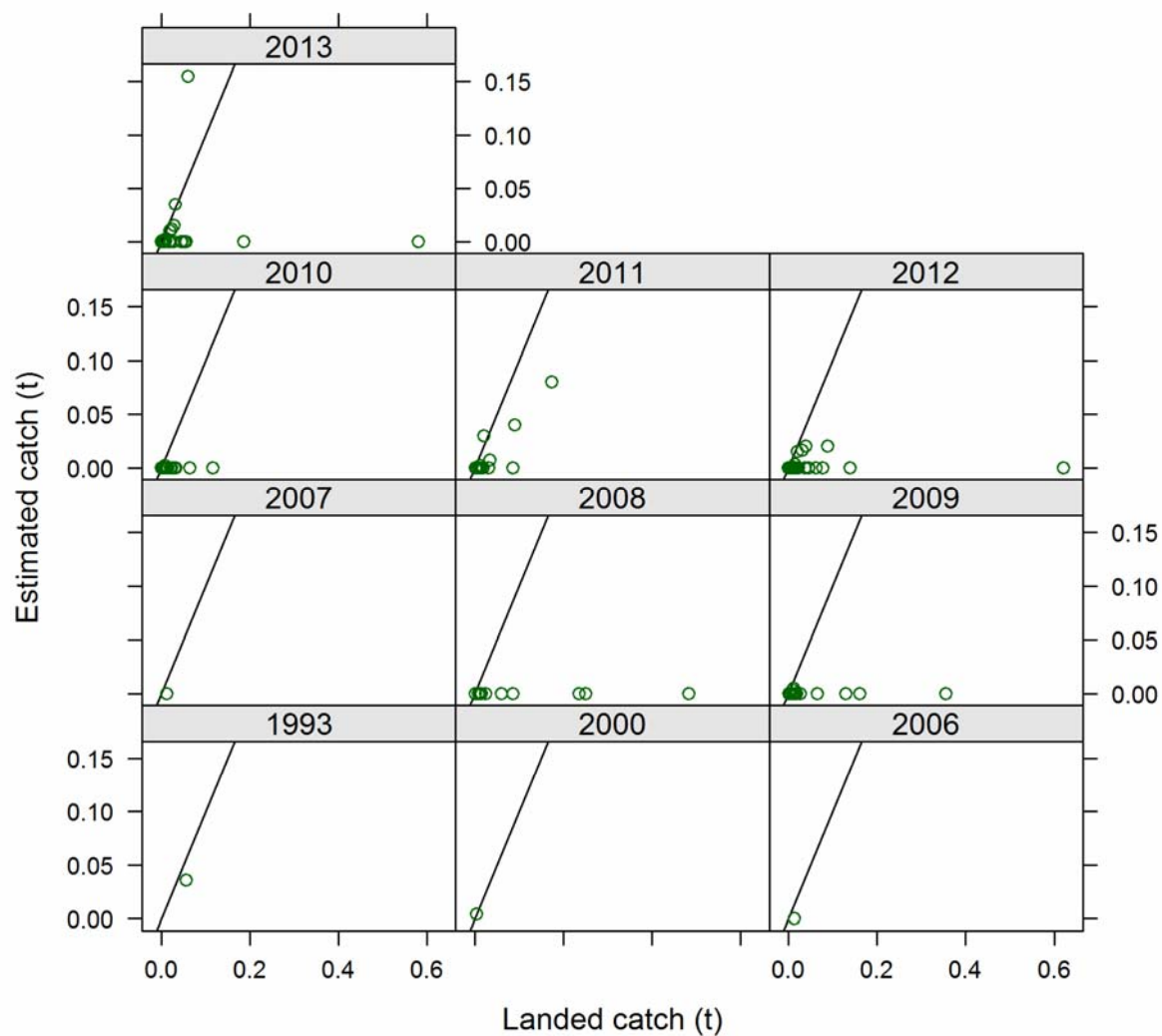


Figure C6c: Estimated catch vs. reported landings on a trip basis in the groomed and merged dataset, for PRK 7 for the 1993, 2000, and 2006–2013 fishing years.

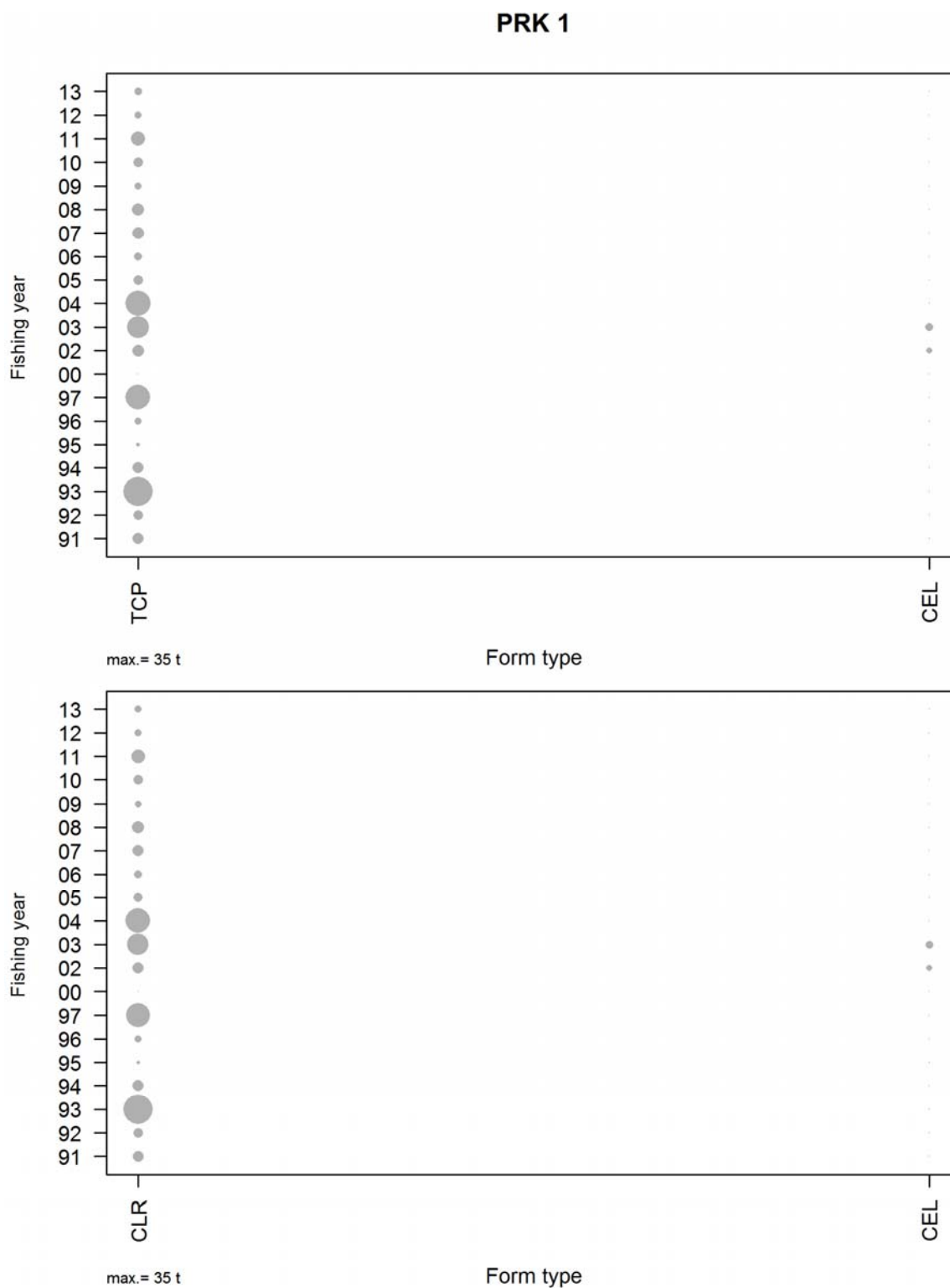


Figure C7a: Proportion of estimated catch by form type in the groomed and unmerged dataset, and proportion of landed catch by form type in the groomed and merged dataset, for PRK 1 for the 1991–2013 fishing years where TCP is Trawl Catch Effort Processing Return; CEL is Catch, Effort, Landing Return; CLR is Catch Landing Return.

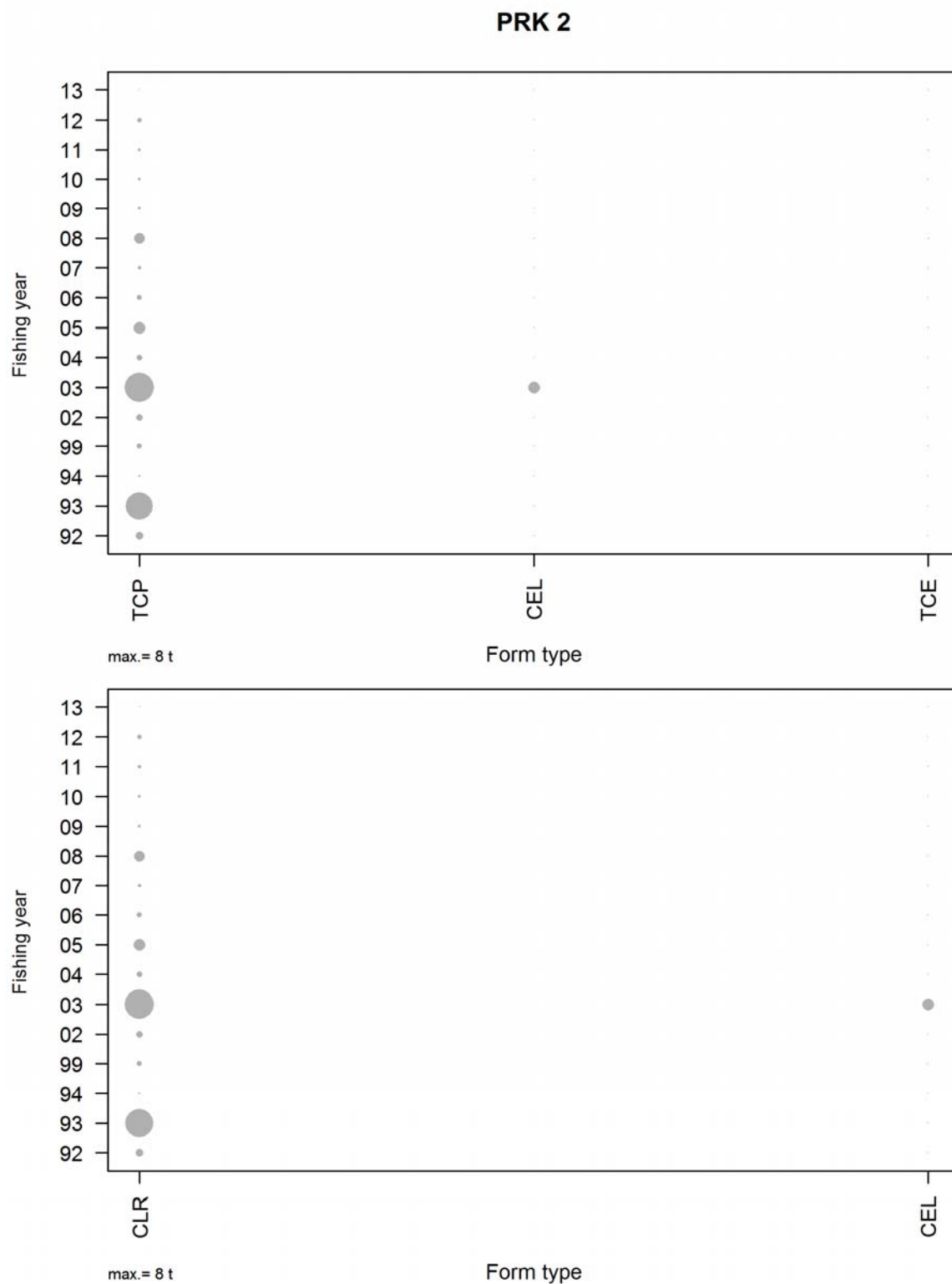


Figure C7b: Proportion of estimated catch by form type in the groomed and unmerged dataset, and proportion of landed catch by form type in the groomed and merged dataset, for PRK 2 for the 1992–2013 fishing years. where TCP is Trawl Catch Effort Processing Return; TCE is Trawl Catch Effort Return; CEL is Catch, Effort, Landing Return; CLR is Catch Landing Return.

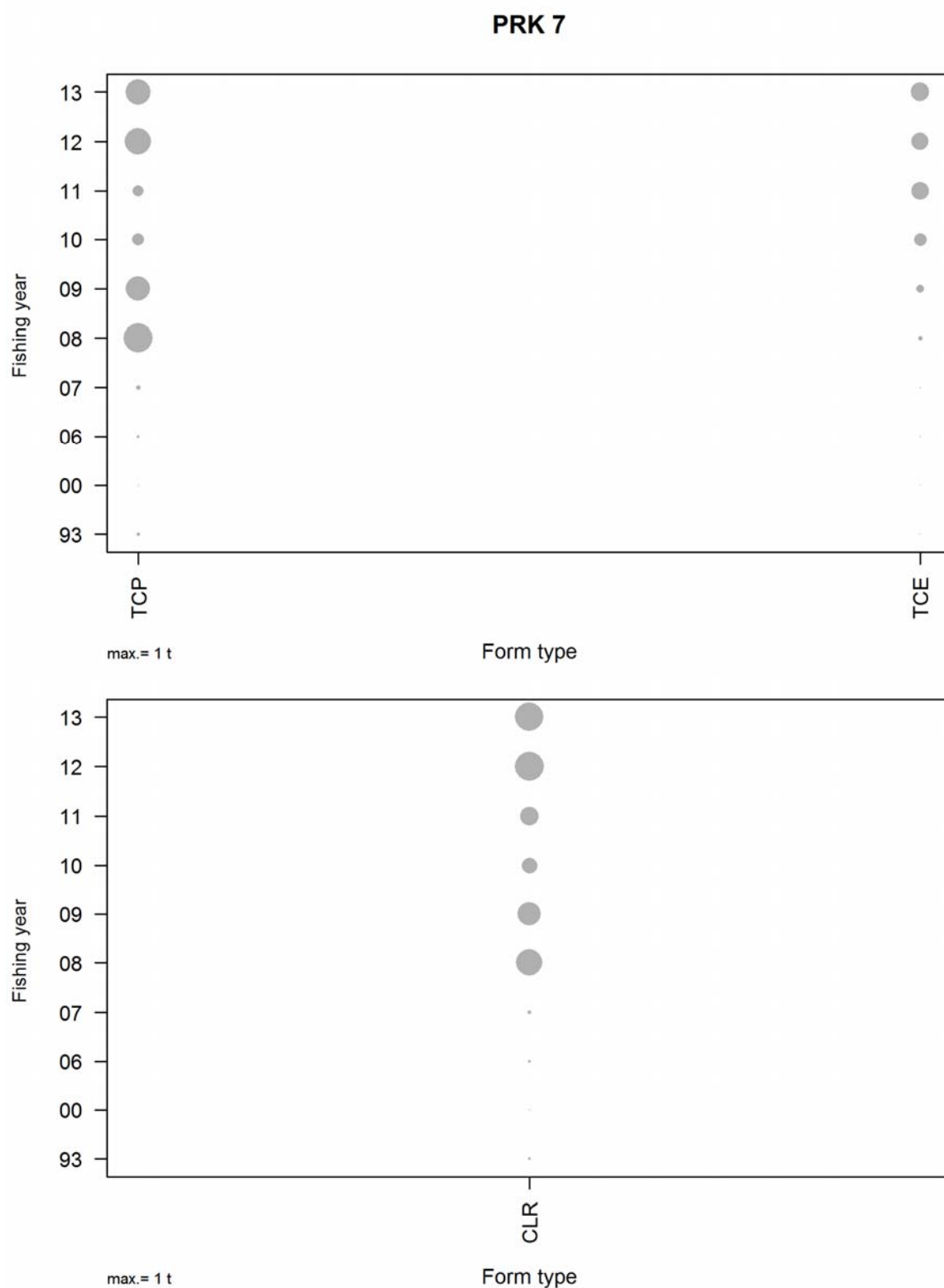


Figure C7c: Proportion of estimated catch by form type in the groomed and unmerged dataset, and proportion of landed catch by form type in the groomed and merged dataset, for PRK 7 for the 1993, 2000, and 2006–2013 fishing years where TCP is Trawl Catch Effort Processing Return; TCE is Trawl Catch Effort Return; CLR is Catch Landing Return.

