



Catches, size, and age structure of the 2012–13 hoki fishery, and a summary of input data used for the 2014 stock assessment

New Zealand Fisheries Assessment Report 2014/41

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ISSN 1179-5352 (online)
ISBN 978-0-478-43722-5 (online)

August 2014



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EXECUTIVE SUMMARY

Ballara, S.L.; O'Driscoll, R.L. (2014). Catches, size, and age structure of the 2012–13 hoki fishery, and a summary of input data used for the 2014 stock assessment.

New Zealand Fisheries Assessment Report 2014/41. 123 p.

This report summarises catches by area and presents the length and age structure of hoki caught commercially during the 2012–13 fishing year. Length frequency and catch-at-age data from spawning and non-spawning fisheries are compared with those from previous years. Biomass indices from research surveys and results from other research on hoki in the last year are also briefly described. Data in this report were incorporated in the hoki stock assessment in 2014.

The total reported hoki catch in 2012–13 was 131 575 t, 1575 t above the TACC of 130 000 t, and 1467 t higher than the catch in 2011–12. Catches in 2012–13 increased in the main spawning areas and decreased in the main non-spawning areas. The spawning catch on the west coast South Island (WCSI) increased by 1700 t to 56 200 t, and was the largest hoki fishery for the third consecutive season. The catch from Cook Strait increased by 3500 t to 19 400 t, and was at a similar level to that in 2006–07. The non-spawning fishery on the Chatham Rise was the second largest hoki fishery, with 36 500 t taken, about 2700 t less than in 2011–12, but similar to the Chatham Rise catch in the previous 7 years. The Sub-Antarctic catch decreased by 1600 t to 14 100 t in 2012–13. About 71 300 t of the total catch was taken from western stock areas in 2012–13 and 60 300 t was taken from eastern areas, consistent with the management targets of 70 000 t west and 60 000 t east.

Length and age frequencies from the commercial fishery show that most of the catch in 2012–13 was fish from 55 to 90 cm (mainly 2006–09 year-classes, aged 4–7 years). The percentage of small fish in the catch in 2012–13 decreased, mainly due to the lack of 3 year old hoki from the 2010 year-class. Most fish caught on the Chatham Rise in 2012–13 were less than 80 cm, and the largest hoki came from the WCSI, east coast South Island, Sub-Antarctic, and Cook Strait fisheries.

The relative biomass index for all hoki from the 2014 Chatham Rise trawl survey decreased by 18% from 2013, with a decrease of 27% in estimated biomass of recruited hoki (aged 3 and older). The estimate of the 2011 year-class (age 2+) was the one of the highest in the Chatham Rise time series, but the estimate from the 2012 year class (age 1+) was one of the lowest. The abundance index from the combined trawl and acoustic survey of the WCSI spawning grounds in 2013 was 13% lower than in 2012, while the acoustic index from Cook Strait was 20% higher than that from the previous survey in 2011.

1. INTRODUCTION

This report provides data relevant to the 2014 hoki stock assessment. Catch statistics and data from commercial sampling during the 2013–14 fishing year are presented and results from other research programmes since March 2013 are summarised. These include results of the trawl surveys of the Chatham Rise in January 2014, a combined trawl and acoustic survey of the west coast South Island (WCSI) in July–August 2013, and acoustic surveys of Cook Strait and the east coast South Island (ECSI) in July–September 2013. Details of model structure, results, and yield estimates from the hoki stock assessment carried out in 2014 will be published separately.

This report provides the final reporting requirement for Objective 2 of DEE2010-02HOKC and Objectives 1, 2 and 7 of MID2010-01D.

DEE2010-02HOKC Objective 2: Provide descriptive analysis of the hoki fishery in 2012–13 fishing year.

MID2010-01D Objective 1: To determine the age and size structure of the commercial catches of hoki in the main non-spawning fisheries from samples collected at sea by the Observer Programme in the 2012–13 year.

MID2010-01D Objective 2: To determine the catch-at-age of commercial catches of hoki from the WCSI and Cook Strait spawning fisheries from data collected by the Observer Programme and from other sources in the 2012–13 year.

MID2010-01D Objective 7: To determine the age and size structure of hoki from the trawl surveys.

1.1 Stock structure

The hoki catch is currently managed under a single TACC which can be caught in all areas of the EEZ, excluding QMA 10 (Fishstock HOK 1). However, since 1990 the Hoki Working Group has assessed hoki as two stocks, “eastern” and “western” (Annala (1990) and subsequent Plenary Reports). Hoki on the west coast of the North and South Islands and in the area south of New Zealand, including Puysegur Bank, Snares Shelf, and Campbell Plateau, are assumed to be one stock unit, the “western stock”. The east coast of the South Island, Mernoo Bank, Chatham Rise, Cook Strait, and the east coast of the North Island up to North Cape are assumed to contain the “eastern stock”. Immature hoki (2–4 years old) from both “stocks” occur together on the Chatham Rise.

Livingston (1997) reviewed the two-stock hypothesis originally adopted in 1990 (Livingston 1990) with respect to data collected in 1990–97, and concluded that this hypothesis was still a valid interpretation for hoki. Morphometric and ageing studies (Horn & Sullivan 1996, Livingston & Schofield 1996) have found consistent differences between adult hoki from the two main dispersed areas (Chatham Rise and Southern Plateau), and from the two main spawning grounds in Cook Strait and west coast South Island (WCSI). These differences demonstrate that there are two sub-populations of hoki. Whether they reflect genetic differences between the two sub-populations, or are the result of environmental differences between the Chatham Rise and Southern Plateau, is not known. The chemistry of otoliths from the WCSI and Cook Strait stocks is similar (Kalish et al. 1996), and no genetic differences were detected between spawning stocks (Smith et al. 1981, 1996).

From 2006 to 2007 (Francis 2007, 2008) and since 2012 (McKenzie 2013, in prep.), the hoki stock assessment model has had two variants which were associated with different stock structure hypotheses. The ‘base case’ hypothesis assumes natal fidelity: a fish that was spawned in one area will grow up to spawn in the same area (i.e., a fish is ‘eastern’ or ‘western’ from birth). The alternative hypothesis does not assume natal fidelity, so fish spawned in one area can themselves spawn in another area (i.e., a fish chooses to be ‘eastern’ or ‘western’ when it matures). Under both hypotheses, once a fish has spawned it shows site fidelity – it cannot change spawning grounds. All model runs from 2008–11 assumed natal

fidelity because of technical problems concerning the definition of unfished biomass without this assumption (Francis 2009, McKenzie 2013). These problems are now resolved and model runs which do not assume natal fidelity are currently included as a sensitivity (McKenzie in prep.).

Francis et al. (2011) described a pilot study, aimed at determining whether analyses of stable isotopes and trace elements in otoliths could be useful in testing stock structure hypotheses and the question of natal fidelity. However, none of the six trace elements or two stable isotopes considered unambiguously differentiated the two hoki stocks. Two earlier pilot studies appeared to provide weak support for the hypothesis of natal fidelity for the western and eastern spawning stocks. Smith et al. (2001) found significant differences in gill raker counts, and Hicks & Gilbert (2002) found significant differences in measurements of otolith zones between samples of 3 year-old hoki from the 1997 year-class caught on the WCSI and in Cook Strait. However, when additional year-classes were sampled, differences were not always detected (Hicks et al. 2003).

Horn (2011) reviewed the published literature on natal fidelity in relationship to management of hoki. He concluded that, because hoki are an off-shore species, widely dispersed in the non-spawning season, with multiple diffuse spawning areas, it is unlikely that hoki exhibit 100% natal fidelity. Even if natal fidelity is the preferred option for hoki from an evolutionary perspective, it is likely that some proportion of the population would stray routinely. An independent review of the hoki assessment model, commissioned by Ministry for Primary Industries in February 2014, noted that “the extents of natal fidelity are important to identify”, and recommended exploration of a range of model structures (Butterworth et al. 2014).

1.2 Description of the hoki fishery

Historically, the main fishery for hoki has operated from late June to late August on the WCSI where hoki aggregate to spawn. The spawning aggregations begin to concentrate in depths of 300–700 m around the Hokitika Canyon from late June, and further north off Westport later in the season. Fishing in these areas continues into September in some years. In 1988 another fishery developed on large spawning aggregations of hoki in Cook Strait. The spawning season in Cook Strait runs from late June to mid-September, peaking in July and August. Small catches of spawning hoki are taken from other grounds off the east coast of South Island (ECSI), and late in the season at Puysegur Bank. There are also anecdotal reports of spawning hoki being caught near the Snares Islands, Chatham Islands, and several other locations off the east coast of North Island (ECNI).

Outside the spawning season, when hoki disperse to their feeding grounds, substantial fisheries have developed since the early 1990s on the Chatham Rise and in the Sub-Antarctic. These fisheries usually operate in depths of 300–800 m. The Chatham Rise fishery generally has similar catches over all months except in July–September, when catches are lower due to the fishery moving to the spawning grounds. In the Sub-Antarctic, catches have typically peaked in April–June. Out-of-season catches are also taken from Cook Strait and ECNI, but these are small compared to spawning season catches.

From 1986 to 1990 surimi vessels dominated the catches and took about 60% of the annual WCSI catch. However, since 1991, the surimi component of catches has decreased and processing to head and gut or to fillet product has increased, as has “fresher” catch for shore processing. The hoki fishery now operates throughout the year, producing high quality fillet product from both spawning and non-spawning fisheries. Twin-trawl rigs have been used in some hoki fisheries since 1998, and trawls made of spectra twine (a high strength twine with reduced diameter resulting in reduced drag and improved fuel efficiencies) were introduced to some vessels in 2007–08.

The Hoki Fishery Management Company introduced a Code of Practice for hoki target trawling in 2001 with the aim of protecting small fish (less than 60 cm). The Code of Practice was replaced by Operational Procedures for Hoki Fisheries, implemented by the Deepwater Group from 1 October 2009. The Operational Procedures aim to manage and monitor fishing effort within four industry management areas, where there are

thought to be high abundance of juvenile hoki (Narrows Basin of Cook Strait, Canterbury Banks, Mernoo, and Puysegur). These areas are closed to hoki target trawling by vessels larger than 28 m, with increased monitoring when targeting species other than hoki. There is also a general recommendation that vessels move from areas where catches of juvenile hoki (now defined as less than 55 cm total length) comprise more than 20% of the hoki catch by number.

1.3 Catch history

The total annual catches of hoki within the EEZ from 1969 to 2012–13 are given in Tables 1 and 2. The hoki fishery was developed by Japanese and Soviet vessels in the early 1970s (Table 1). Catches increased to 100 000 t in 1977, but dropped to less than 10 000 t in 1978 when the 200 n. mile Exclusive Economic Zone (EEZ) was declared and a quota limit of 60 000 t was introduced (Figure 1). Hoki remained a relatively small fishery of up to 50 000 t a year until 1986, when the TACC was increased. The fishery expanded to an estimated catch in 1987–88 of about 255 000 t (Table 2). Reported annual catches ranged between 175 000 and 215 000 t from 1988–89 to 1995–96, increasing to 246 000 t in 1996–97, and peaking at 269 000 t in 1997–98, when the TACC was over-caught by 19 000 t. The TACC was reduced to 90 000 t in 2007–08 and catches declined accordingly (Table 2). The TACC has been increased in four steps since 2009–10 and catches have increased. The current TACC from 1 October 2013 is 150 000 t.

Catches by area since 1988–89 are given in Table 3 and Figure 2. The pattern of fishing has changed markedly since 1988–89 when over 90% of the total catch was taken in the WCSI spawning fishery. This has been due to a combination of TAC changes and redistribution of fishing effort. The catch from the WCSI declined steadily from 1988–89 to 1995–96, increased again to between 90 000 and 107 000 t from 1996–97 until 2001–02, then dropped sharply to a low of 20 500 t in 2008–09. The WCSI catch increased again to 36 400 t in 2009–10, to 48 300 t in 2010–11, to 54 500 t in 2011–12, and to 56 200 t in 2012–13. This was about 42% of the total hoki catch in 2012–13, making the WCSI the largest fishery in New Zealand for the three most recent years (Table 3). In Cook Strait, catches peaked at 67 000 t in 1995–96, declined to 14 900 t in 2010–11, and then increased to 15 900 t in 2011–12, and 19 400 t in 2012–13. Non-spawning catches on the Chatham Rise peaked at about 75 000 t in 1997–98 and 1998–99, then decreased to a low of 30 700 t in 2004–05, before increasing again to 39 000 t from 2008–09 to 2011–12, decreasing slightly to 36 500 t in 2012–13. The Chatham Rise was the largest hoki fishery from 2006–07 to 2009–10, but catches are now lower than those from the WCSI, contributing about 28% of the total hoki catch in 2012–13. Catches from the Sub-Antarctic peaked at over 30 000 t in 1999–00 to 2001–02, declined to a low of 6200 t in 2004–05 before increasing slowly to 15 000 t in 2011–12, and decreasing to 14 000 t in 2012–13. Catches from Puysegur decreased from 1300 t in 2012–13 to 950 t in 2012–13; ECSI increased from 2500 t to 3300 t; and ECNI increased from 900 t to 1000 t (Table 3).

From 1999–2000 to 2001–02, there was a redistribution in catch from eastern stock areas (Chatham Rise, ECSI, ECNI, and Cook Strait) to western stock areas (WCSI, Puysegur, and Sub-Antarctic) (Figure 2). This was initially due to industry initiatives to reduce the catch of small fish in the area of the Mernoo Bank, but from 1 October 2001 was part of an informal agreement with the Minister of Fisheries that 65% of the catch should be taken from the western fisheries to reduce pressure on the eastern stock. This agreement was removed following the 2003 hoki assessment in 2002–03, which indicated that the eastern hoki stock was less depleted than the western stock and effort was shifted back into eastern areas, particularly Cook Strait. From 2004–05 to 2006–07 there was a further agreement with the Minister that only 40% of the catch should be taken from western fisheries. From 1 October 2007 the target catch from the western fishing grounds was further reduced to 25 000 t within the overall TACC of 90 000 t. This target was exceeded in both 2007–08 and 2008–09, with about 30 000 t taken from western areas. In 2009–10, the target catch from the western fishing grounds was increased to 50 000 t within the overall TACC of 110 000 t, and catches were at about the industry-agreed catch split. The target catch from the western fishing grounds was further increased to 60 000 t in 2010–11 (within the overall TACC of 120 000 t), to 70 000 t in 2011–12 and 2012–13 (overall TACC of 130 000 t), and to 90 000 t in 2013–14 (overall TACC 150 000 t). The split between eastern and western catches has been within 2000 t of the management targets since 2011–12.

1.4 Recent hoki research

The importance of the hoki fishery and the complexity of the life cycle have resulted in a high level of research activity for over two decades. This was summarised in a recent book chapter (Livingston et al. in press). Research results presented in the past year are summarised here.

McKenzie (in prep.) reported the stock assessment carried out in 2013, using the Bayesian model developed in 2002 (Francis et al. 2003) and implemented in the general-purpose stock-assessment program CASAL (Bull et al. 2012). The Hoki Working Group agreed on three final model runs. In all final model runs the problem of the lack of old fish in both fishery-based and survey-based observations is dealt with by allowing natural mortality to be age dependent. In one of the final model runs it was assumed that the catchability for the Southern Plateau trawl surveys series was constant, whereas for the other two final runs, two catchabilities were fitted to this series instead of just one. For each model run with two catchabilities, two sensitivities were conducted: (1) using a domed spawning selectivity instead of allowing for an age varying natural mortality, and (2) not assuming natal fidelity (but assuming adult fidelity). Both the eastern and western hoki stocks are estimated to be increasing after reaching their lowest levels in about 2006. The western stock was estimated to be 45–65% B_0 and the eastern stock 50–57% B_0 . The western stock experienced an extended period of poor recruitment from 1995 to 2001 inclusive. However, recruitment has been near or above average since 2001, except for 2010 where it was below average, and 2011 where it was well above average (though estimated with high uncertainty) (McKenzie in prep.).