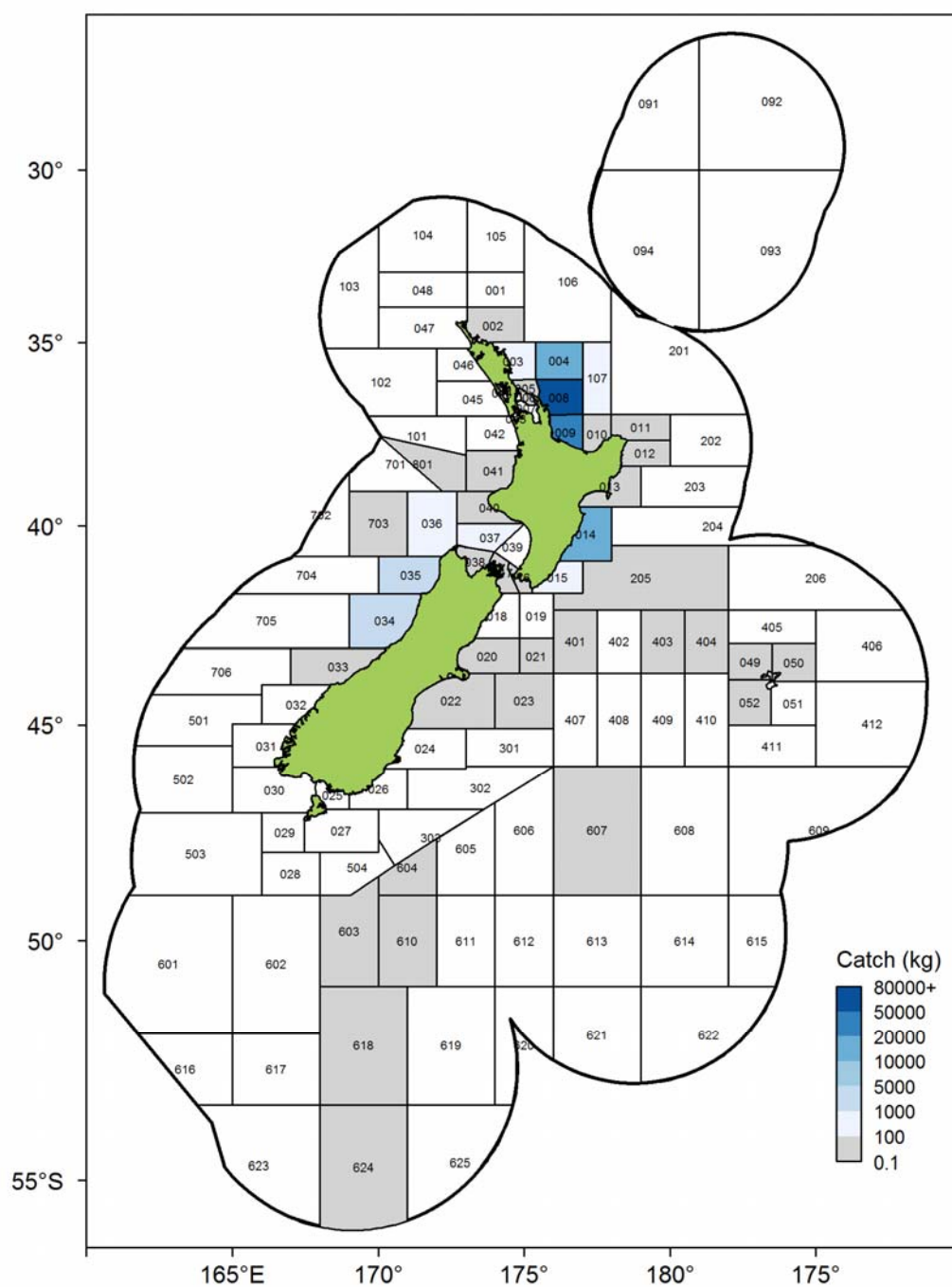


Figure C8: Combined catch (in tonnes) of all commercial prawn killer catches from for all years combined by statistical area for the 1991–2013 fishing years.

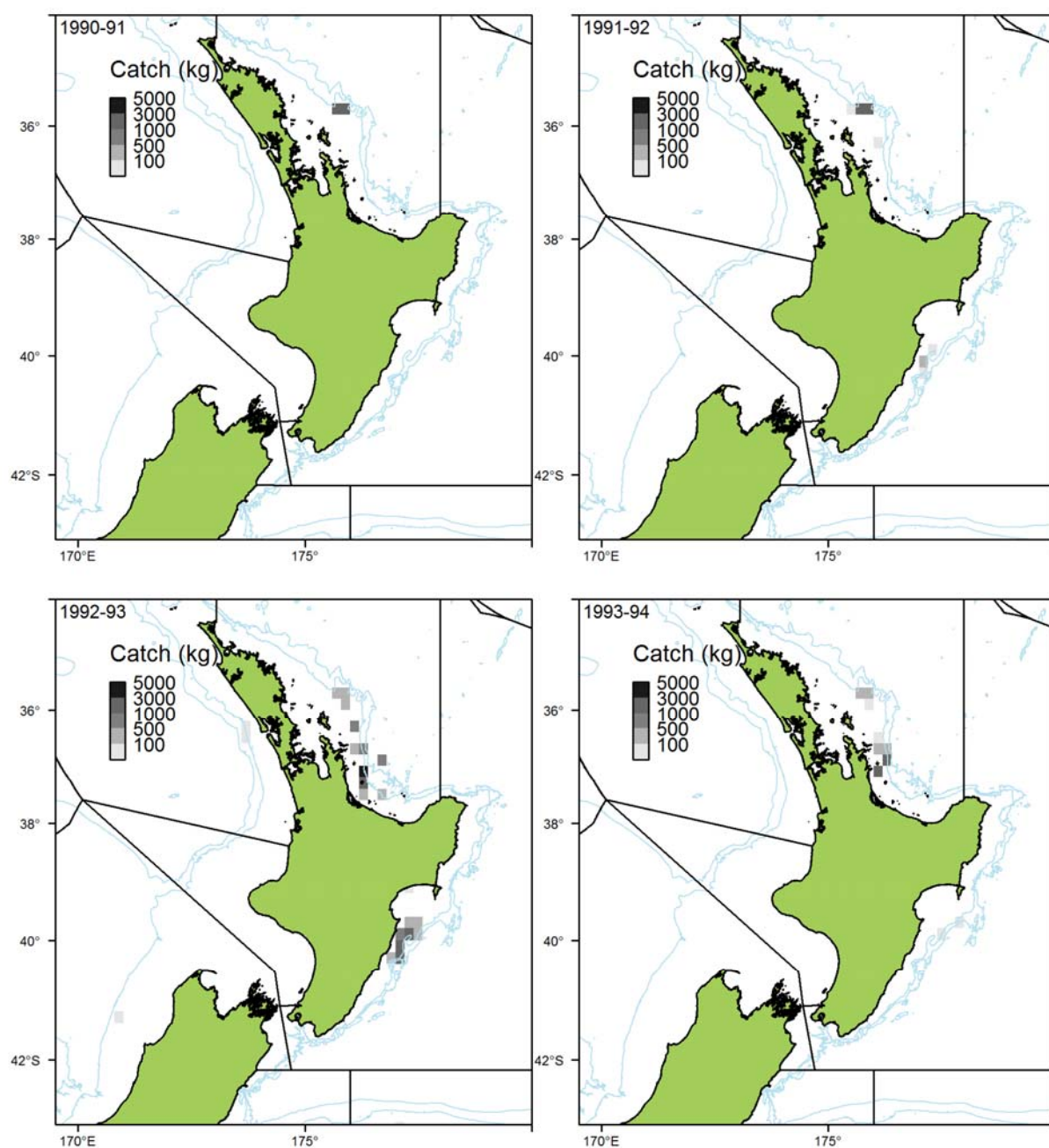


Figure C9: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 1991–1994 fishing years.

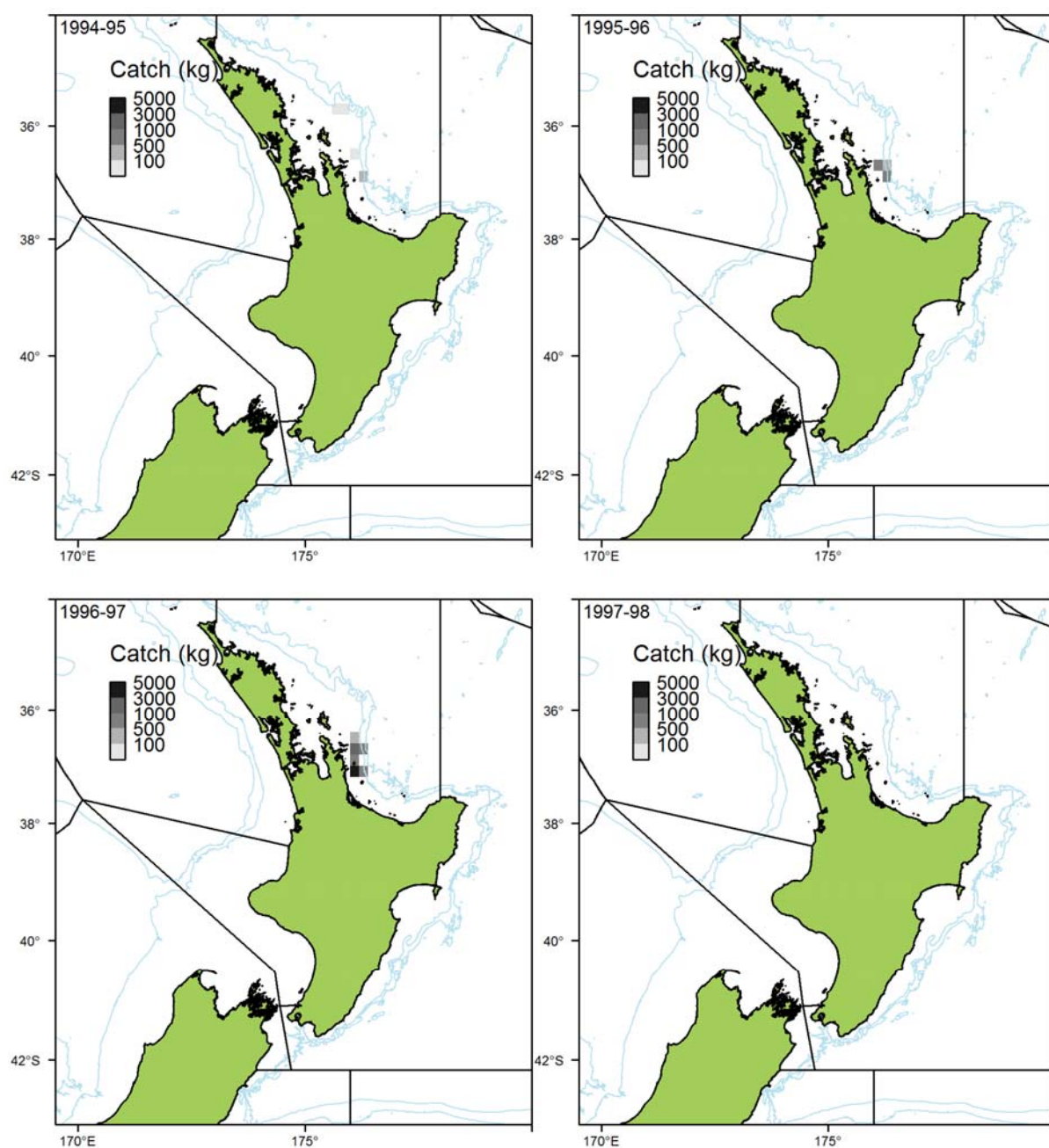


Figure C9 continued: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 1995–1998 fishing years.

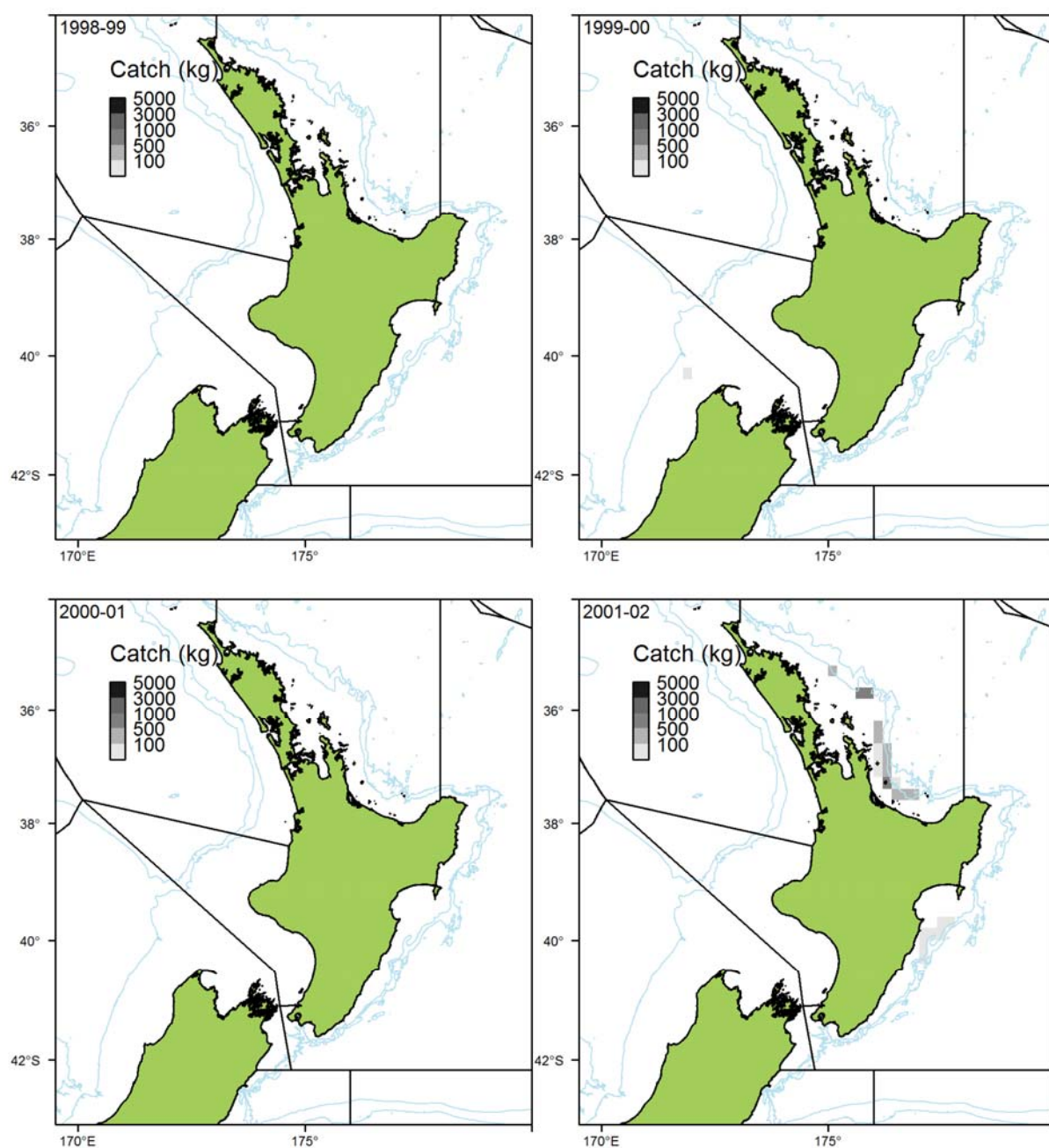


Figure C9 continued: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 1999–2002 fishing years.

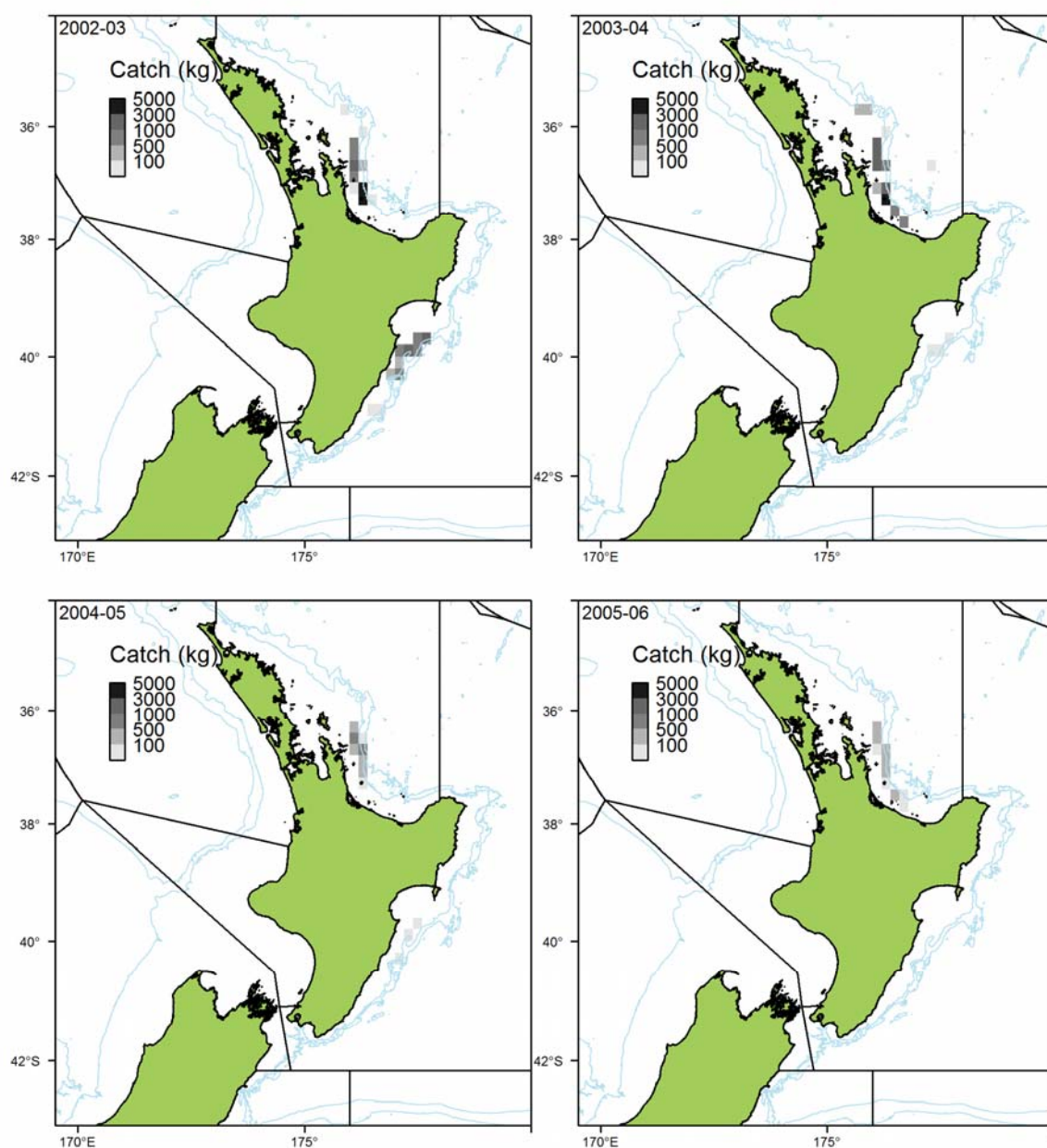


Figure C9 continued: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 2003–2006 fishing years.