An independent review of the hoki assessment model was commissioned by Ministry for Primary Industries and carried out from 17–21 February 2014. The Review Panel concluded that in broad terms, the results from the hoki assessment model were satisfactory and robust in regard to resource status and trends (Butterworth et al. 2014). The Panel made 26 recommendations for future work to explore, document, and improve the assessment. Recommendations identified as urgent were addressed for the 2014 assessment. These were to continue to use two catchabilities for the Southern Plateau trawl survey series in final model runs and to produce diagnostics to show how different data components affect model trends. In addition, another high priority recommendation, to explore the influence of penalties on likelihood profiles, resulted in a change in the parameterization of year-class strength in 2014 (Andy McKenzie, NIWA, pers. comm.).

Work continues on the acoustic target strength (TS) of hoki. Recent Australian work on blue grenadier (Kloser et al. 2011) raised concern that New Zealand acoustic estimates based on the TS-length relationship of Macaulay (2006) may greatly overestimate hoki biomass. Target strength experiments on hoki using an acoustic-optical system (AOS) were carried out in July–August 2012 on the WCSI survey (O’Driscoll et al. 2014) in an attempt to reconcile the very large difference in TS estimates for hoki. Dunford et al. (in prep) estimated a new TS-length relationship based on a weighted non-linear least-squares fit to individual points in the combined Australian and New Zealand dataset. Data were derived from 86 optically verified hoki from 35–110 cm total length. Absolute estimates of abundance for Cook Strait were 40–47% of those obtained using the TS-length relationship of Macaulay (2006), but higher than those estimated from Kloser et al. (2011). Because the alternative TS-length relationships in equations have different slopes, there is potential to bias relative indices of abundance where the size of hoki varies between surveys. However, the length of hoki caught in Cook Strait and on the WCSI has been quite similar over the acoustic time-series, and the choice of the TS-length relationship has relatively little impact on relative acoustic indices.

New fisheries-independent estimates of hoki abundance since the 2013 hoki assessment were the trawl survey of the Chatham Rise in January 2014, a combined trawl and acoustic survey carried out on the WCSI in July–August 2013, and acoustic surveys of Cook Strait and the east coast South Island (ECSI) in July–September 2013. Results from these surveys are summarised in Section 3.1. The fishing industry

also collected acoustic data in four snapshots of the inner Hokitika Canyon between 29 May and 11 July 2013, before the start of the WCSI survey on 26 July (O’Driscoll 2014). Acoustic estimates of hoki abundance were low in May, but increased from late June, consistent with plateau model assumptions about hoki as a transient spawning population. Results from this survey did not change our interpretation of abundance indices used in the hoki assessment. However, data on the size distribution of the fish (see Section 2.2.1), show that the early season fishery in this area was dominated by very large hoki. It is not clear whether these large fish remain on the WCSI spawning grounds throughout July and August.

2. HOKI FISHERY, 2012–13

2.1 Catch and effort information

2.1.1 Total Allowable Commercial Catch (TACC) and other management controls

In the 2012–13 fishing year the TACC for HOK1 was 130 000 t. This TACC applied to all areas of the EEZ except the Kermadec FMA which had a TACC of 10 t. There was an agreement with the Minister for Primary Industries that no more than 70 000 t of the TACC should be taken from western stock areas.

Chartered vessels may not fish inside the 12-mile Territorial Sea and there are various vessel size restrictions around some parts of the coast. On the WCSI, a 25-mile line closes much of the hoki spawning area in the Hokitika Canyon and most of the area south to the Cook Canyon to vessels over 46 m overall length. In Cook Strait, the whole spawning area is closed to vessels over 46 m overall length.

2.1.2 Catch

The overall catch of 131 575 t was 1467 t higher than the catch in 2011–12 and about 1575 t higher than the TACC (see Table 2). The total estimated catch from catch-effort-and-landing-return (CELR), lining-catch-effort-return (LCER), net-catch-effort-and-landing-return (NCELR), trawl-catch-effort-return (TCER), lining-trip-catch-effort-return (LTCER), tuna-long-lining-catch-effort-return (TLCER), and trawl-catch-effort-and-processing-return (TCEPR) data was 127 962 t. As the data extraction was done in mid-December 2013, a small amount of data may still not have been entered into the database. As estimated catches did not match the total monthly harvest return (MHR) catch, estimated catches were scaled up to the MHR total catch of 131 575 t.

Relative to 2011–12, catches in 2012–13 increased in the main spawning areas and decreased in the main non-spawning areas (Figure 2a, Table 3). The WCSI was the largest fishery for the third consecutive year, with the catch increasing by 1700 t to 56 200 t in 2012–13. Catches inside the 25 n. mile line made up 11% of the total WCSI catch in 2012–13, a drop compared to 2011–12, and down from a peak of 41% of the catch in 2003–04 (Table A1a). The Chatham Rise was the second largest hoki fishery, with 36 500 t taken from this area in 2012–13. The catch from Cook Strait of 19 400 t was up by about 3500 t from that in 2011–12, and back to a similar catch level to 2006–07. The catch from the Sub-Antarctic of 14 100 t in 2012–13 was about 1600 t lower than in 2011–12 (see Table 3). Catches from Puysegur decreased by 350 t to 950 t, whereas catches from ECSI and ECNI increased by 780 t to 3300 t, and by 190 t to 1050 t, respectively. Overall, about 71 274 t of the total catch in 2012–13 was taken from western areas (Figure 2a), 1274 t above the level of the industry-agreed catch split.

Most hoki catch was recorded on the TCEPR form (124 200 t), with the WCSI and Cook Strait the only areas where a substantial amount of catch was recorded on the TCER form (Table A1, Figure 2b). Most hoki catch on the WCSI and in Cook Strait was taken by midwater trawling, whereas most catch was taken by bottom trawling on the Chatham Rise and Sub-Antarctic (Figure 2b).

Up until 2003–04 almost all of the hoki catch was from target hoki tows. Since then, hoki has remained the main target species, but hoki targeting decreased, especially on the Sub-Antarctic, WCSI and Chatham Rise, until 2008–09 when only 86% of the overall hoki catch was from tows targeting hoki (Figure 3). With the increases in TACC from 2009–10, hoki targeting has again increased, and in 2012–13, 95% of the overall catch was taken from hoki target tows (96% of the hoki catch on the WCSI, 83% on the Sub-Antarctic, and 97% on the Chatham Rise). Cook Strait has remained almost exclusively a hoki target fishery.

A high proportion of the hoki catch in 2012–13 was taken during the spawning season from June to September (Figure 4). Peak catches on the WCSI spawning grounds were in July and August, as in previous years (Figure 5), with most of the catch taken by mid-August. In Cook Strait, peak catches were from mid-July to mid-September, and about 4000 t was caught outside the spawning season (Figure 5). Fishing during the spawning season on the ECSI occurred mainly in August and September, and mainly in May and June at Puysegur (Figure 5). Outside the spawning season, most of the catch was taken from October 2012 to June 2013 on the Chatham Rise and in the Sub-Antarctic, with small amounts of catch taken over the rest of the year in these areas (see Figures 4 and 5). Small catches were taken year-round from the ECNI (Figures 4 and 5).

2.1.3 CPUE analysis

Unstandardised catch and effort from TCEPR data for the six largest hoki fisheries (WCSI, Cook Strait, Chatham Rise, ECSI, Sub-Antarctic, and Puysegur) are summarised in Appendix 1. Standardised CPUE analyses on tow-by-tow target hoki catches reported on TCEPR for the WCSI, Cook Strait, Chatham Rise, and Sub-Antarctic were also carried out (Appendix 1 and Figure 6). Catch rate analysis did not include data from CELR forms (which account for up to a third of the catch in some years in Cook Strait and some catch from the WCSI, but do not provide tow-by-tow effort data), the TCER forms (which have been in use for only five years), or from the LCER, LTCER, TLCER or NCELR forms. Standardised CPUE analyses using observer tow-by-tow target hoki catches for the WCSI, Cook Strait, Chatham Rise, and Sub-Antarctic were also carried out.

Standardised analyses were carried out only to explore trends in catch rate. CPUE indices are not believed to provide reliable estimates of hoki abundance and are not currently included in the hoki stock assessment (McKenzie in prep.). Changes in fleet structure (e.g., use of twin trawls), fishing practices (e.g., target fishing, use of escapement panels on smaller boats, incorrect recording of tow duration as some vessels leave the catch in the water until ready to process, changes in target bag size to reflect processing capacity of vessel and quality of fish product), and the reliability of gear parameters recorded on the fishing returns are problems for CPUE analyses. There are also other effects on catching ability that cannot be quantified, such as improvements or changes in net and bottom rig design, and electronic equipment,

A lognormal linear model was used for all standardised analysis models following Dunn (2002). A forward stepwise Generalised Linear Model (Chambers & Hastie 1991) implemented in R code (R Development Core Team 2013) was used to select variables in the model. *Fishing year* was forced into the model as the first term, and the algorithm added variables based on changes in residual deviance. The explanatory power of a particular model is described by the reduction in residual deviance relative to the null deviance defined by a simple intercept model. Variables were added to the model until an improvement of less than 1% of residual deviance explained was seen following inclusion of an additional variable. Variables were either categorical or continuous, with model fits to continuous variables being made as third-order polynomials, though a fourth-order polynomial was also offered to the models for duration. Categorical variables offered to the model included *vessel key*, *primary method*, *month*, *vessel experience* (number of years vessel in the fishery), *twin vessel* (true/false variable for a vessel that has used a twin trawl), *statistical area*; continuous variables included *fishing duration*, *fishing distance* (calculated from positions at start and end of tow), *distance 2* (calculated as *fishing duration* ×

speed), *start latitude*, *start longitude*, *start time*, *mid time* (mid time of tow), *depth of bottom*, *effort depth* (depth of net), *depth above bottom* (*depth of bottom* minus *effort depth*), *effort width* (wing spread), *day of season*, and *effort height* (headline height). As the WCSI dataset included both midwater and bottom tows, nested effects between *method* and *effort duration*, *effort depth*, *effort height*, *effort speed*, *depth above bottom* and *effort width* were used. The dependent variable was the log-transformed estimated catch per tow, with positive catches retained and zero hoki catches excluded.

A vessel variable was incorporated into the CPUE standardisation to allow for differences in fishing power between vessels. A subset of “core” vessels was chosen for each analysis, with vessels not involved in the fishery for a certain number of years (varied by analysis) and with a minimum level of annual effort excluded because they provided little information for the standardisations, which could result in model over-fitting (Francis 2001). TCEPR data were investigated for level of catch and effort for different years of vessel participation in the fishery, and the “core” vessels were defined as those which reported approximately 80% of positive hoki catches in the defined fishery. For observer data (where there were fewer tows), core vessels were defined as those that were in the fishery for at least two years, and contributed more than 35 observed tows.

The standardised indices were calculated using GLM, with associated standard errors. Indices were presented using the canonical form (Francis 1999) so that the year effects for an area were standardised to have a geometric mean of 1. The CVs represent the ratio of the standard error to the index. The 95% confidence intervals are also calculated for each index.

The influence of each variable accepted into the lognormal models was described by influence plots (Bentley et al. 2012). They show the combined effect of (a) the expected log catch for each level of the variable (model coefficients) and (b) the distribution of the levels of the variable in each year, and therefore describe the influence that the variable has on the unstandardised CPUE and which is accounted for by the standardisation.

Fits to the model were investigated using standard residual diagnostics. For each model, a plot of residuals against fitted values and a plot of residuals against quantiles of the standard normal distribution were produced to check for departures from the regression assumptions of homoscedasticity and normality of errors in log-space (i.e., log-normal errors).

Both TCEPR and observer data lognormal CPUE models were run. On the WCSI, models were run for midwater and bottom trawls targeting hoki, with sensitivities using tows targeting hoki and other species (“main target species”). Cook Strait models were for midwater tows that targeted hoki. For the Chatham Rise and ECSI, and Sub-Antarctic, CPUE models were run for bottom tows with either main target species or target hoki tows. Selected explanatory variables for target hoki runs are listed in Table 4.

Unstandardised catch rates for the WCSI are presented for both midwater and bottom trawls (Table A2). Midwater trawl catches accounted for 67% of the total spawning season catch on the WCSI in 2012–13. The unstandardised catch rate from all non-zero midwater tows in 2012–13 decreased slightly from 2011–12, but was the second highest in the series, with a median catch of 7.9 t per hour, and a median tow duration of 2.1 hours. Catch rates were higher for target hoki tows, and median tow duration lower. Catch rates in bottom trawls on the WCSI were lower than in midwater trawls, with a median catch rate of 2.3 t per hour for all non-zero hoki catches and 4.8 t per hour for target hoki tows. Median tow duration of bottom trawls decreased to 5.1 hours for all target species, and 3.5 hours for target hoki only tows, in 2012–13. From 1999–2000 to 2003–04, standardised catch rates from non-zero tows showed a similar decline to non-standardised catch rates. However, standardised indices have increased at a much higher rate than unstandardised indices since 2003–04 (Table A3–A4, Figure 6a). All WCSI datasets for TCEPR and observer data showed similar overall trends (Figure 6b).

Midwater trawl catches accounted for more than 99.9% of the spawning season catch of 11 597 t reported on TCEPR forms from Cook Strait in 2012–13. A further 4093 t of catch was reported on TCER forms (see Figure 2b). Non-standardised catch rates continued to be high in Cook Strait, with an increase in median catch rate to 17.5 t per hour in non-zero mid-water tows in 2012–13, and an decrease in median

tow duration to 0.7 hours (equivalent to a median catch of 12 t per tow). Overall the non-standardised catch rates showed a slight increase from 1989–90 to 2012–13, whereas standardised catch rates showed a flat trend (Table A3–A4, Figure 6). Catch rates in Cook Strait appear to reflect a fishing strategy where vessels limit the size of catches to maintain fish quality.

Over 96% of the Chatham Rise catch in 2012–13 was taken in bottom trawls, with most of the catch reported on TCEPR forms (see Figure 2b). There has been a general increase in tow duration on the Chatham Rise since the 1990s, with a median tow duration of 4.8 hour in 2012–13. The median non-standardised catch rate in bottom trawls on the Chatham Rise in 2012–13 of 1.2 t per hour was similar to the previous four years. The catch rate in hoki target trawls increased from 0.6 t per hour in 2002–03 to 1.7 t per hour in 2008–09, and has decreased slightly to 1.4 t per hour in 2012–13. Standardised catch rates generally decreased from 1991–92 to 2003–04, increased to 2008–09 and have levelled off with small ups and downs since then (Table A3–A4, Figure 6a). Similar trends were observed for all Chatham Rise data sets (Figure 6b).

Bottom trawl catches reported on TCEPR forms accounted for over 99% of the catch taken from the Sub-Antarctic in 2012–13 (see Figure 2b). Median tow duration in 2012–13 decreased slightly to 4.8 hours and non-standardised catch rates in bottom trawls remained the same as in 2011–12 at 0.5 t per hour. Catch rates for hoki target bottom trawls were much higher than those for all target trawls (1.5 t per hour in 2012–13) and were slightly higher than those on the Chatham Rise in 2012–13. Standardised catch rates generally decreased from 1996–97 to 2003–04 and have increased to much higher levels since (Figure 6a). Vessels targeting main species showed similar trends (Table A3–A4, Figure 6b), although observed vessels showed lower indices in 2011–12 and 2012–13.

Spawning season catches from the ECSI were mainly reported on TCEPR (see Figure 2b). Midwater tow target hoki catch rates in 2012–13 were 6.5 t per hour, and bottom tow catch rates were 2.4 t per hour. Spawning season catches from Puysegur were also mainly reported on TCEPR (see Figure 2b), with midwater and bottom tow target hoki catch rates in 2012–13 at 2.5 t and 3.0 t per hour respectively.

Standardised CPUE indices for WCSI, Chatham Rise, and Sub-Antarctic all showed overall similar trends: decreasing from 1991–92 to 2003–04 and increasing to 2012–13 (Figure 6b).

2.1.4 Bycatch

Estimates of bycatch in the hoki fishery were determined from data collected by Ministry for Primary Industries observers. For target hoki trawls, the observer data in 2012–13 represent about 45% of vessels, 16.6% of tows, and 24.1% of the total catch (Table 5). The bycatch rate (defined as the percentage of the hoki catch) was estimated for the main bycatch species by fishery in Table 6. Other bycatch species are also taken, particularly in the non-spawning fisheries, but bycatch rates for these species are usually less than 1%. Note that some of the apparent changes in bycatch rates may have been related to changes in observer coverage between years (e.g., Livingston et al. 2002), so the data should be treated with caution. As there have been changes in the proportion of hoki target catches (see Figure 3, Section 2.1.2), caution also needs to be exercised when interpreting the definition of the hoki target fishery. A more comprehensive analysis of catch and discards in the hoki, hake and ling fishery from 2000–01 to 2006–07 is provided by Ballara et al. (2010). Bycatch rates were also plotted by area for midwater and bottom tows (Figure 7).