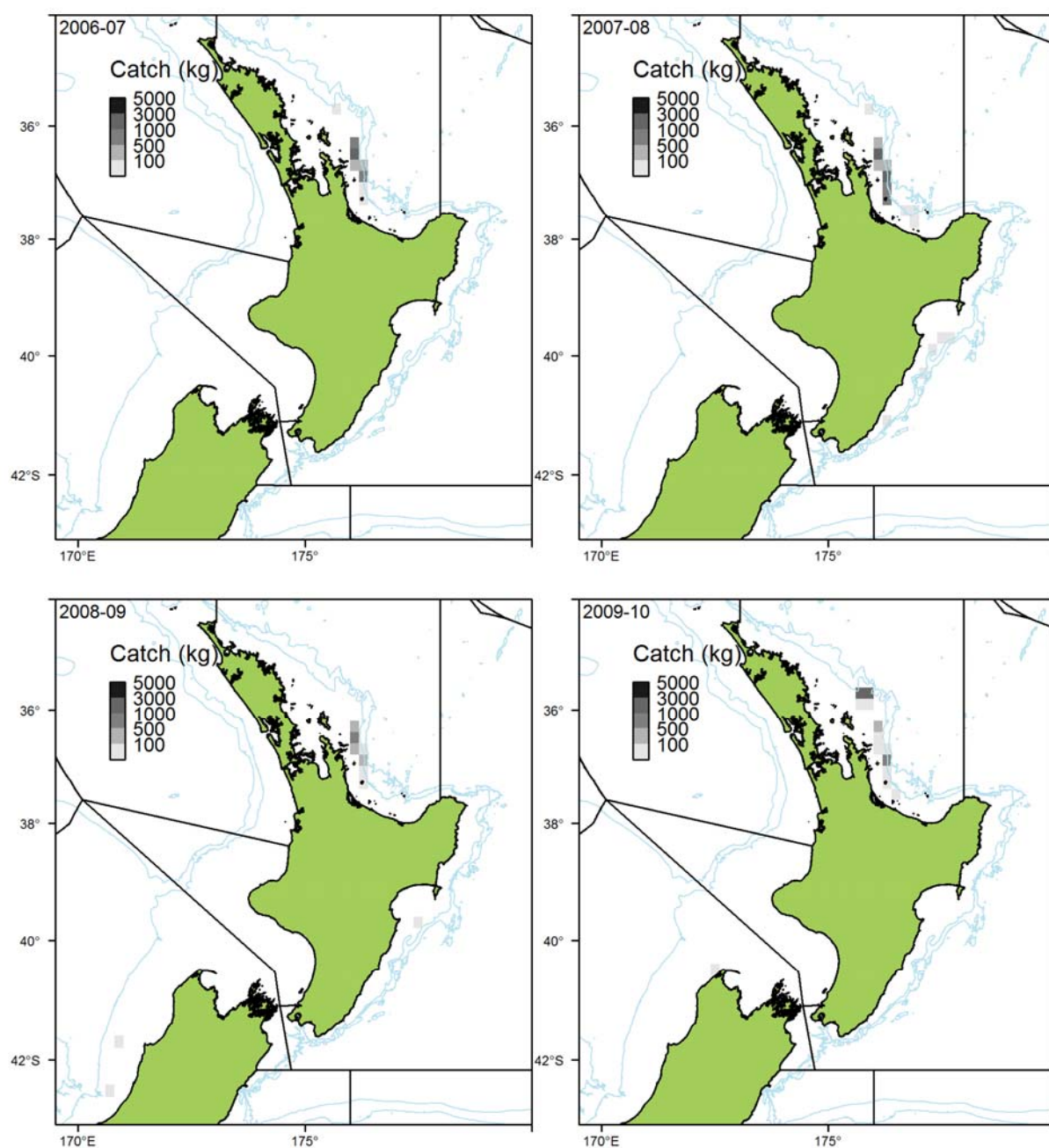


Figure C9 continued: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 2007–2010 fishing years.

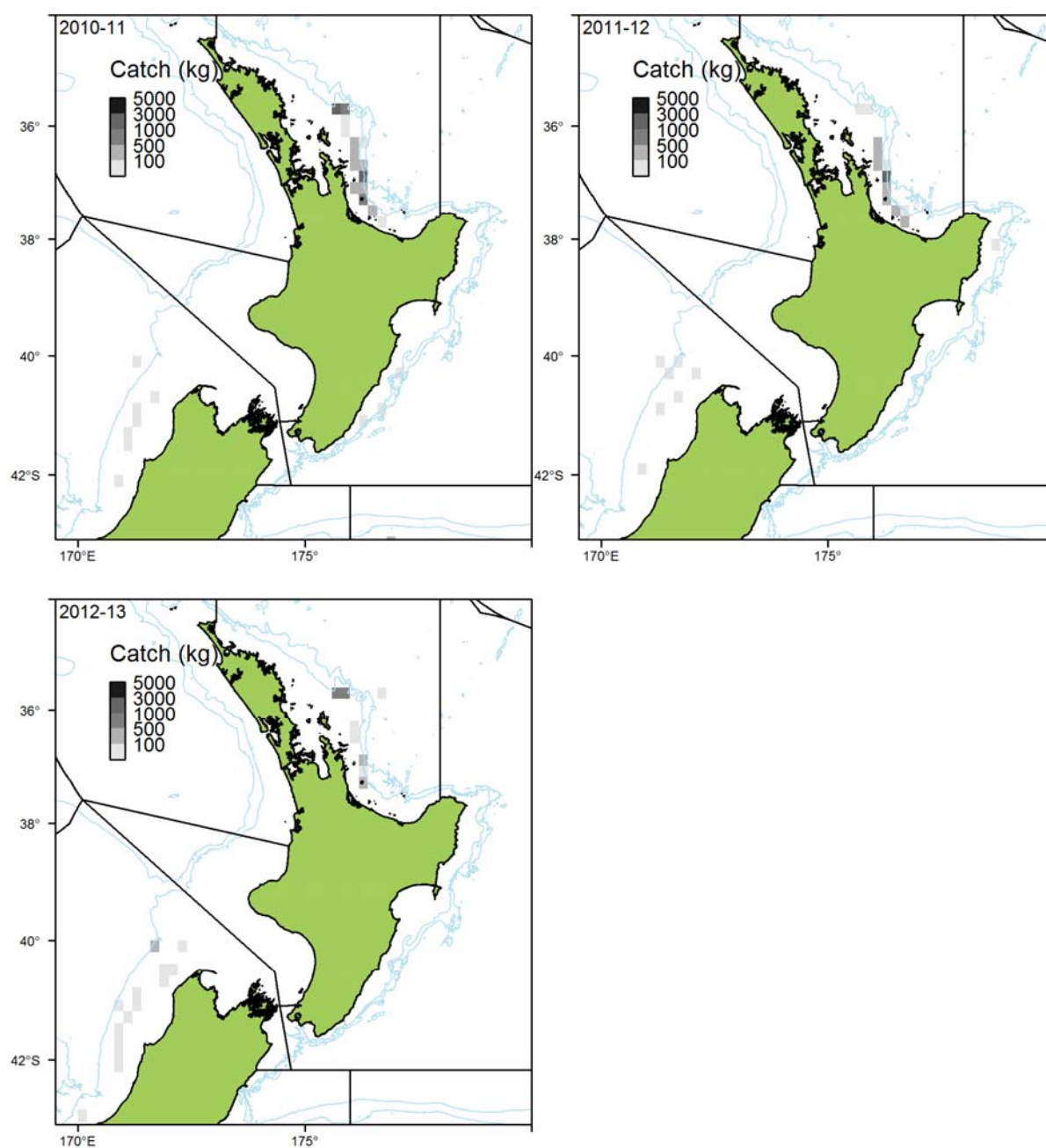


Figure C9 continued: Estimated catch of prawn killer reporting on TCEPR and TCER forms (in tonnes) by fishing year, aggregated into 0.2 degree spatial blocks 2011–2013 fishing years.

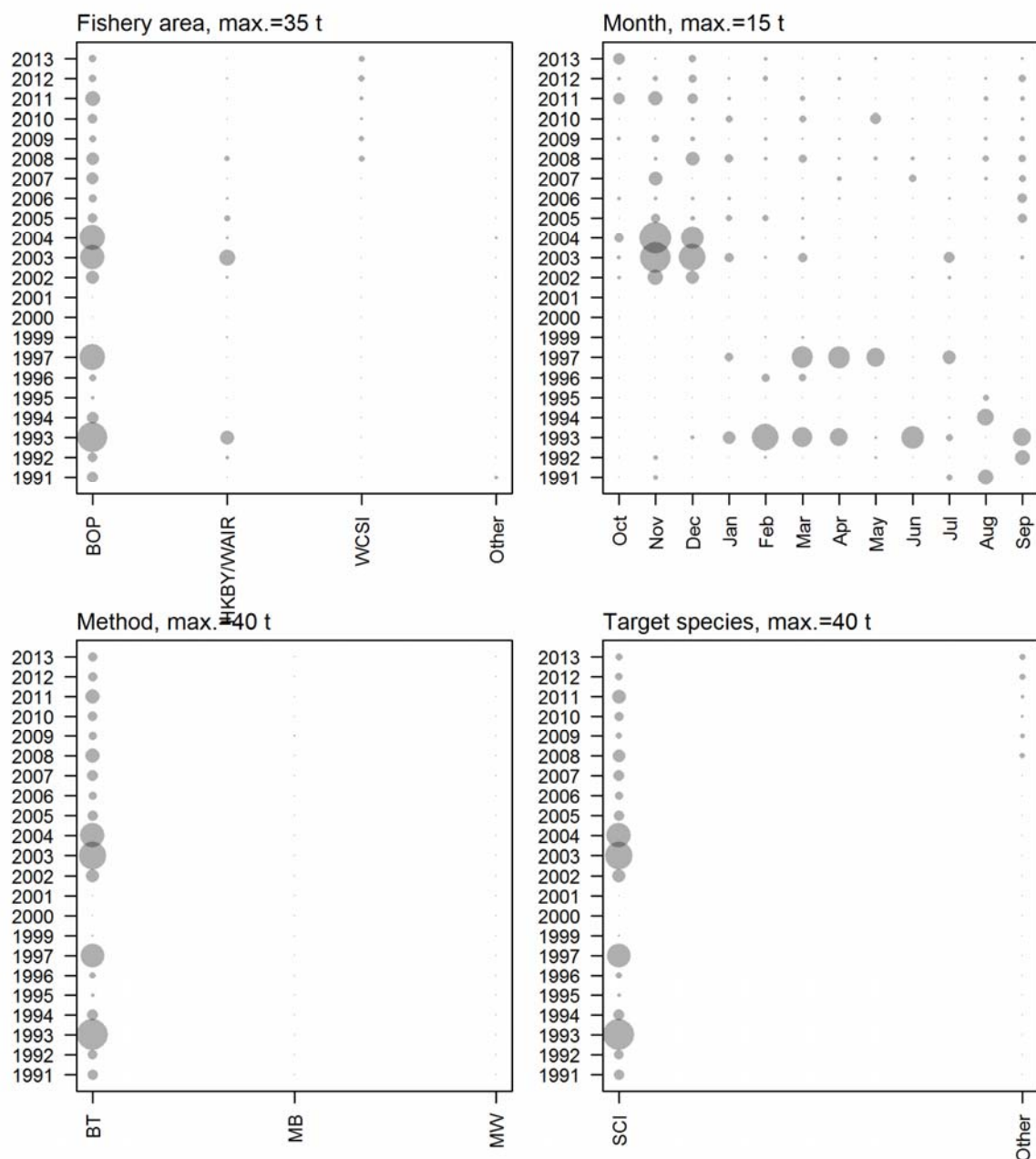


Figure C10: Distribution of annual prawn killer catch by fishery area, month, method, and target species from the groomed and merged data set. Circle size is proportional to catch; maximum circle size is indicated on each plot. Fishery areas are shown in Figure 2. BOP, Bay of Plenty; HKBY/WAIR, Hawke Bay/Wairarapa; WCSI, west coast South Island; Other, all other areas in the NZ EEZ combined. BT is bottom trawl; MB is midwater trawl on the bottom (within 3 m of the seabed); MW is midwater trawl. SCI, scampi; Other is all other species combined.

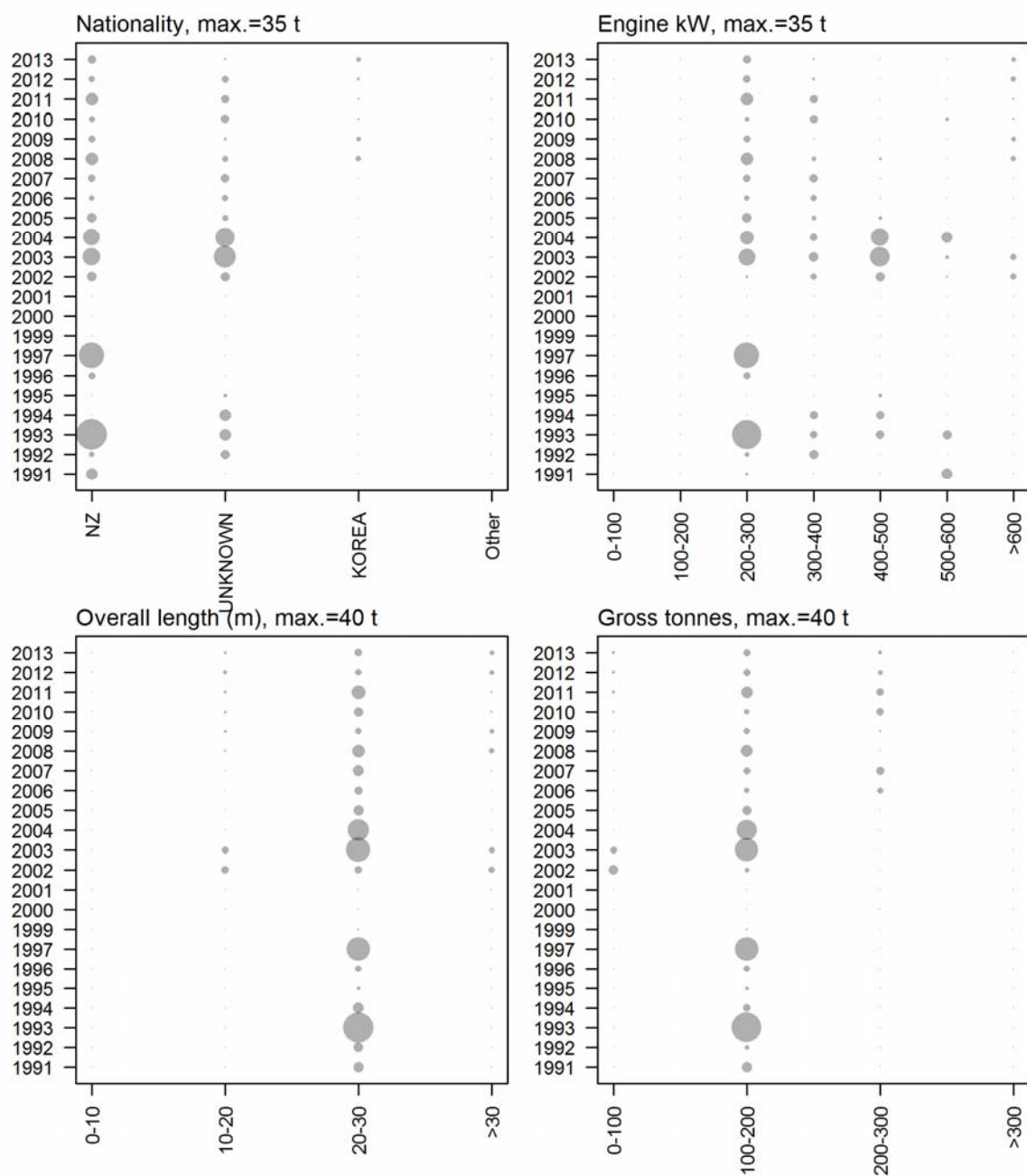


Figure C11: Distribution of annual prawn killer catch by nationality, vessel power, overall length, and gross tonnage groomed and merged data set. Circle size is proportional to catch; maximum circle size is indicated on each plot.

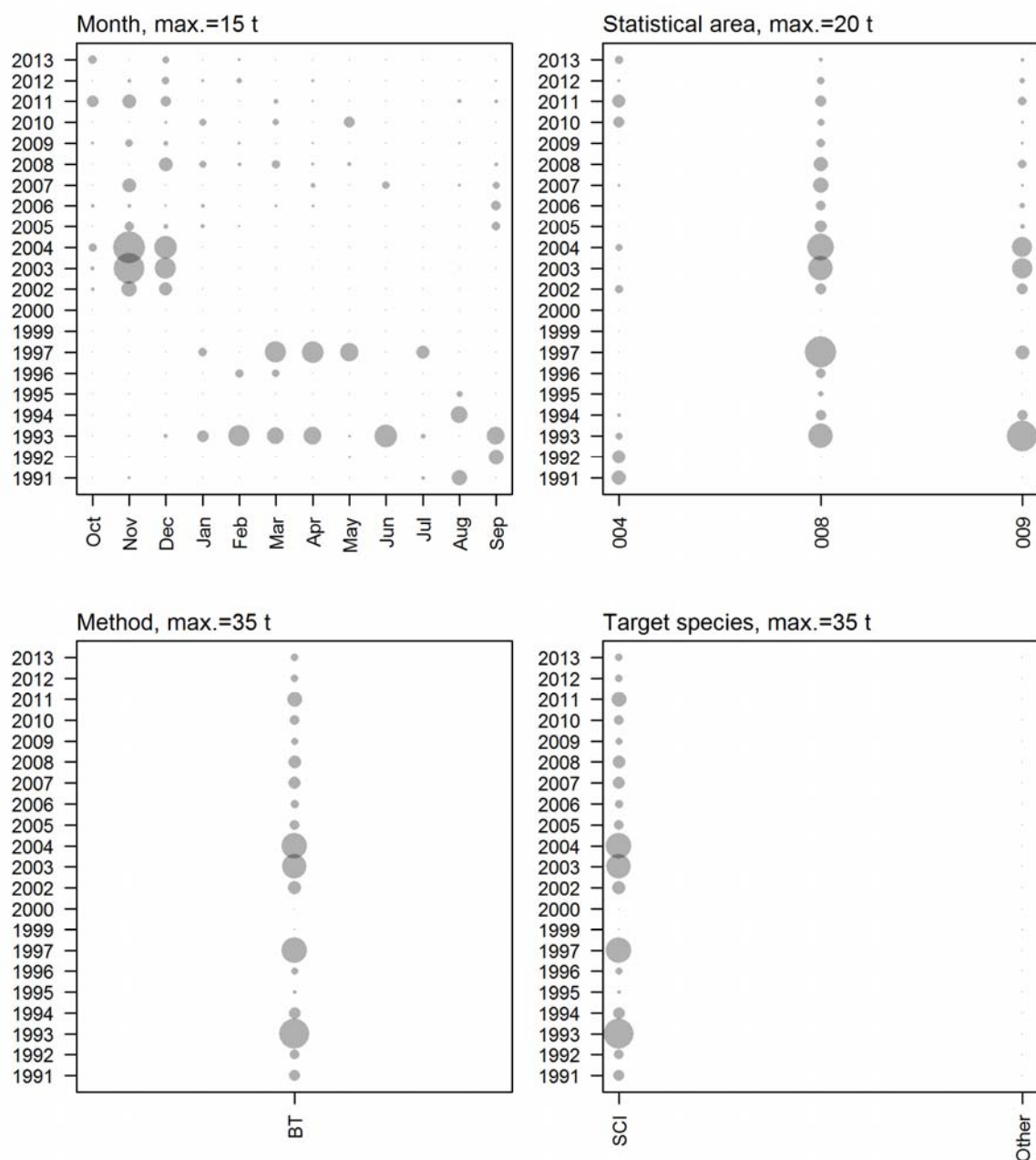


Figure C12: Distribution of annual prawn killer catch by month, statistical area, method, and target species for the Bay of Plenty fishery for all merged data. BT is bottom trawl. SCI is scampi. Circle size is proportional to catch; maximum circle size is indicated on each plot.

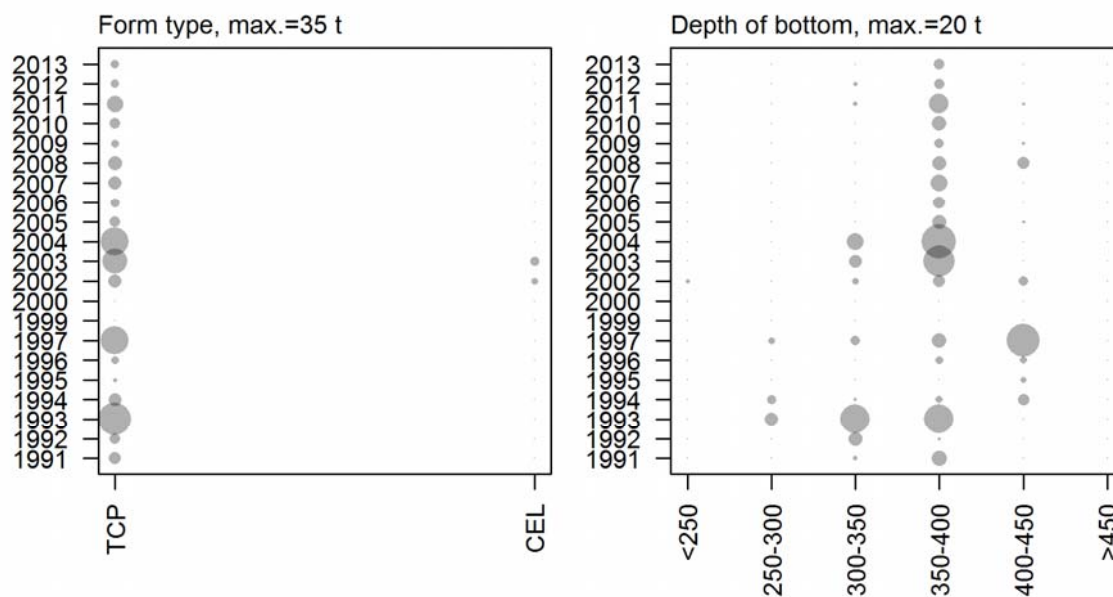


Figure C13: Distribution of annual prawn killer catch by form type and depth for the Bay of Plenty fishery (see Figure 2) for the groomed and merged daily processed data. Circle size is proportional to catch; maximum circle size is indicated on each plot. TCP is Trawl Catch Effort Processing Return, CEL is Catch Effort Landing Return.

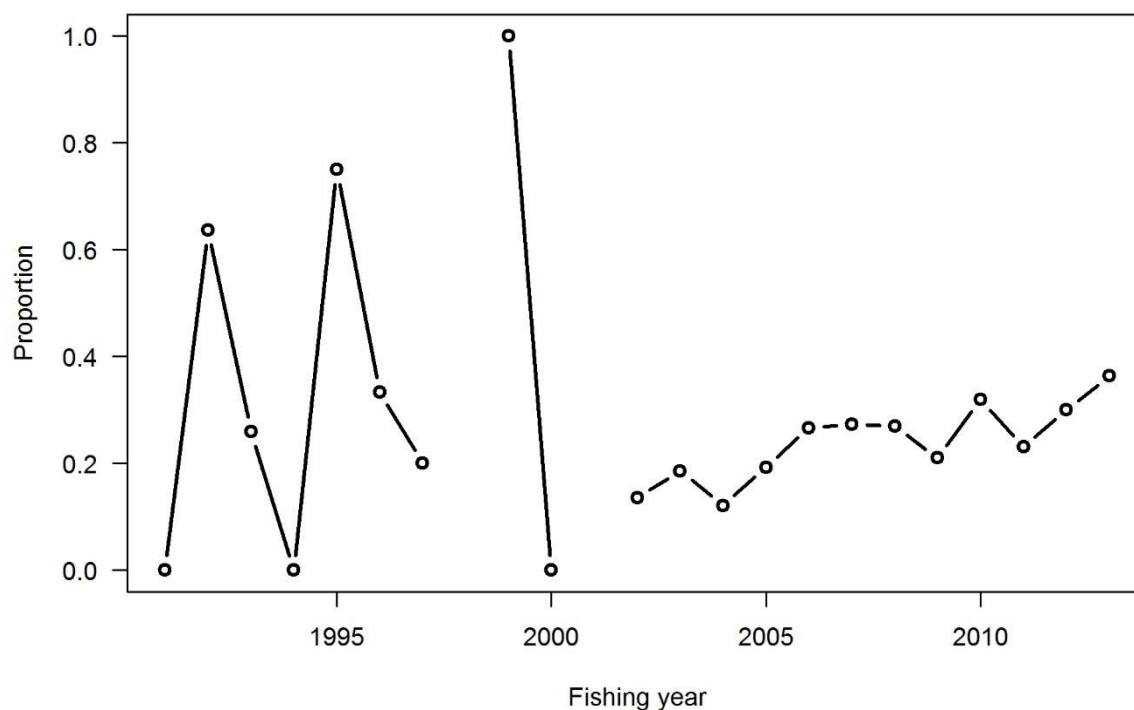


Figure C14: Proportion of effort strata that recorded no prawn killer catch in the scampi target bottom trawl fishery by fishing year.

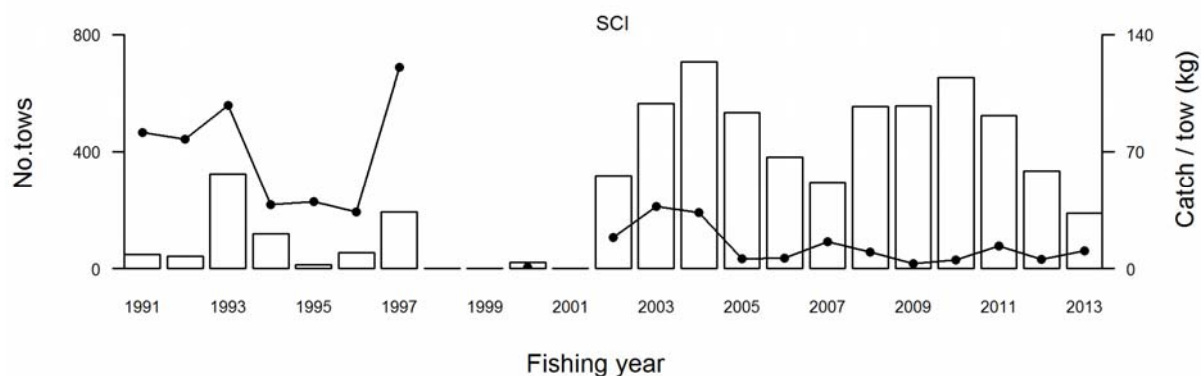


Figure C15: Unstandardised catch rates of prawn killer in the scampi bottom trawl fishery (kg/tow) and the number of tows for the Bay of Plenty fishery by fishing year.

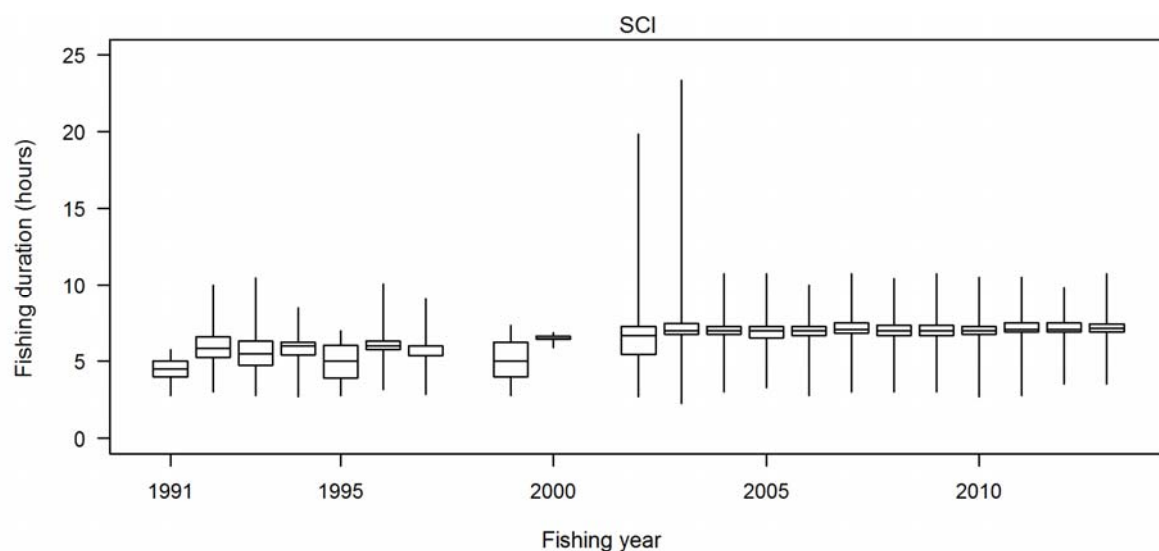


Figure C16: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for tow duration (hours) for bottom trawl tows that caught prawn killer while targeting scampi for Bay of Plenty fishery.

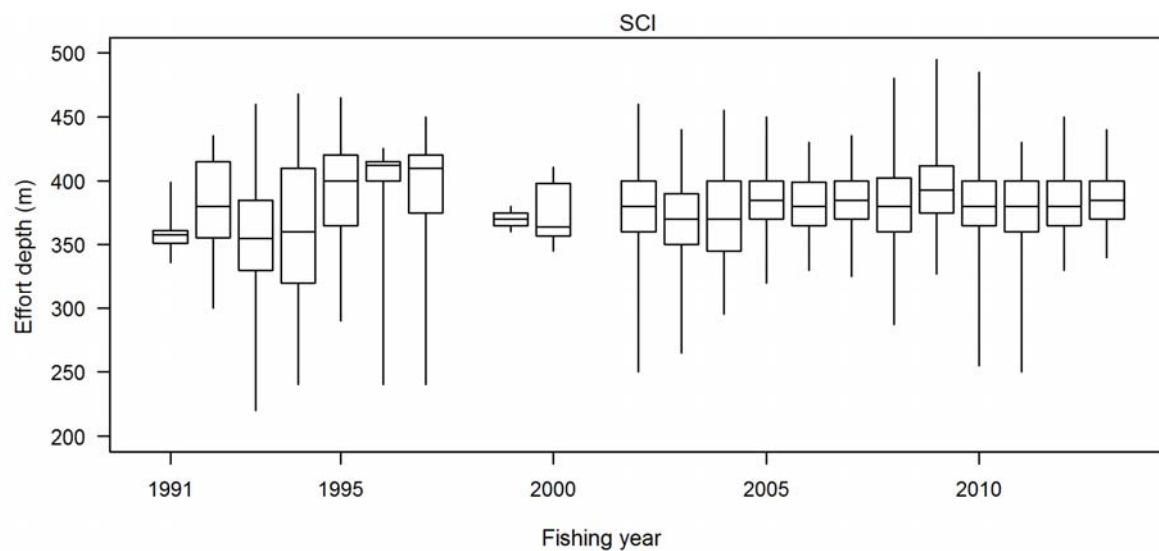


Figure C17: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for effort depth (metres) for bottom trawl tows that caught prawn killer while targeting scampi for Bay of Plenty fishery.

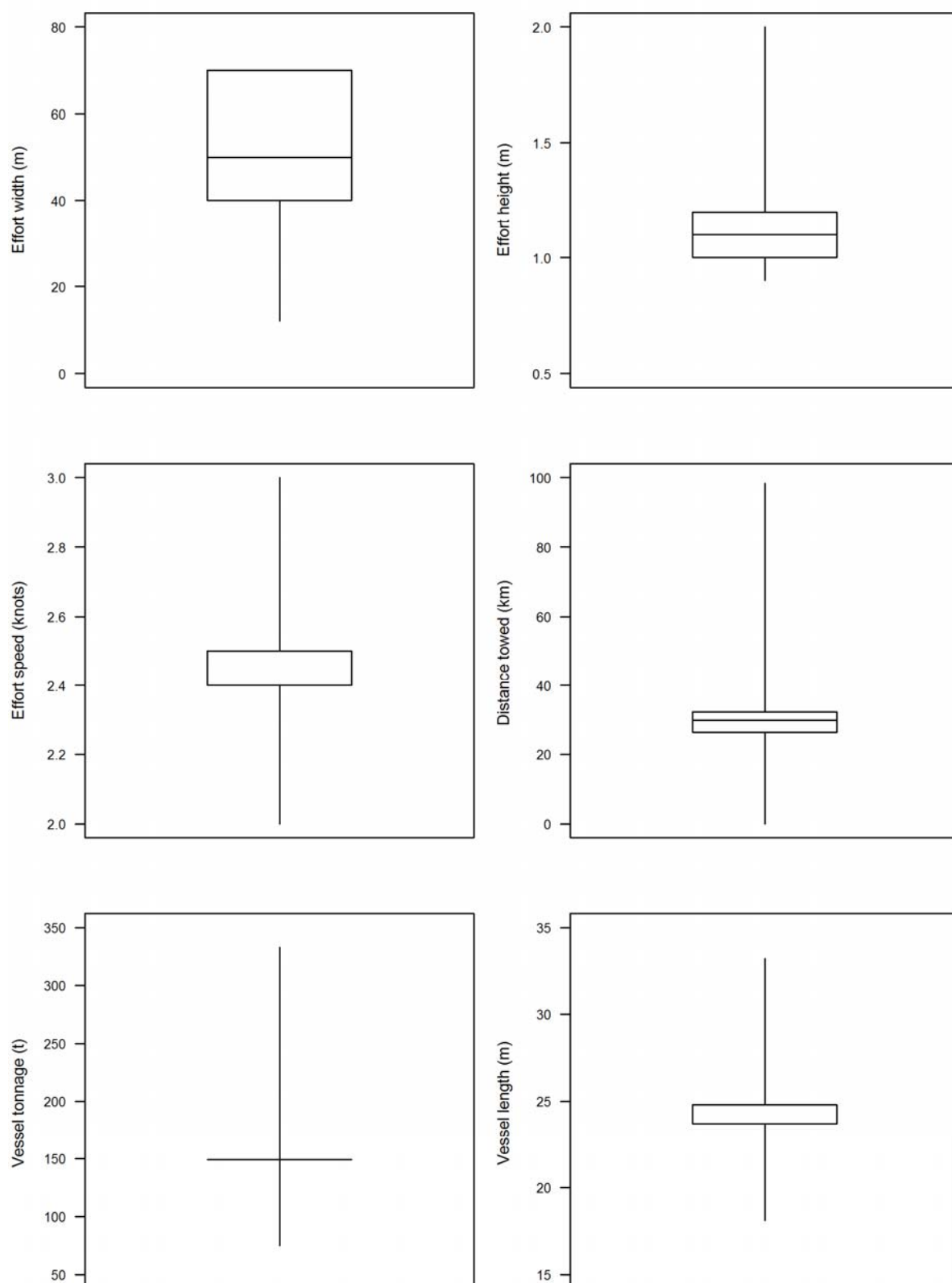


Figure C18: Median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for other fishing effort variables and vessel characteristics for the Bay of Plenty fishery for vessels that caught prawn killer while targeting scampi by bottom trawl.