Overall bycatch rates in the spawning areas in 2012–13 were generally low (less than 2%) for most species. On the WCSI, bycatch rates for hake (4.7%) and ling (2.6%) increased in 2012–13, silver warehou remained similar (0.5%), and spiny dogfish decreased (0.8%). As in the past, there was very little bycatch in Cook Strait, with spiny dogfish having the largest observed bycatch rate (0.6%).

In the non-spawning areas, bycatch rates in 2012–13 were also low for most species. On the Chatham Rise, ling (3.6%), hake (1.0%), silver warehou (3.1%), javelinfish (6.9%), and rattails (7.5%) showed increases in bycatch rates from 2011–12, whereas spiny dogfish (0.9%) showed a decrease. Of the main Sub-Antarctic bycatch species, bycatch rates decreased for hake (1.0%), ling (10.7%), southern blue whiting (0.2%), and white warehou (0.6%), but increased for silver warehou (3.7%), spiny dogfish (2.2%), rattails (2.1%), and javelinfish (3.2%).

2.2 Size and age composition of commercial catches

Data to estimate length frequencies in 2012–13 were available from the Ministry for Primary Industries' Observer Programme (OP). No shed sampling of landed hoki has been carried out since 2009–10. The industry observer programme formerly run by the Hoki Fishery Management Company (HMC) has been discontinued and no data have been provided since 2004–05.

Density plots of all commercial TCEPR and TCER trawls in which hoki was caught in 2012–13 are shown in Figure 8 with the observed position of all tows sampled for hoki length frequency distributions by the OP shown in the TCEPR plot. Hoki were measured by OP observers in 2335 tows (almost twice as many as in 2011–12 where 1192 were collected), of which 1035 came from the WCSI, 50 from Cook Strait, 656 from the Chatham Rise, 480 from the Sub-Antarctic, 46 from the ECSI, 23 from Puysegur, and none from ECNI and WCNI. Tables 7 and 8 describe observer trip timing in greater detail for the main areas sampled. In Cook Strait, 25 samples were also collected by a NIWA scientist on the FV *Thomas Harrison* during a hoki industry acoustic survey (O'Driscoll et al. in press).

Length frequencies were estimated for each of the major fisheries as the weighted (by the catch weight) average of individual length samples. Length frequency data from each area were post-stratified. Data from the WCSI were stratified by area (inside or outside 25 n. miles) and time. Length frequencies from outside the line in late May and June were split into weekly time periods and applied to the outside the line catch (Table 8). As there were 18 length frequencies from inside the line in late May and at the beginning of June, these samples were scaled up to June inside the line catch. Length frequencies from outside the line from July to September were split into weekly time periods throughout the season, although adjacent weeks were combined if there were fewer than 10 OP length samples available, and applied to the inside and outside the line catch as there were no length frequencies from inside the line for this period (Table 8).

Length frequencies from Cook Strait are normally stratified by month, island of landing, and vessel size. However, because of patchy OP coverage in 2013, Cook Strait stratification was by 1–3 month periods from May for small and large vessels (Table 8). A regression tree method (described below) was used to stratify the two non-spawning fishing areas.

Catch-at-age from spawning fisheries was estimated using age-length keys derived from otolith ageing. Otoliths were available from the OP and from WCSI 2013 trawl survey samples on *Tangaroa*. All available otoliths (643) from Cook Strait (164 OP samples, and 420 acoustic survey samples) and a sub-sample of 781 otoliths from the WCSI (601 trawl survey, and 180 OP samples) were selected, prepared, and read using the validated technique of Horn & Sullivan (1996) as modified by Cordue et al. (2000). The sub-sample was derived by randomly selecting a set number of otoliths from each of a series of 1 cm length bins covering the bulk of the catch and then systematically selecting additional otoliths to ensure that the tails of the length distribution were represented. The chosen sample sizes approximated those necessary to produce mean weighted CVs of less than 20% across all age classes, in each of the spawning areas.

Age-length keys were constructed for each spawning fishery and applied to the total length frequency to produce an age frequency for the catch of each sex separately. Catch-at-age estimates were determined using the 'catch.at.age' software (Bull & Dunn 2002). This software also incorporates data from otolith ring measurements using the consistency scoring method of Francis (2001) in the age-length key.

Catch-at-age in both the Chatham Rise and Sub-Antarctic fisheries was estimated by sampling directly for age. This continued the approach used since 1998–99 for the Chatham Rise (Francis 2002) and since 2000–01 for the Sub-Antarctic (Ballara et al. 2003). Sampling directly for age is necessary because a single age-length key is not appropriate in non-spawning fisheries. The fisheries are spread over much of the year and there will be substantial fish growth. This means that for any given length the proportions at age will change through the fishery. To sample directly for age, observer coverage must be sufficient to provide a random sample of otoliths from the fishery. Francis (2002) suggested that even a sample size of 1200 otoliths may not be sufficient to achieve a target CV of 0.20 in some years.

On the Chatham Rise in 2012–13, 1254 otoliths out of 6028 otoliths collected (including 2494 males, 3514 females, and 20 unsexed fish) from 611 tows were selected as follows:

1. Reject all otoliths from tows catching less than 1 t of hoki.
2. For tows catching between 1 t and 4 t of hoki, select at random 1 otolith from each tow.
3. For tows catching between 4 t and 6 t of hoki, select at random 2 otoliths from each tow.
4. For tows catching between 6 t and 8 t of hoki, select at random 3 otoliths from each tow.
5. For tows catching more than 8 t of hoki, select at random 4 otoliths from each tow.

On the Sub-Antarctic in 2012–13, 1240 otoliths out of 4141 otoliths collected (including 1982 males, 2146 females, and 13 unsexed fish) from 361 tows were selected as follows:

1. Reject all otoliths from tows catching less than 1 t of hoki.
2. For tows catching between 1 t and 2 t of hoki select at random 1 otolith from each tow.
3. For tows catching between 2 t and 6 t of hoki select at random 2 otoliths from each tow.
4. For tows catching between 6 t and 12 t of hoki select at random 3 otoliths from each tow.
5. For tows catching more than 12 t of hoki select at random 4 otoliths from each tow.

The method to estimate catch-at-age for the Chatham Rise and Sub-Antarctic followed that of Francis (2002) as modified by Smith (2005). First, the regression tree method (Breiman et al. 1984) was used to stratify the two fishing areas by minimising the weighted least squares of the mean lengths (as a proxy for age) of fish in the observed tows (see Smith (2005) for details). Next, the estimated age frequencies by sex for the observed tows within each stratum were obtained by scaling the otolith ages and sexes up by the estimated numbers of hoki of each sex caught in the tow and averaging over all tows in the stratum. Finally, the number of fish caught in each stratum was estimated from the TCEPR data, and catch-at-age frequencies were calculated as the weighted average, over the strata, of the estimated age frequencies by sex. Numbers of fish were estimated from catch weights using the length-weight relationship of Francis (2003).

Estimates of catch-at-age before 1999–2000 in the Sub-Antarctic and up to 1997–98 on the Chatham Rise were based on an optimised length frequency model (OLF) described in detail by Hicks et al. (2002).

2.2.1 Size and age composition in spawning fisheries

West coast South Island

Most of the 2013 catch from the WCSI fishery was dominated by larger fish from 60 to 100 cm (Figure 9) from the 2004–09 year-classes (ages 4–9) (Figure 10). The main length modes for female and male hoki were from 60–110 cm and 60–100 cm respectively (Figure 9), and were made up of hoki aged 4 (2009 year-class) and older. The 2010 year-class (Figures 9 and 10), at average length 60 cm, was poorly represented (Figures 9 and 10), but a mode centred on 50 cm represented fish from the 2011 year-class. A few small (30–35 cm) hoki from the 2012 year-class were also caught (Figures 9 and 10).