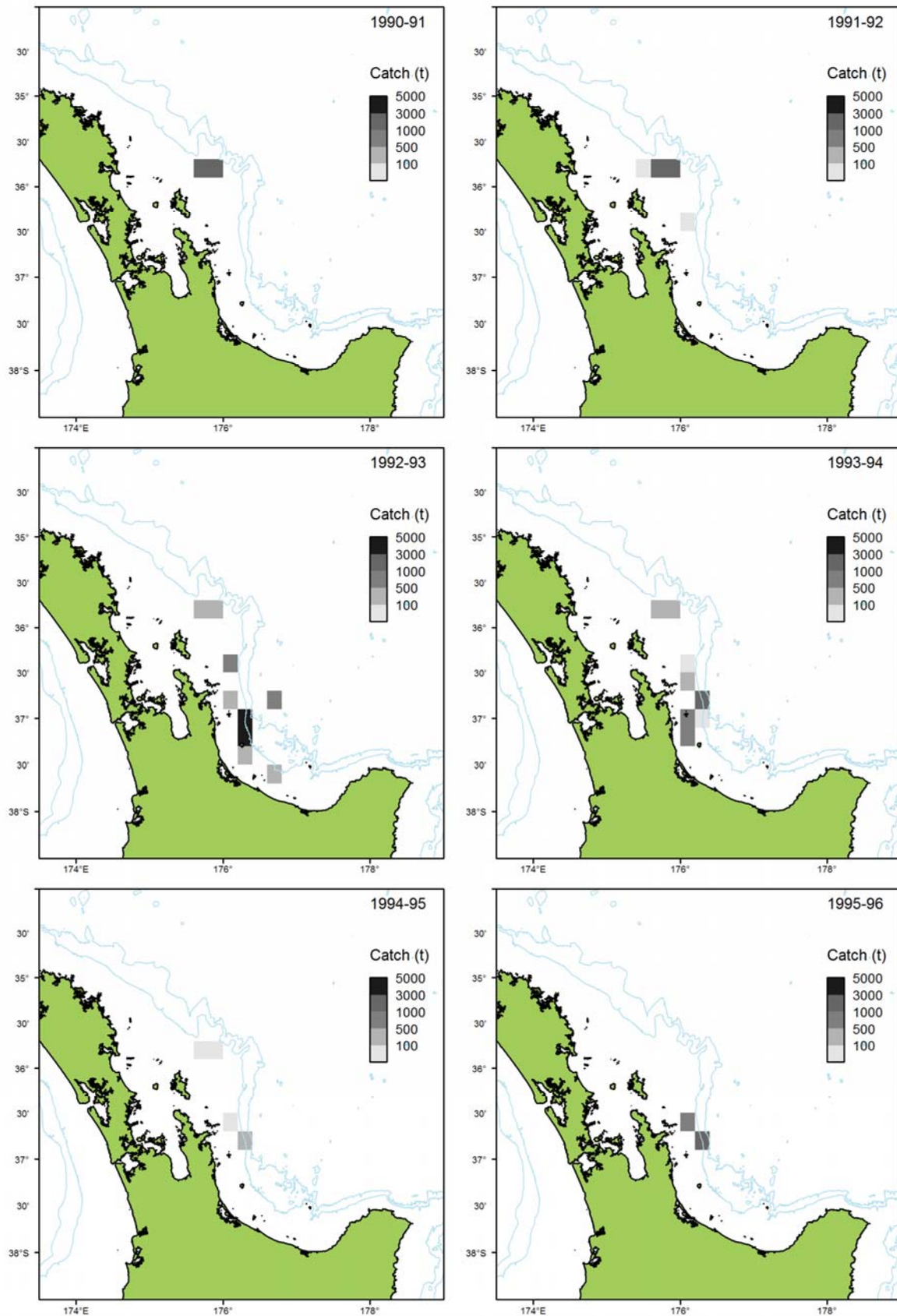


Figure C19: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Bay of Plenty fishery aggregated into 0.2 degree spatial blocks for 1991 to 1996 fishing years for the TCEPR form.

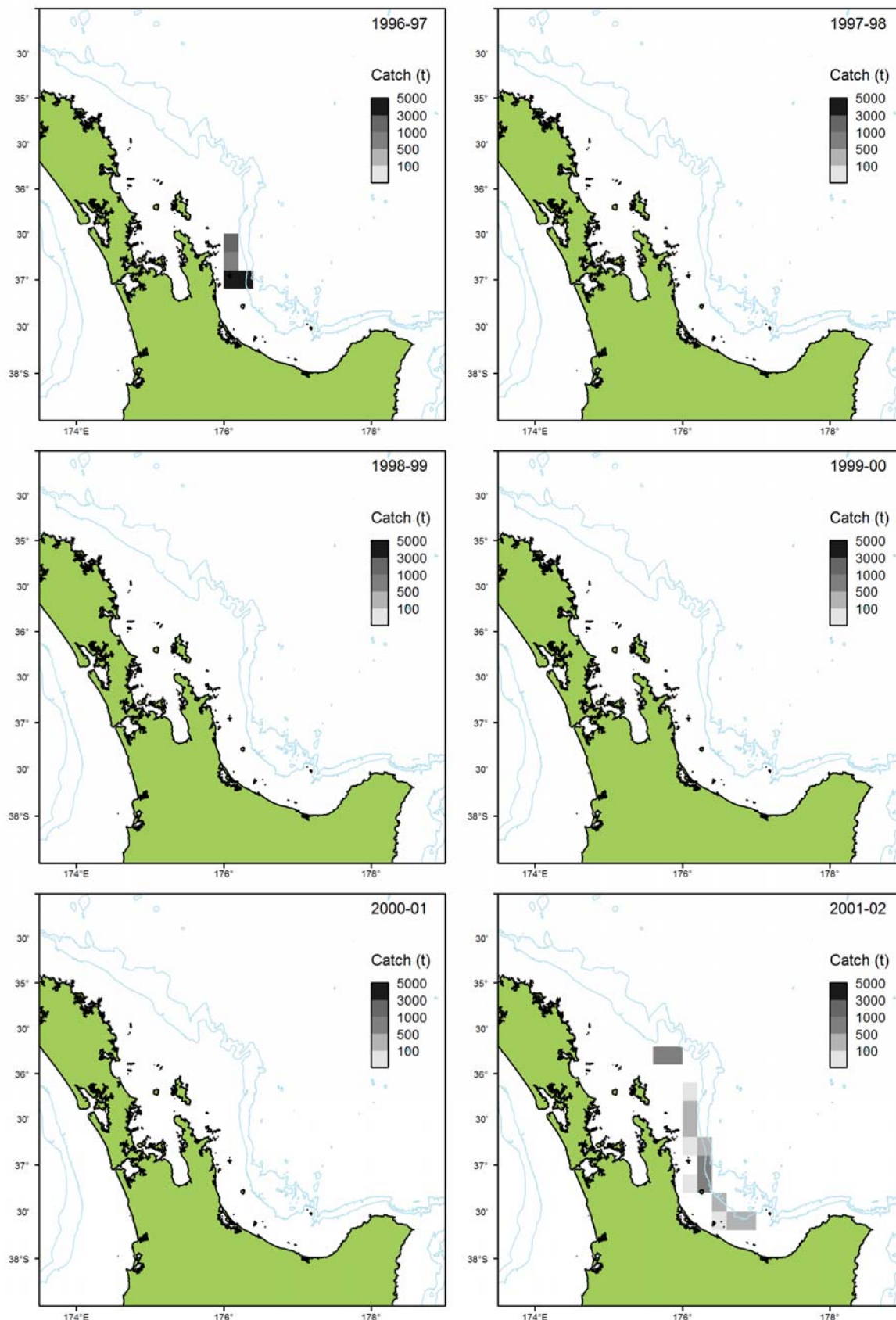


Figure C19 continued: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Bay of Plenty fishery aggregated into 0.2 degree spatial blocks for 1997 to 2002 fishing years for the TCEPR form.

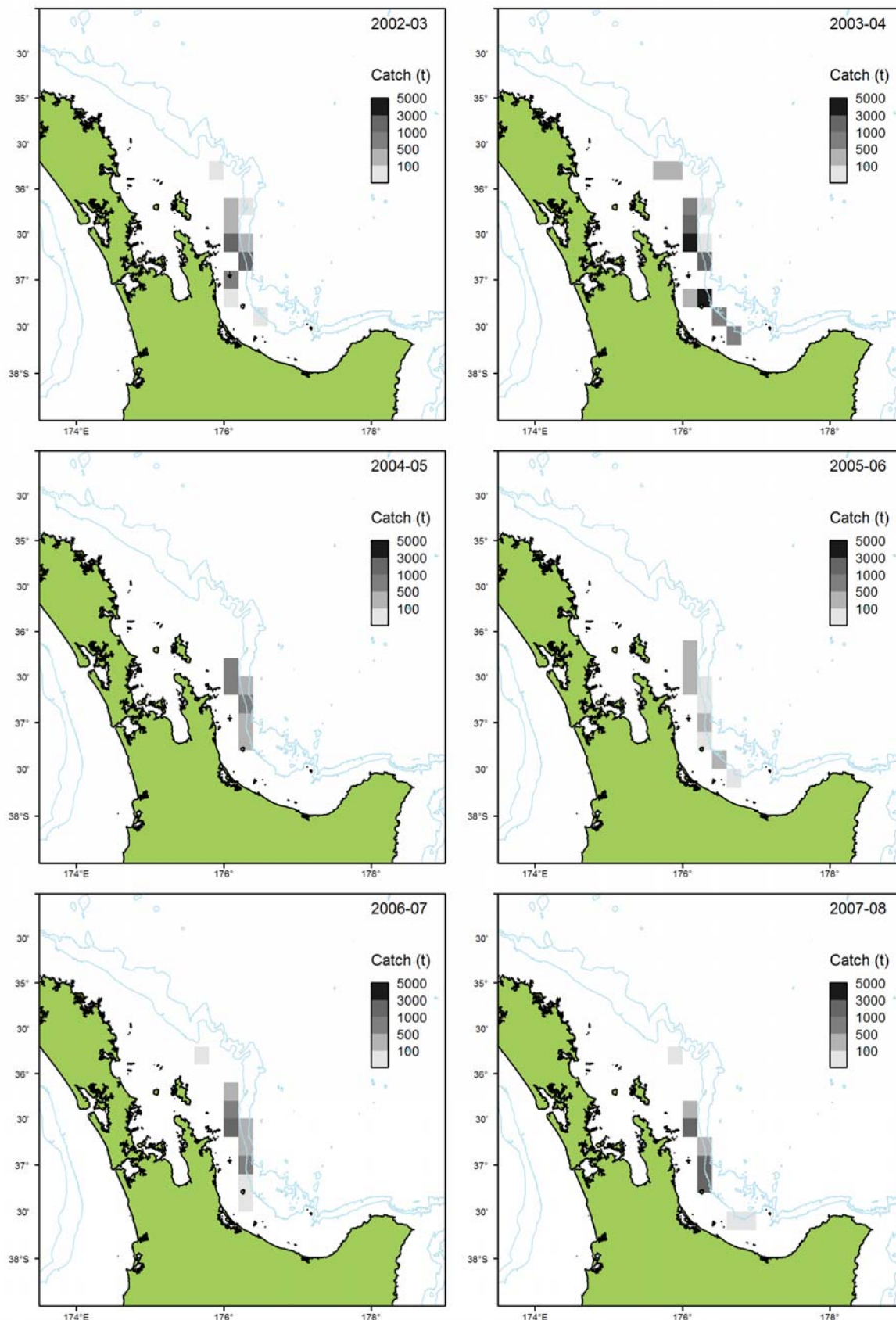


Figure C19 continued: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Bay of Plenty fishery aggregated into 0.2 degree spatial blocks for 2003 to 2008 fishing years for the TCEPR form.

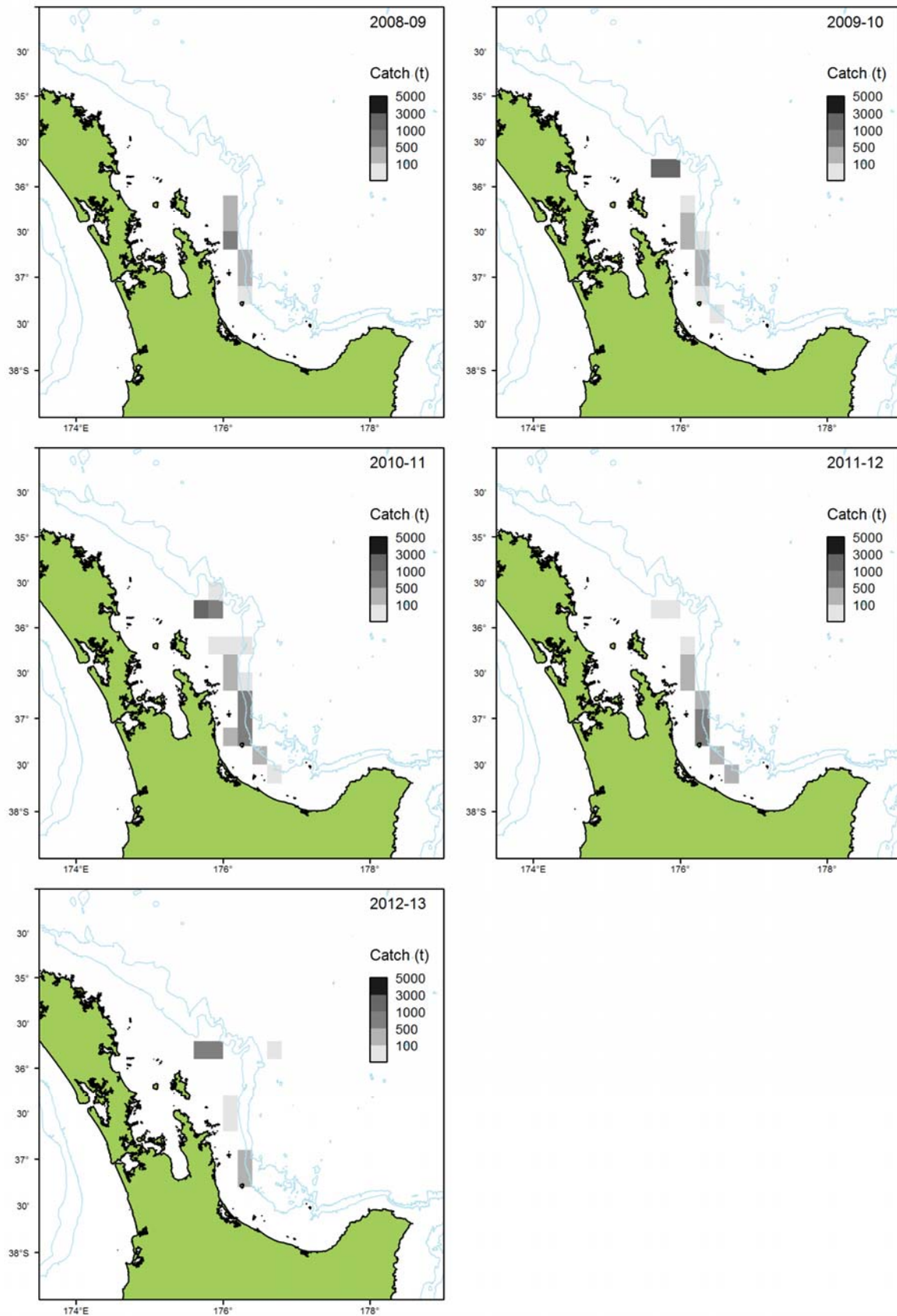


Figure C19 continued: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Bay of Plenty fishery aggregated into 0.2 degree spatial blocks for 2009 to 2013 fishing years for the TCEPR form.

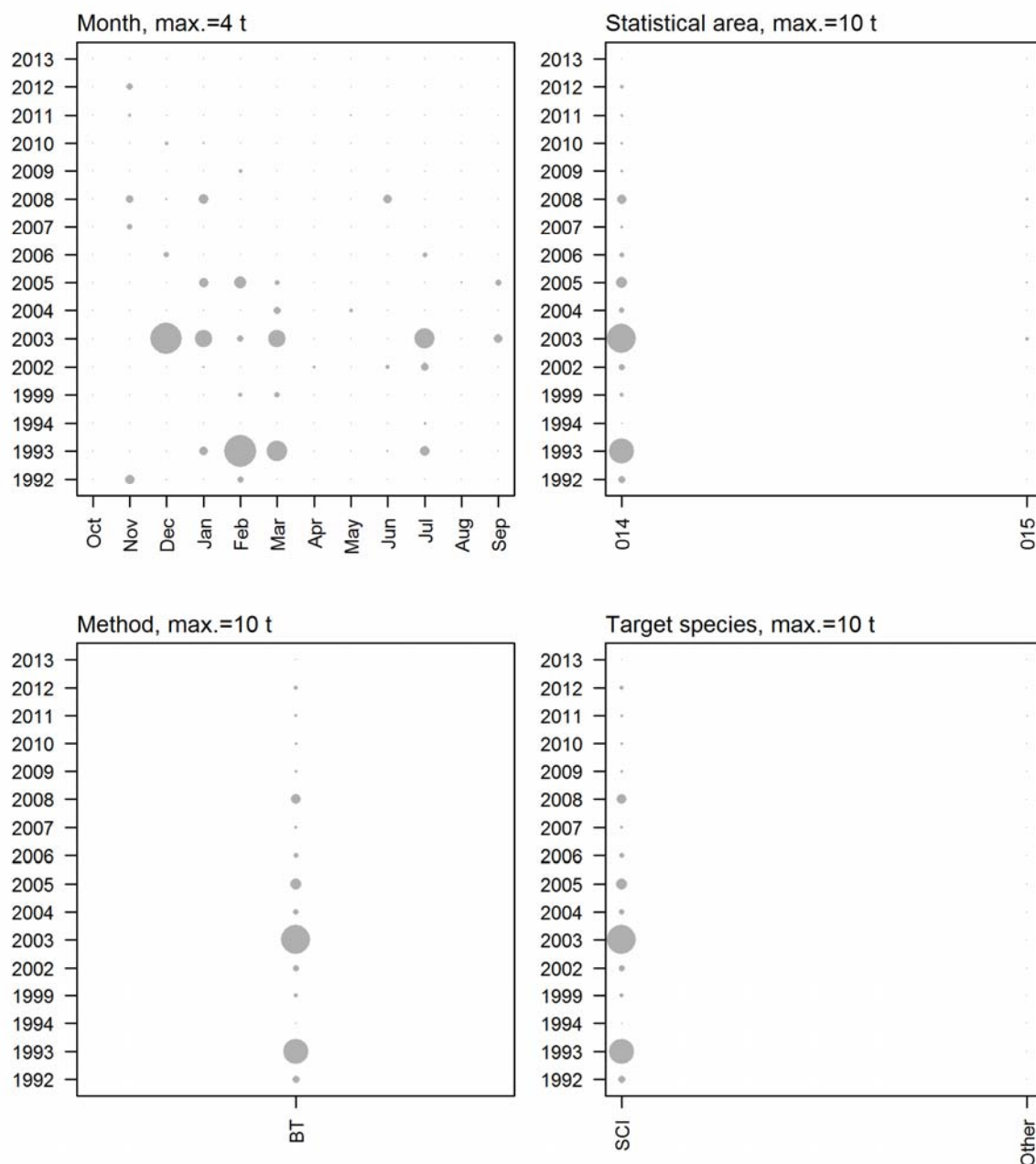


Figure C20: Distribution of annual prawn killer catch by month, statistical area, method, and target species for the Hawke Bay/Wairarapa fishery for all merged data. BT is bottom trawl. SCI is scampi. Circle size is proportional to catch; maximum circle size is indicated on each plot.

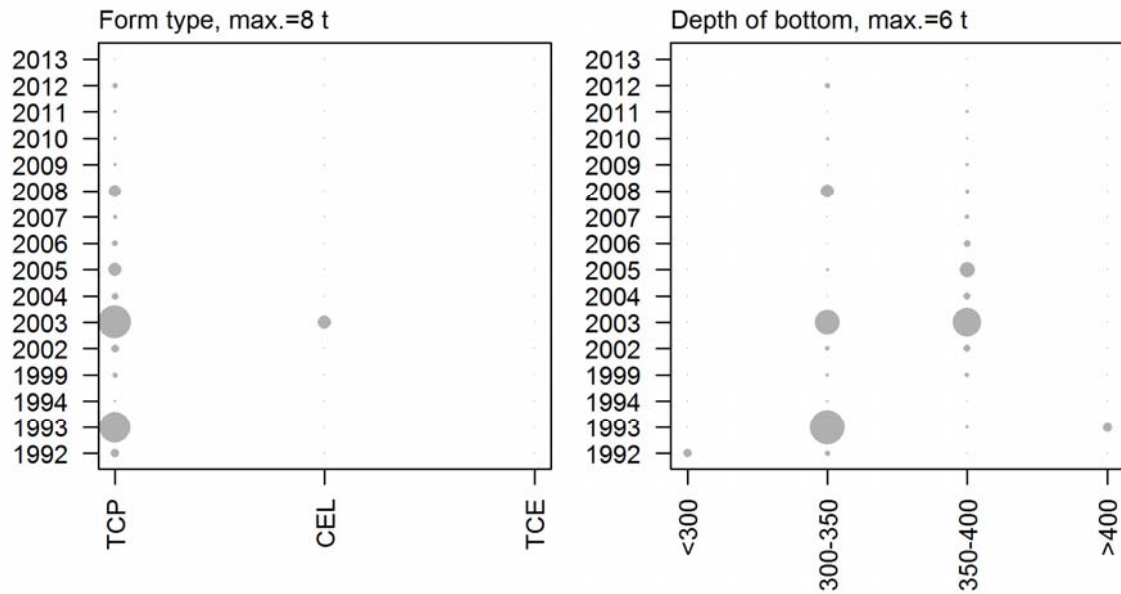


Figure C21: Distribution of annual prawn killer catch by form type and depth for the Hawke Bay/Wairarapa fishery (see Figure 2) for the groomed and merged daily processed data. Circle size is proportional to catch; maximum circle size is indicated on each plot. TCP is Trawl Catch Effort Processing Return, CEL is Catch Effort Landing Return, TCE is Trawl Catch Effort Return.

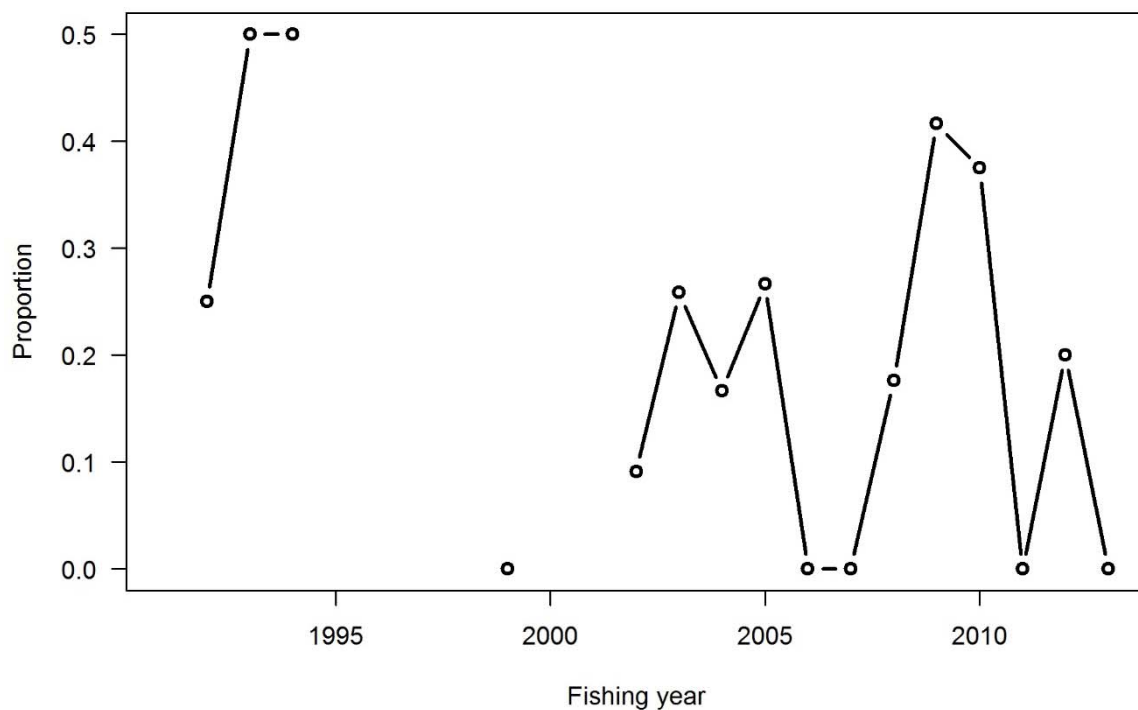


Figure C22: Proportion of effort strata that recorded no prawn killer catch in the scampi target bottom trawl fishery by fishing year.

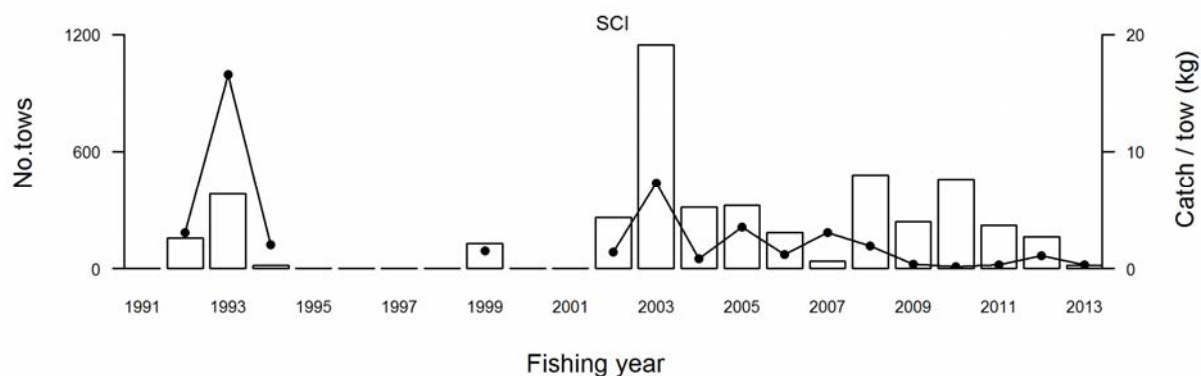


Figure C23: Unstandardised catch rates of prawn killer in the scampi bottom trawl fishery (kg/tow) and the number of tows for the Hawke Bay/Wairarapa fishery by fishing year.

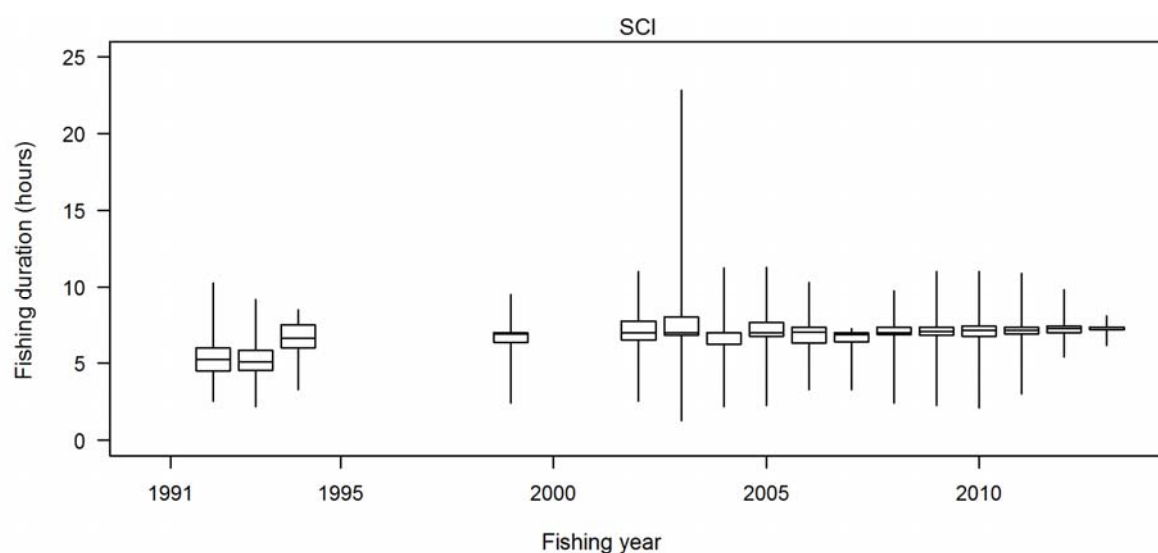


Figure C24: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for tow duration (hours) for bottom trawl tows that caught prawn killer while targeting scampi for Bay of Plenty fishery.

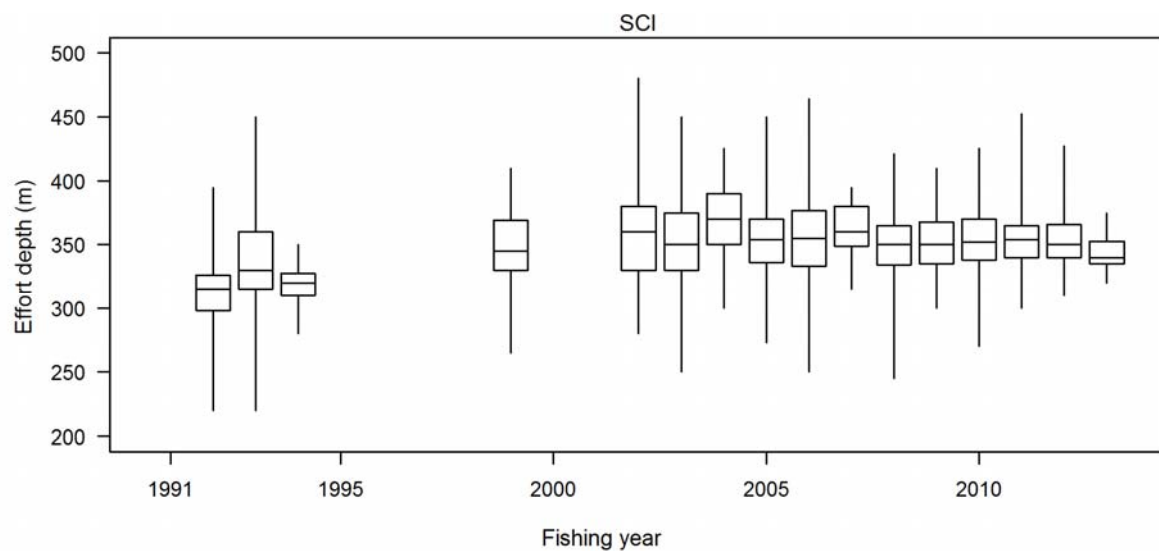


Figure C25: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for effort depth (metres) for bottom trawl tows that caught prawn killer while targeting scampi for the Hawke Bay/Wairarapa fishery.

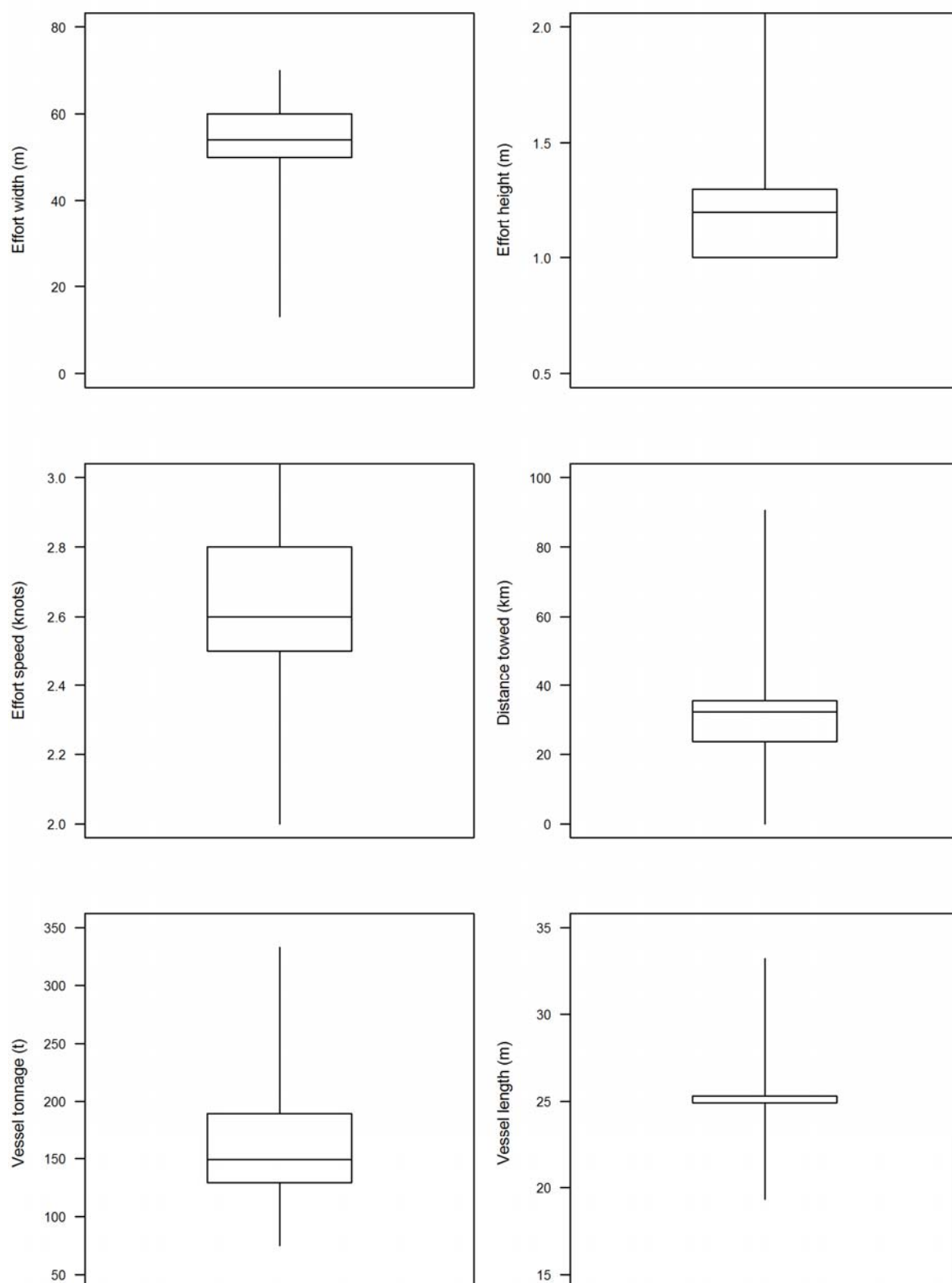


Figure C26: Median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for other fishing effort variables and vessel characteristics for the Hawke Bay/Wairarapa fishery for vessels that caught prawn killer while targeting scampi by bottom trawl.

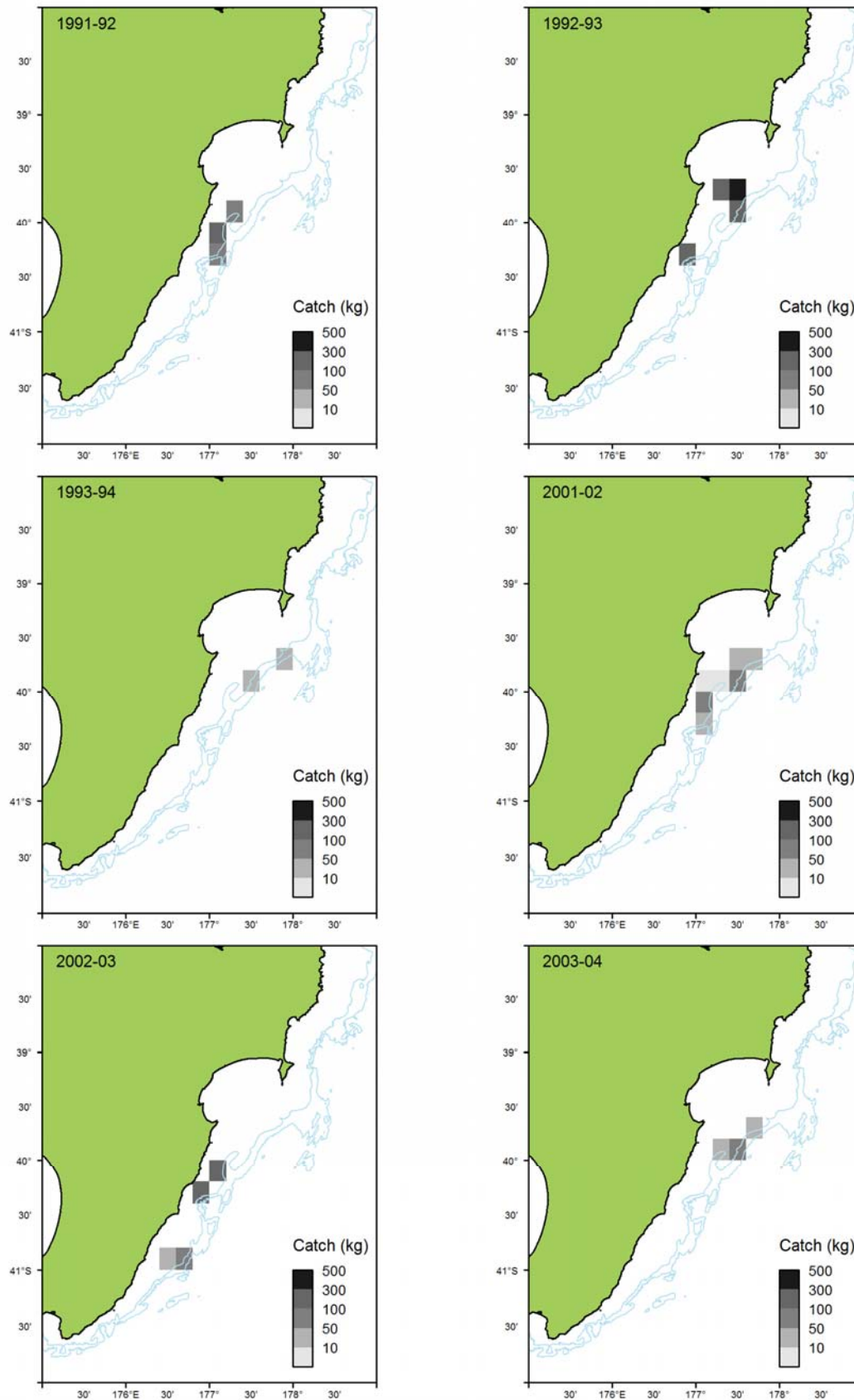


Figure C27: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Hawke Bay /Wairarapa fishery aggregated into 0.2 degree spatial blocks for fishing years with available data (indicated in top right corner of each plot) for the TCEPR and TCER forms.