From 2000 to 2004, the sex ratio of the WCSI catch was highly skewed (Figure 11a), with many more females caught than males. In 2005–11, as the catch of younger fish increased, the sex ratio reversed with more males than females caught, and in 2012, the catch contained about 50% males and females (Figure 11a). In 2013 the percentage of males decreased to 45%. The percentage of hoki aged 7 and older in the WCSI catch declined steeply from 68% in 2003–04 to 16% in 2005–06, but has increased again to 49% in 2012–13 (Figure 11b). Conversely, the percentage of small fish (less than 65 cm, which is approximately

equivalent to ages 3 years and younger) by number in the WCSI catch increased from 20% in 2006–07 to 31% in 2008–09, then decreased again to 8% in 2012–13 (Figure 11b). Some of these small fish are spawning: 11% of the female fish less than 55 cm (i.e., mostly 2 year-olds from the 2011 year-class) were in spawning condition (ripe and running ripe), compared to 41% of all fish (Table 9). The spawning state of male hoki is not recorded by observers, but observations from research tows in other areas suggest that a higher proportion of small males than females would be mature.

Comparisons in previous years show that there were differences in the length frequencies from shed samples of hoki caught inside the 25 n. mile line and at-sea samples of fish outside this area in most years, with a higher proportion of larger fish (greater than 70 cm) from samples taken inside the line (Ballara & O’Driscoll 2014). In 2013, the observer data from inside the line in late May and early June had very large fish (Figure 12).

The overall mean length of hoki from the WCSI during the 2013 spawning season showed a decreasing trend for the females although the male trend was flat (Figure 13). The pattern of declining mean length over the spawning season used to be a common feature of the WCSI fishery, but was not observed between 1999 and 2006. The large difference between the mean lengths of males and females seen in catches from the 2004 and 2005 seasons was reduced in 2006–10 (Figure 13). The mean length at age for hoki aged from 3–10 years on the WCSI has increased since the start of the fishery, but may now be decreasing (Figure 14).

The OP data used to estimate catch-at-age was reasonably representative of the overall spatial, depth, and temporal distribution of the catch in 2012–13, although vessels less than 60 m were not well sampled (Figure 15).

Cook Strait

The length distribution of female hoki from Cook Strait in 2013 was unimodal: females were mainly from 60 to 110 cm, while males were 55–95 cm (see Figure 16). There was a broad age distribution of females from ages 4 to 13, while most males were ages 3–10 (see Figure 17). The modal ages were 4 and 6 (2009 and 2007 year-classes) for males and 8 (2005 year-class) for females (see Figure 17). Few female fish from the 2010 year-class (age 3) were caught in Cook Strait in 2013, and only 2.5% of the catch was fish less than 65 cm (see Figure 11b).

In 2013, the OP data used to estimate catch-at-age was reasonably representative of the overall spatial and depth distribution of the catch, but temporal coverage was poor for large vessels (Figure 18, see Table 8). For vessels larger than 40 m there were samples taken in May and early June, and in September, but the only samples during the main spawning period in July–August were collected by the NIWA scientist on the Cook Strait acoustic survey. Samples from vessels smaller than 40 m were collected in May, August and September (Figure 19).

Length frequencies by stratum showed that the size distribution of the catch was broadly similar, and for small vessels there were more males measured than females in July to September, whereas for the large vessels there were more females (Figure 20). The sex ratio of the Cook Strait catch has fluctuated over time, but was female dominated from 2001–05, and has been generally male-dominated since then (see Figure 11a). The apparent change in sex ratio may be related to a sampling bias, as there is some evidence that larger vessels catch a higher proportion of female hoki in Cook Strait (e.g., O’Driscoll 2012). There was no clear trend in the mean length of male hoki over the season, although females showed a slight decreasing trend from August (Figure 21). As on the WCSI, the mean length at age has increased over time in the Cook Strait fishery (Figure 22), although there is now a slight decreasing trend especially at ages 6 and 7.

The Cook Strait catch-at-age data for 2011–2013 were not used in the 2014 hoki stock assessment model as they were not considered representative of the commercial catch due to poor observer coverage and the rapidly changing sex ratio. The shore-based shed sampling programme for hoki from Cook Strait is likely to be reinstated in 2014.

Puysegur

In 2012–13, 23 samples were collected from Puysegur during the spawning season, and these were mainly fish of 45–100 cm (Figure 23). These fish have not been aged but are probably from the 2006–2009 year classes (larger mode) and the 2011 year class (smaller mode) present.

East coast South Island

In the 2013 spawning season 46 samples were collected from the ECSI. Fish from this area (Figure 24) showed a similar overall length distribution to the Chatham Rise distribution although without the smaller length modes less than 60 cm seen on the Chatham Rise and ECSI females had more larger fish (over 95 cm).

2.2.2 Size and age composition in non-spawning fisheries

Chatham Rise

About 97% of the commercial catch, 92% of length frequencies, and 96% of the available otoliths came from the hoki target fishery in 2012–13 (Figure 25). The remainder of otoliths were from tows targeting barracouta, hake, ling, sea perch, arrow squid, and silver warehou. The tree-based regression split the OP data from the Chatham Rise fishery into seven strata based on depth, longitude and date (Table 10). The mean length of hoki on the Chatham Rise was smaller in shallower water, earlier in the season, and to the west.

The length distribution of hoki from the Chatham Rise in 2012–13 was bimodal and similar for males and females (Figure 26). The catch was dominated by hoki of 40–90 cm from the 2007–09 year-classes (ages 3–5), with few fish from the 2010 year class (age 2+) and few larger, older fish caught (Figure 27). The modal age was 4+ (2008 year-class). More females than males were caught in 2012–13, with males comprising 43% of the catch (see Figure 11a). There was a lower proportion of large old fish (males and females) in the Chatham Rise than in other areas, with only 17% of the catch aged 7 years or older (see Figure 10b), and only 29% of these being male (see Figure 11a). About 30% of the catch by number was less than 65 cm in 2012–13, a large decrease from 2010–11 (53%), mainly due to the lack of 2+ fish in the catch (see Figure 11b).

The OP data used to estimate catch-at-age was reasonably representative of the overall spatial and temporal distribution of the catch in 2011–12 (Figure 28), although coverage was lower than ideal from February to April, and slightly under-sampled on the northern Chatham Rise (Figure 28).

Sub-Antarctic

About 83% of the commercial catch, 58% of length frequencies, and 78% of the available otoliths came from the hoki target fishery in 2012–13 (Figure 29). The remainder of otoliths were from tows targeting hake, ling, squid, silver warehou, or white warehou. The tree-based regression split the OP data from the Sub-Antarctic fishery into four strata based on depth and time (Table 10). Smaller fish were found on the Snares Shelf, especially in shallower water, and generally early on in the season.

The catch in 2012–13 consisted of a broad mode of large fish, mainly 60–105 cm (females) and 60–96 cm (males) (Figure 30). Catch-at-age estimates showed that the Sub-Antarctic catch, like that from the other

areas, consisted mainly of fish from the 2005–09 year-classes. The modal age of females and males was 4+ (2008 year-class). There was a higher proportion of old fish caught in the Sub-Antarctic than on the Chatham Rise (Figure 31) and the catch of fish less than 65 cm decreased markedly from 42% in 2009–10 to 8% in 2012–13 (see Figure 11b). About 48% of the fish caught in the Sub-Antarctic in 2012–13 were males (see Figure 11a).

The OP sampling in the Sub-Antarctic was reasonably representative of the overall spatial or temporal distribution of the catch (Figure 32), with good sampling in most months (see Table 7). Coverage was good on the Snares Shelf and to the east of the Auckland Islands, but lower in other areas.

Problems with estimation of catch-at-age in non-spawning fisheries

In addition to the problems associated with whether OP coverage is representative of the catch, there is an on-going problem with selection of otoliths. Observers collect otoliths from 10 fish out of the 50–150 sampled for length measurement (and otoliths from three fish in the spawning fisheries). As in previous years (e.g., Ballara et al. 2008), a rank sums test showed that the observers tended to select larger fish for extraction of otoliths from the Sub-Antarctic and Chatham Rise in 2012–13 (Figure 33). This introduces a bias into the age estimates which is difficult to correct. Electronic aids now being used to help observers take random samples for otoliths should have solved this problem.