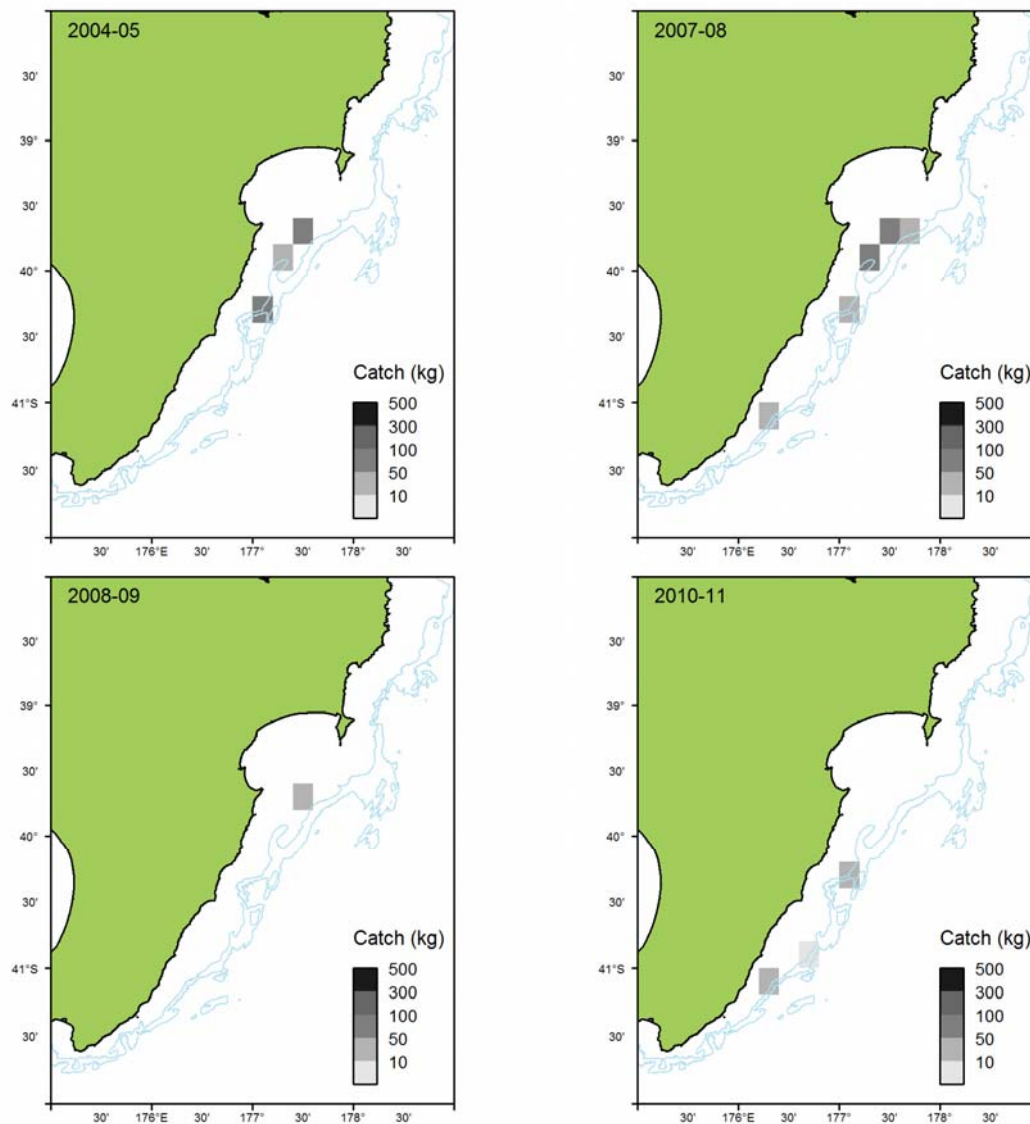


Figure C27 continued: Distribution of estimated prawn killer catch taken by bottom trawl gear for the Hawke Bay/Wairarapa fishery aggregated into 0.2 degree spatial blocks for fishing years with available data (indicated in top right corner of each plot) for the TCEPR and TCER forms.

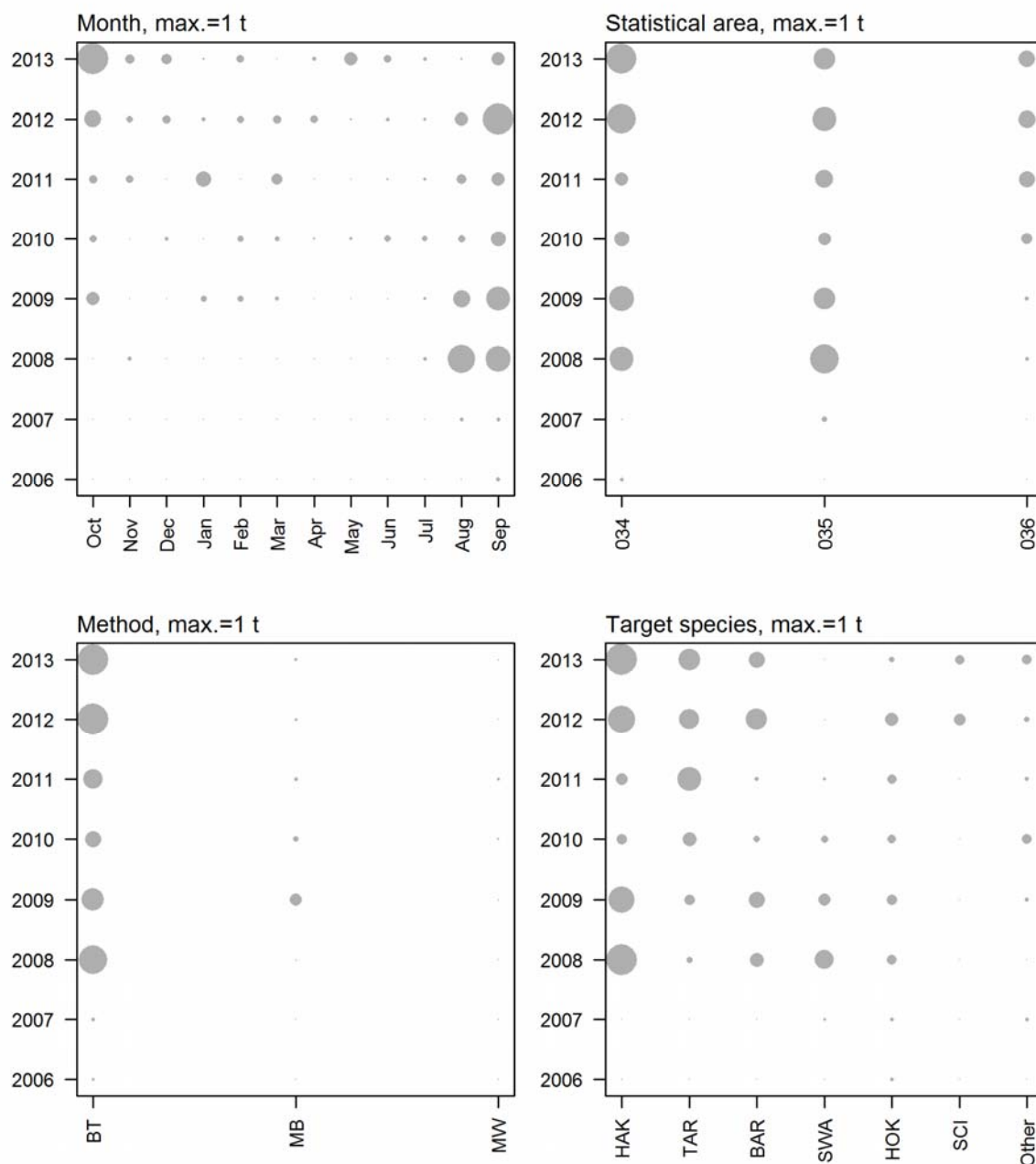


Figure C28: Distribution of annual prawn killer catch by month, statistical area, method, and target species for the West coast South Island fishery for all merged data. BT is bottom trawl, MB is midwater trawl on the bottom (within 3 m of the seabed), MW is midwater trawl. See Table 2 for species codes. Circle size is proportional to catch; maximum circle size is indicated on each plot.

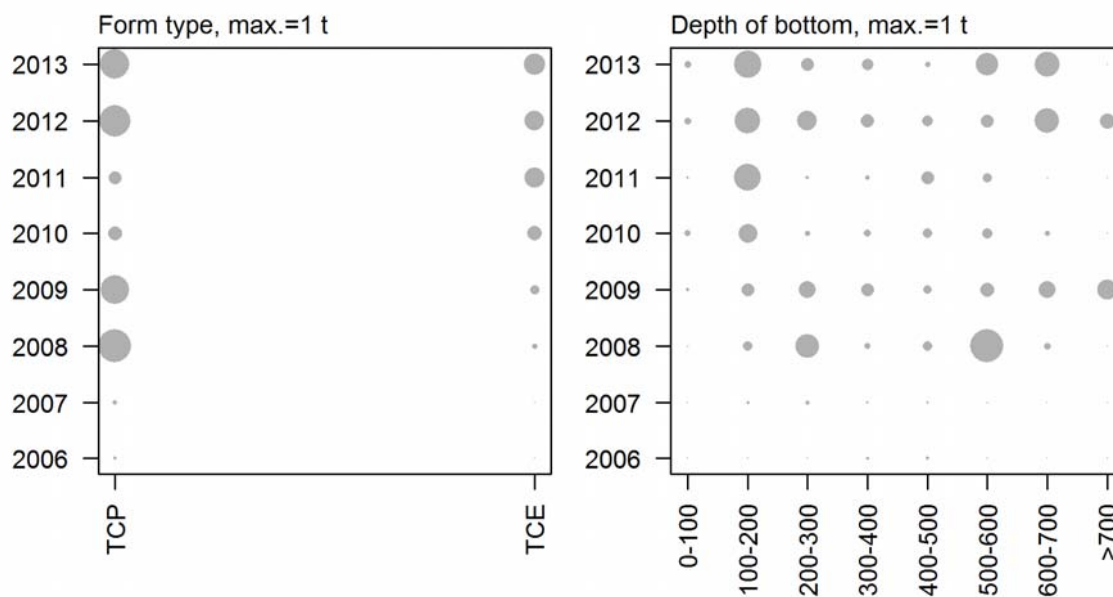


Figure C29: Distribution of annual prawn killer catch by form type and depth for the West coast South Island fishery (see Figure 2) for the groomed and merged daily processed data. Circle size is proportional to catch; maximum circle size is indicated on each plot. TCP is Trawl Catch Effort Processing Return, TCE is Trawl Catch Effort Return.

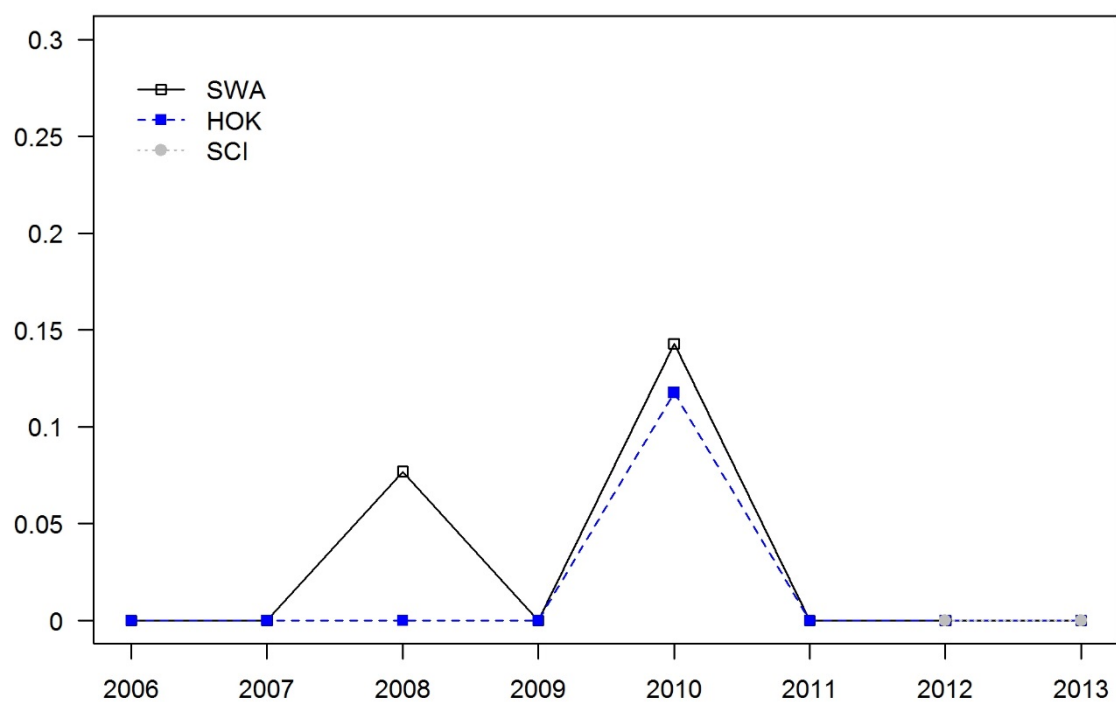
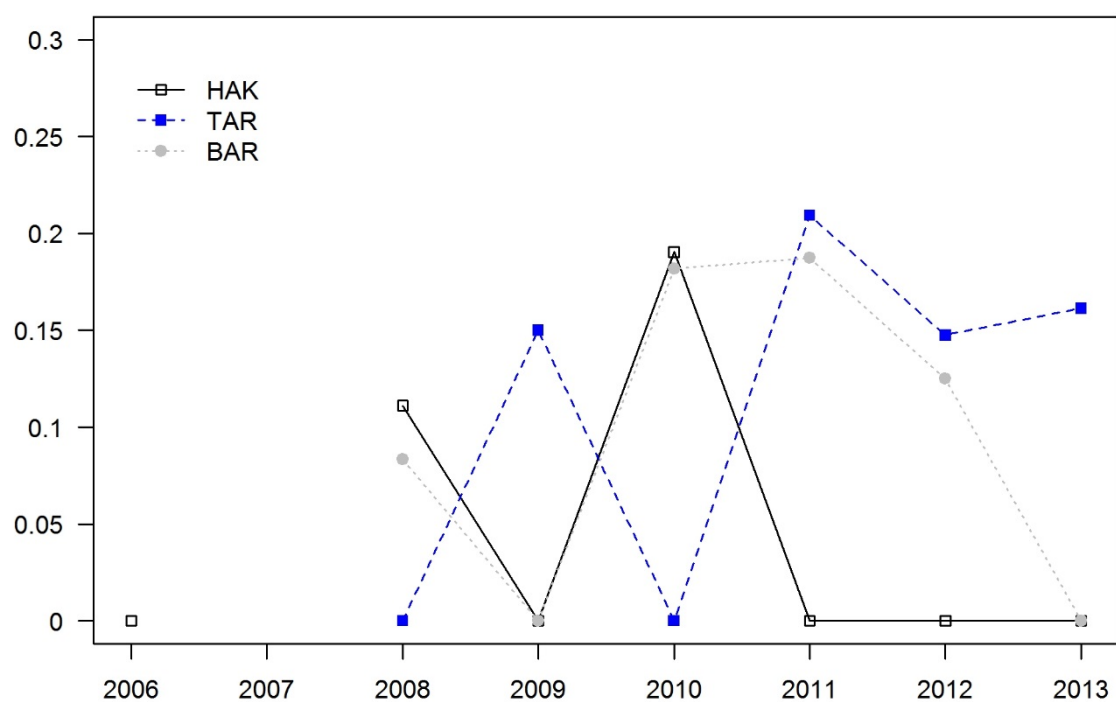


Figure C30: Proportion of effort strata that recorded no prawn killer catch by target species by fishing year.