2.2.3 Comparison of size and age composition between main areas

Length distributions from the main fisheries in 2012–13 are compared in Figure 34. The catch in all areas was dominated by fish from 55 to 90 cm (mainly 2006–09 year-classes, aged 4–7 years), with very few from the 2010 year class, hence the percentage of small fish in the catch in each area was lower (see Figure 11b). Most fish on the Chatham Rise were less than 80 cm. Large female fish (over 90 cm) were proportionately more abundant in Cook Strait, ECSI, Sub-Antarctic, and WCSI.

3. HOKI RESEARCH

3.1 Resource surveys

3.1.1 Trawl surveys

Chatham Rise

The twenty-third annual trawl survey of the Chatham Rise was completed between 2 and 26 January 2014, with 87 tows in the core 200–800 depth strata used for biomass estimation. The total biomass of all hoki in 2014 decreased by 18% to 101 900 t (Table 11). There was a 27% decrease in the biomass estimate for recruited hoki (3 years and older) from 72 100 t in 2012 to 52 900 t in 2014. The biomass estimate for age 2+ (2011 year-class) of 43 300 t was one of the highest estimates in time series, but not as strong as indicated at age 1+ in the 2013 survey. The estimate for age 1+ (2012 year-class) of 5 700 t was one of the lowest estimates in the series (Table 11).

Hoki size and age frequencies from the 2014 Chatham Rise survey showed a small peak of 1+ hoki (33–48 cm), were dominated by 2+ (48–54 cm) hoki, and had few larger 3+ fish (55–85 cm) (Figures 35 and 36).

The 2014 Chatham Rise trawl survey included additional deepwater strata from 800–1300 m. Some large hoki (typically longer than 80 cm) were caught deeper than the core survey boundary at 800 m, but the deepwater strata only contributed a small proportion (2.5%) of the total hoki biomass.

Sub-Antarctic

No Sub-Antarctic trawl survey was carried out in December 2013.

West Coast South Island

A second combined trawl and acoustic survey of the west coast South Island (WCSI) was carried out using *Tangaroa* from 26 July to 23 August 2013. This was the tenth in a series of acoustic surveys of WCSI hoki spawning areas, and also the third in a new time series of trawl estimates for middle depth species from the WCSI, with results that are comparable to the random trawl component from the 2000 and 2012 WCSI surveys.

A total of 65 successful random trawl survey tows were completed in the area north of Hokitika Canyon. The 2013 trawl abundance estimate for hoki was 14 184 t (CV 27 %). This was less than half of the abundance estimated from daytime random tows in the equivalent strata in the 2012 WCSI survey. The amount of variability in northern trawl estimates on the WCSI from 2000, 2012, and 2013 is not consistent with changes in WCSI acoustic indices over the same period, estimated hoki abundance from trawl surveys in the Sub-Antarctic (Bagley et al. 2014), or western spawning stock biomass estimated from the hoki assessment model (McKenzie in prep.). Trawl survey estimates of hoki biomass on the WCSI were not included in the 2014 hoki assessment.

Several modes were present in the hoki scaled length frequency from the 2013 WCSI survey (Figure 37) including small (1-year old) hoki at 25–37 cm. Most male hoki were between 40 and 80 cm, and most females were 40–100 cm. The modal age of hoki in the 2013 survey was age 2 years (2011 year-class) with few males older than age 7 and few females older than age 10 (Figure 38). Hoki were not aged from the 2000 survey.

3.1.2 Acoustic surveys

West coast South Island

As described above, a combined trawl and acoustic survey of spawning hoki abundance on the WCSI was carried out using *Tangaroa* from 26 July to 23 August 2013. Three acoustic snapshots of the area from Hokitika Canyon south and two snapshots north of Hokitika Canyon were completed, with 18 targeted tows to identify acoustic marks and collect biological samples. Acoustic estimates of hoki abundance were sensitive to the choice of hoki target strength, sound absorption, stratum areas, and the method used to correct for species composition in mixed marks. ‘Old’ acoustic estimates were calculated using the same methods as previous surveys in the time series, and gave an average abundance index across the snapshots of 357 000 t (Table 12). This was 13% lower than the equivalent acoustic index from 2012 and slightly below the long-term average of the time-series (Table 13). The acoustic survey weighting (expressed as a CV), which includes uncertainty associated with survey timing, sampling precision, mark identification, calibration, and target strength, was 35%.

Cook Strait

An acoustic survey of spawning hoki abundance in Cook Strait was carried out from the industry vessels *Thomas Harrison* and *Aukaha* from 21 July to 3 September 2013 (O’Driscoll et al in press). Nine acoustic snapshots of the main Cook Strait spawning grounds were completed. Acoustic data collection was supervised by vessel officers, but a NIWA staff member was on board *Thomas Harrison* for one trip from 5–16 August to direct mark identification trawling. During this trip, two acoustic snapshots were carried out, and biological data were collected from 25 trawls, including 8 mark identification tows and 17 commercial tows. Seven of the nine Cook Strait snapshots were carried out according to agreed protocols and met all the pre-survey criteria for estimating hoki abundance. Acoustic estimates of hoki abundance ranged from 233 000 t during 8–10 August to 666 000 t during 20–21 August, with an average estimate over the seven accepted snapshots of 377 000 t (Table 14). This was 20% higher than the equivalent estimate from 2011 (314 000 t) (Table 15). The survey weighting (CV) for the 2013 survey was 30%.

East coast South Island

A single snapshot, with 9 transects, was carried out from *Thomas Harrison* in Pegasus Canyon on 20 August 2013 (O’Driscoll et al. in press). The acoustic estimate was 134 000 t, which was mainly (80% of biomass) from hoki school marks. This result confirms that significant hoki spawning aggregations occur off the east coast South Island.

4. CONCLUSIONS

The total reported hoki catch in 2012–13 was 131 575 t, 1575 t above the TACC of 130 000 t, and 1467 t higher than the catch in 2011–12. Catches in 2012–13 increased in the main spawning areas and decreased in the main non-spawning areas. The WCSI was the largest hoki fishery for the third consecutive season, followed by the non-spawning fishery on the Chatham Rise

Length and age frequencies from the commercial fishery show that most of the catch in 2012–13 was fish from 55 to 90 cm (mainly 2006–09 year-classes, aged 4–7 years). The percentage of small fish in the catch in 2012–13 decreased, mainly due to the lack of 3 year old hoki from the 2010 year-class. Most fish caught on the Chatham Rise in 2012–13 were less than 80 cm, and the largest hoki came from the WCSI, east coast South Island, Sub-Antarctic, and Cook Strait fisheries.

The relative biomass index for all hoki from the 2014 Chatham Rise trawl survey decreased by 18% from 2013. The estimate of the 2011 year-class (age 2+) was the one of the highest in the Chatham Rise time series, but the estimate from the 2012 year class (age 1+) was one of the lowest. The abundance index from the combined trawl and acoustic survey of the WCSI spawning grounds in 2013 was 13% lower than in 2012, while the acoustic index from Cook Strait was 20% higher than that from the previous survey in 2011.

5. ACKNOWLEDGMENTS

This work was funded by Ministry for Primary Industries Research Projects MID2010-01D, and DEE2010-02HOKC. It also incorporates results from Ministry for Primary Industries Research Projects HOK2010-04C and HOK2010-05C. Thanks to the many scientific and industry staff who contributed to the collection and analysis of data used in this report. We especially thank Colin Sutton for otolith preparation, Peter Horn and Debbie Hulston for their ageing work. We also thank Peter Horn for reviewing this report.

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TABLES

Table 1: Reported trawl catches (t) from 1969 to 1987–88; 1969–83 by calendar year, 1983–84 to 1987–88 by fishing year (1 October to 30 September). Source, FSU data.