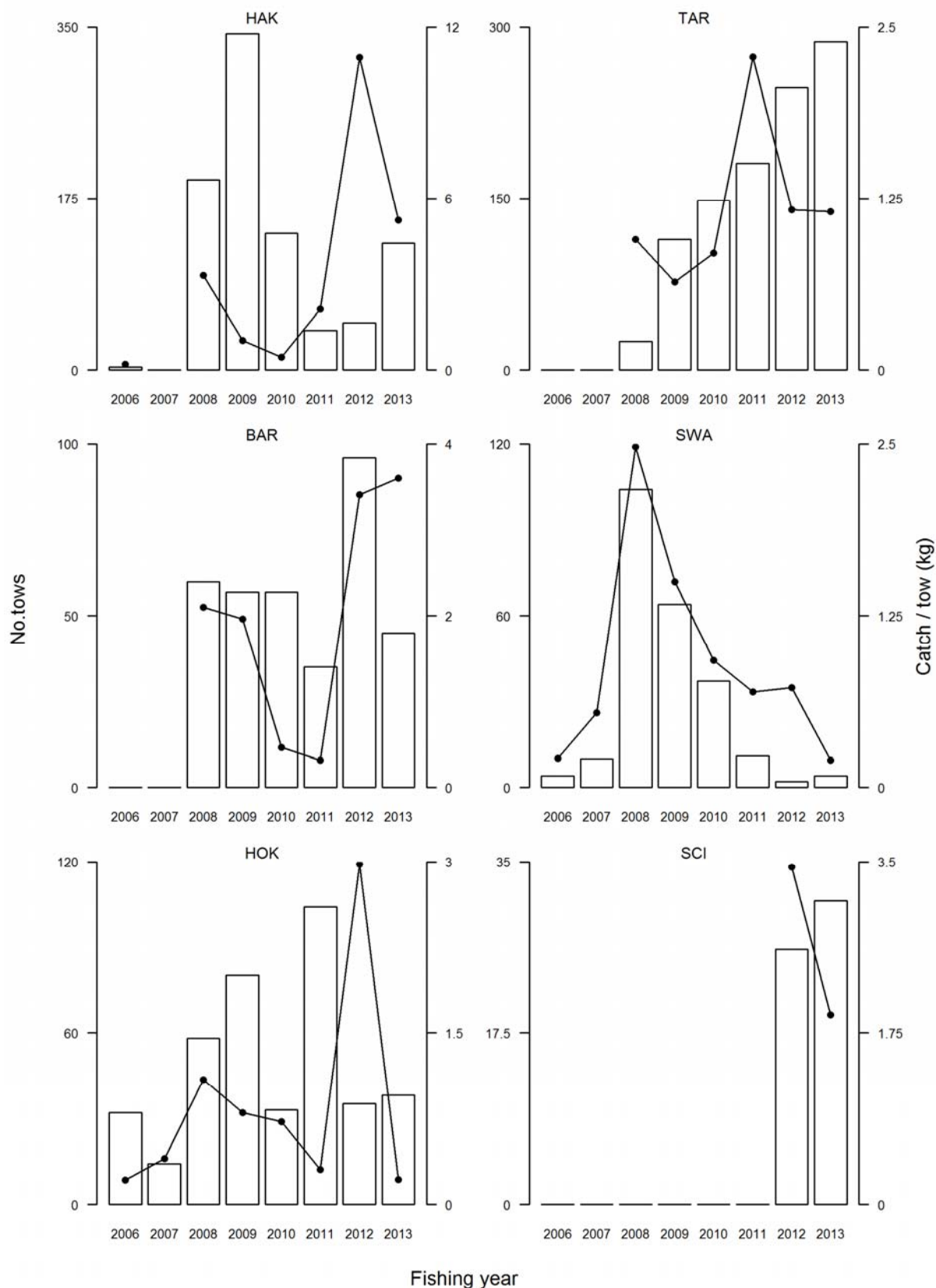


Figure C31: Unstandardised catch rates of prawn killer by target species (kg/tow) and the number of tows for the West coast South Island fishery by fishing year.

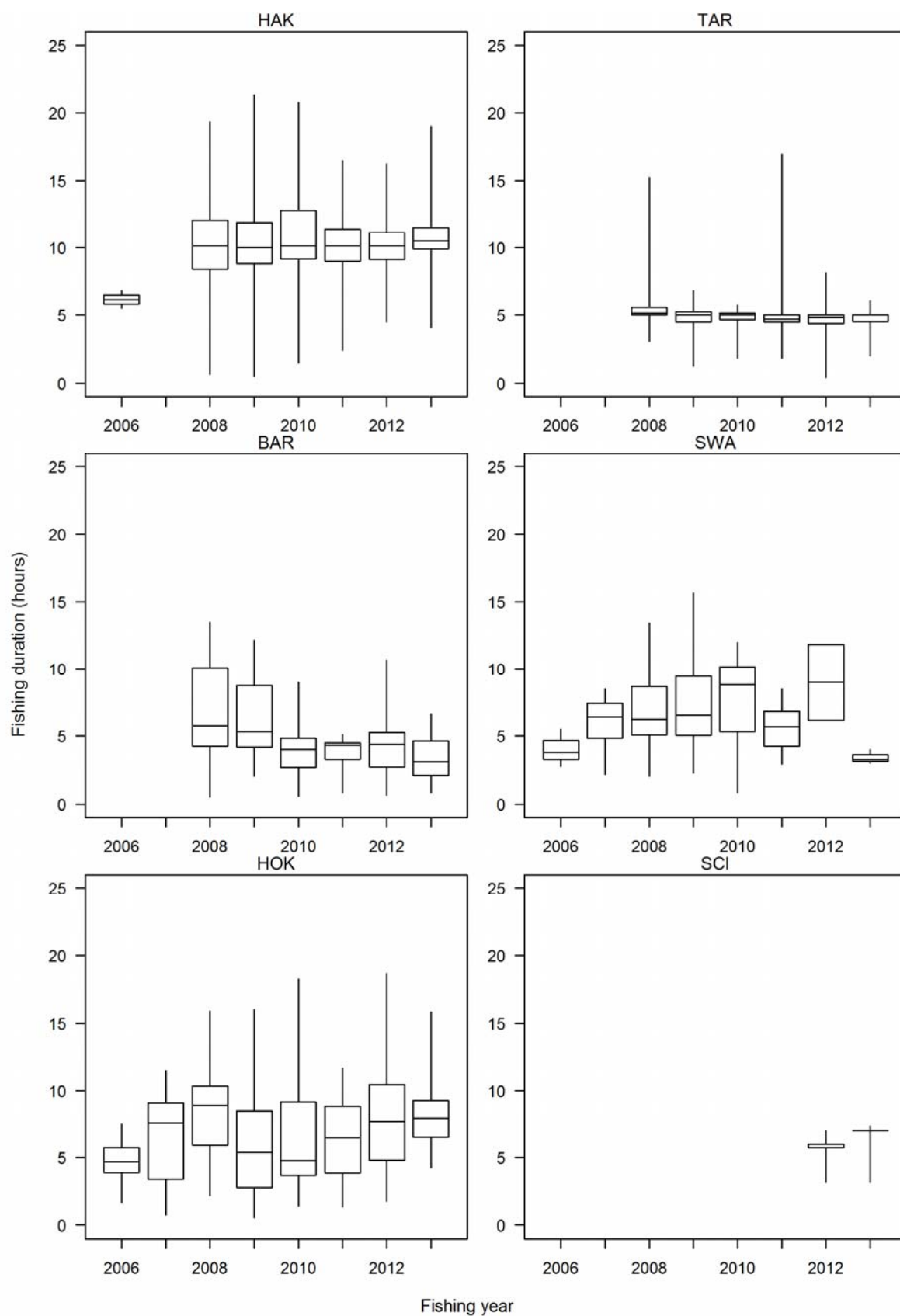


Figure C32: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for tow duration (hours) by target species for bottom trawl tows that caught prawn killer for the west coast South Island fishery.

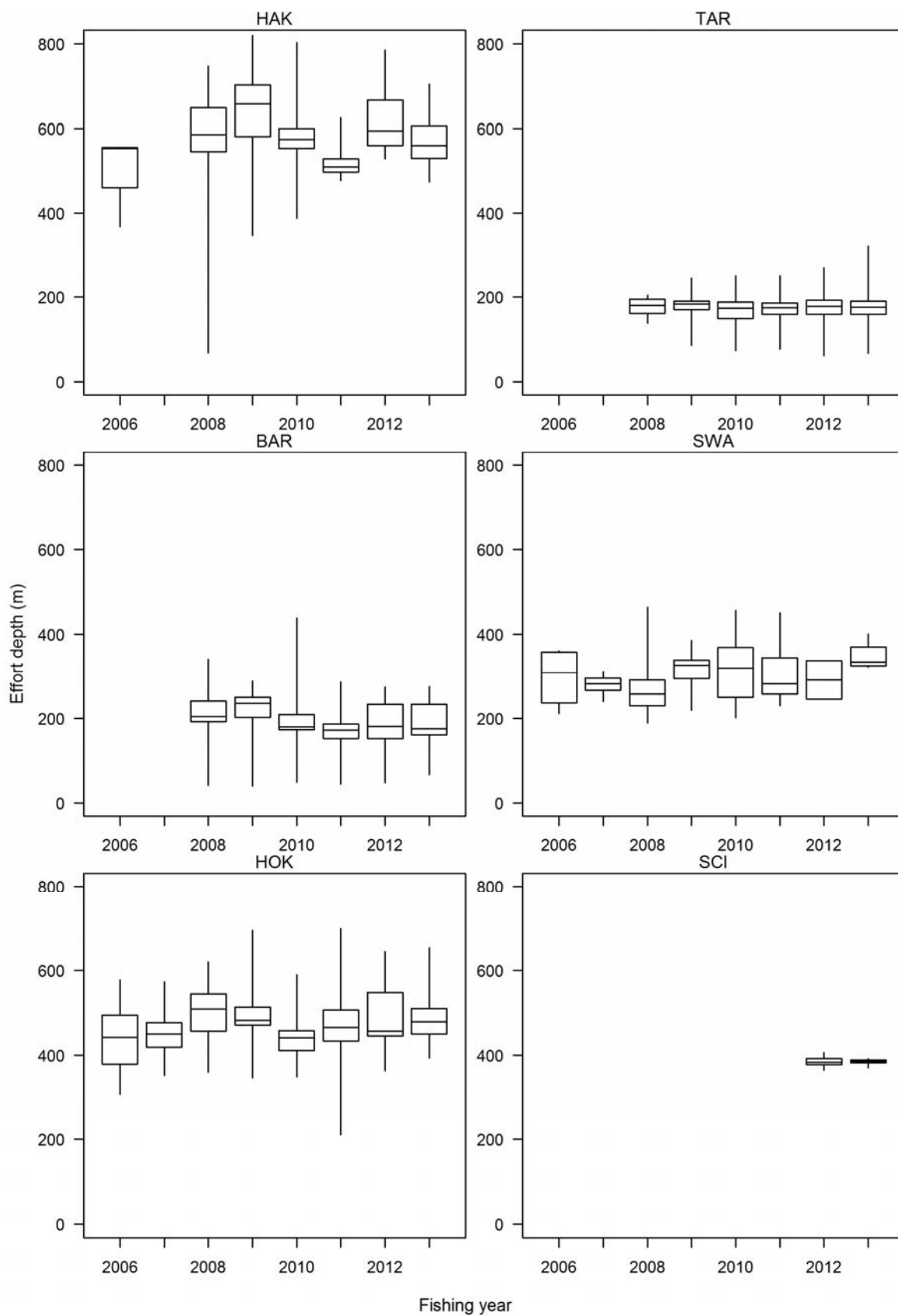


Figure C33: Annual median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for effort depth (metres) by target species for bottom trawl tows that caught prawn killer for the west coast South Island fishery.

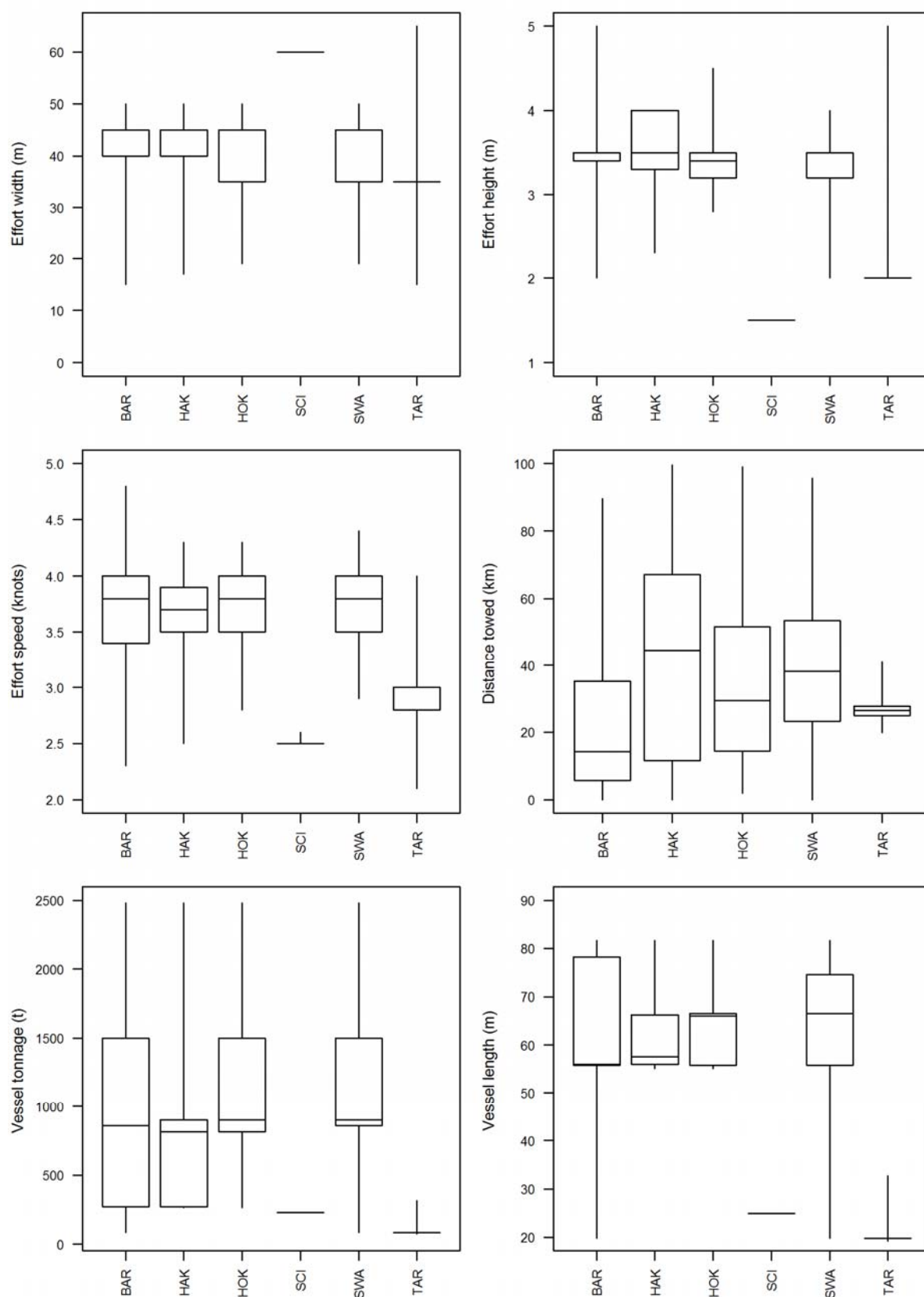


Figure C34: Median (horizontal line), inter-quartile ranges (box), and range (vertical lines) for other fishing effort variables and vessel characteristics by target species for the West coast South Island fishery for vessels that caught prawn killer.

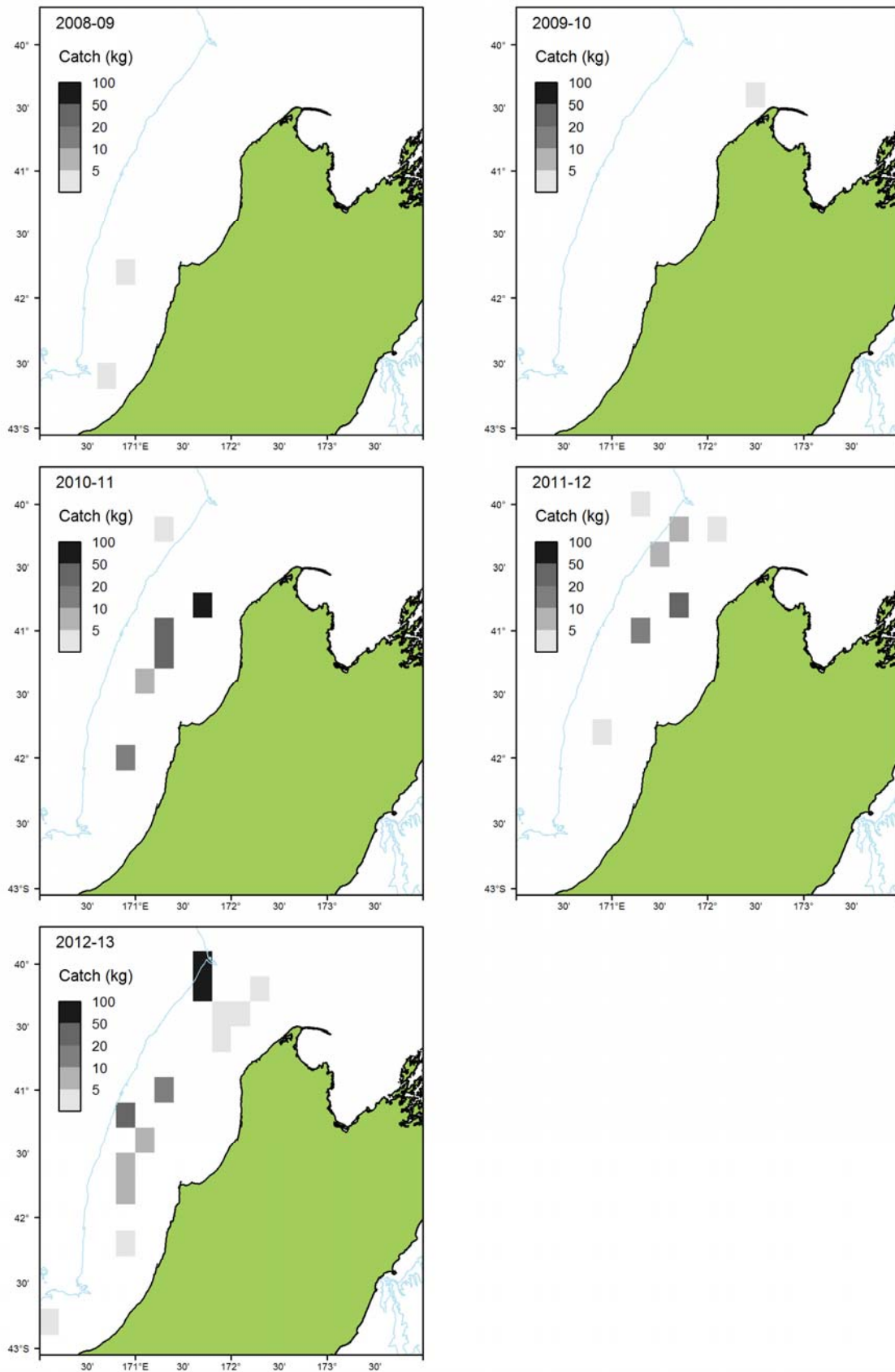


Figure C35: Distribution of estimated prawn killer trawl catch for the West coast South Island fishery aggregated into 0.2 degree spatial blocks for fishing years with available data (indicated in top right corner of each plot) for the TCEPR and TCER forms.