Year	U.S.S.R.	Japan	South Korea	New Zealand		Total
				Domestic	Chartered	
1969		95				95
1970		414				414
1971		411				411
1972	7 300	1 636				8 936
1973	3 900	4 758				8 658
1974	13 700	2 160		125		15 985
1975	36 300	4 748		62		41 110
1976	41 800	24 830		142		66 772
1977	33 500	54 168	9 865	217		97 750
1978*	2 028 ⁺	1 296	4 580	678		8 581
1979	4 007	8 550	1 178	2 395	7 970	24 100
1980	2 516	6 554		2 658	16 042	27 770
1981	2 718	9 141	2	5 284	15 657	32 802
1982	2 251	7 591		6 982	15 192	32 018
1983	3 853	7 748	137	7 706	20 697	40 141
1983–84	4 520	7 897	93	9 229	28 668	50 407
1984–85	1 547	6 807	35	7 213	28 068	43 670
1985–86	4 056	6 413	499	8 280	80 375	99 623
1986–87	1 845	4 107	6	8 091	153 222	167 271
1987–88	2 412	4 159	10	7 078	216 680	230 339

* Catches for foreign licensed and New Zealand chartered vessels from 1978 to 1984 are based on estimated catches from vessel logbooks. Few data are available for the first 3 months of 1978 because these vessels did not begin completing these logbooks until 1 April 1978.

+ Soviet hoki catches are taken from the estimated catch records and differ from official Ministry for Primary Industries statistics. Estimated catches are used because of the large amount of hoki converted to meal and not recorded as processed fish.

Table 2: Reported catch (t) from QMS¹, estimated catch (t) data, and TACC (t) for HOK 1 from 1986–87 to 2012–13. Estimated catches include TCEPR and CELR data (from 1989–90), LCER data (from 2003–04), NCELR data (from 2006–07), and TCER and LTCER data (from 2007–08).

Year	Estimated catch	Reported catch (MHR)		TACC
		Exclude HOKET	Include HOKET	
1986–87	175 000		158 171	250 000
1987–88	255 000		216 206	250 000
1988–89	210 000		208 500	250 000
1989–90	210 000		208 851	251 884
1990–91	215 000		212 720	201 897
1991–92	215 000		212 167	201 897
1992–93	195 000		191 994	202 155
1993–94	190 000		192 385	202 155
1994–95	168 000		176 787	220 350
1995–96	194 000		209 639	240 000
1996–97	230 000		246 756	250 000
1997–98	261 000		269 239	250 000
1998–99	234 000		244 528	250 000
1999–00	237 000		242 423	250 000
2000–01	230 625	229 858	229 862	250 000
2001–02	200 054	195 492	195 506	200 000
2002–03	182 560	184 659	184 668	200 000
2003–04	133 764	135 784	135 787	180 000
2004–05	102 885	104 364	106 189	100 000
2005–06	101 984	104 385	105 965	100 000
2006–07	97 790	101 009	102 861	100 000
2007–08	87 815	89 318	91 045	90 000
2008–09	87 598	88 805	89 475	90 000
2009–10	105 105	107 209	107 209	110 000
2010–11	115 782	118 805	118 805	120 000
2011–12	126 184	130 108	130 108	130 000
2012–13	127 962	131 575	132 618	130 000

1. Discrepancies between QMS data and estimated catches from 1986 to 1990 arose from incorrect surimi conversion factors. The estimated catch in those years was corrected from conversion factors measured each year by Ministry observers on the WCSI fishery. Since 1990 the current conversion factor of 5.8 has been used, and the total catch reported to the QMS is considered to be more representative of the true level of catch. From 2000–01 MHR catches have been shown including and excluding HOKET catches (catches outside the EEZ).

Table 3: Estimated total catch (t) of hoki by area¹, 1988–89 to 2012–13. Estimated (TCEPR and CELR) catches were scaled to reported (QMR or MHR) catch totals. Data also includes LCER (from 2003–04), and NCELR estimated data (from 2006–07), and TCER and LTCER data (from 2007–08).

Fishing Year	Spawning fisheries				Non-spawning fisheries					Total catch
	WCSI	Puysegur	Cook Strait	ECSI	Sub- Antarctic	Chatham Rise	WC ECNI	NI	Other ²	
1988–89	188 000	3 500	7 000	-	5 000	5 000	-	-	-	208 500
1989–90	165 000	8 000	14 000	-	10 000	13 000	-	-	-	210 000
1990–91	154 000	4 000	26 500	1 000	18 000	11 500	-	-	-	215 000
1991–92	105 000	5 000	25 000	500	34 000	45 500	-	-	-	215 000
1992–93	98 000	2 000	21 000	-	26 000	43 000	2 000	-	3 000	195 000
1993–94	113 000	2 000	37 000	-	12 000	24 000	2 000	-	1 000	191 000
1994–95	80 000	1 000	40 000	-	13 000	39 000	1 000	-	-	174 000
1995–96	73 000	3 000	67 000	1 000	12 000	49 000	3 000	-	2 000	210 000
1996–97	91 000	5 000	61 000	1 500	25 000	56 500	5 000	-	1 000	246 000
1997–98	107 000	2 000	53 000	1 000	24 000	75 000	4 000	-	3 000	269 000
1998–99	94 562	2 883	45 252	1 977	23 753	73 594	2 315	94	97	244 527
1999–00	102 721	2 880	43 192	2 351	33 772	56 014	1 387	98	4	242 419
2000–01	102 234	6 798	36 298	2 411	30 076	49 847	2 035	147	-	229 846
2001–02	92 716	5 322	23 976	2 971	30 175	39 151	1 147	39	-	195 497
2002–03	73 860	5 948	36 713	7 382	20 199	39 092	929	532	4	184 659
2003–04	45 112	1 158	41 034	2 140	11 635	33 650	880	126	-	135 735
2004–05	32 647	5 501	24 485	4 259	6 337	30 434	516	36	-	104 215
2005–06	38 281	1 457	21 405	653	6 961	34 944	673	8	-	104 382
2006–07	33 328	408	20 113	1 006	7 661	37 813	667	8	-	101 004
2007–08	20 928	308	18 470	2 323	8 708	37 920	640	19	-	89 316
2008–09	20 548	233	17 535	1 054	9 807	39 011	588	25	-	88 801
2009–10	36 349	272	17 880	669	12 275	39 138	618	7	-	107 208
2010–11	48 373	1 176	14 937	1 625	12 655	38 447	1 588	2	-	118 803
2011–12	54 531	1 308	15 859	2 531	15 743	39 246	858	31	-	130 107
2012–13	56 221	955	19 390	3 312	14 098	36 538	1 051	9	-	131 574

1 Estimated catches by area from TCEPR, CELR, LCER, NCELR, and TCER adjusted pro rata to the total reported (QMR or MHR) catches (excluding HOKET catches) in Table 2.

2 Area undefined because of missing positions or statistical areas.

- No catches

Table 4: Variables retained in order of decreasing explanatory value by each lognormal model for each area and the corresponding total R² value.

WCSI: TCEPR BT and MW tow-by-tow, target hoki

Variable	R-squared
Year	6.18
Day of year	16.87
Vessel	24.97
Mid time of tow	28.33

WCSI: Observer BT and MW catch for target hoki

Variable	R-squared
Year	6.50
Vessel	16.37
Day of year	24.64
Start time of tow	27.69

Cook Strait: TCEPR MW tow-by-tow, target hoki

Variable	R-squared
Year	1.99
Day of year	16.89
Vessel	22.55

Cook Strait: Observer MW catch for target hoki

Variable	R-squared
Year	3.83
Vessel	10.76
Day of year	15.28

Chatham Rise: TCEPR BT tow-by-tow, target hoki

Variable	R-squared
Year	9.81
Vessel	14.59
Start time of tow	17.82
Duration	20.77
Month	22

Chatham Rise: Observer BT catch for target hoki

Variable	R-squared
Year	12.10
Vessel	16.89
Duration	18.89
Start time of tow	21.34
Month	22.58

Sub-Antarctic: TCEPR BT tow-by-tow, target hoki

Variable	R-squared
Year	5.47
Start time of tow	10.97
Vessel	15.65
Month	19.50
Duration	22.08
Statistical area	23.72
Depth of bottom	24.77

Sub-Antarctic: Observer BT catch for target hoki

Variable	R-squared
Year	7.41
Mid time of tow	12.82
Vessel	17.63
Duration	20.67
Depth of net	22.94
Month	24.59
Statistical area	26.68

Table 5: Observer coverage 2012–13 by area, BT (bottom trawl), BPT (bottom pair trawl), MW (midwater tow), MPT (midwater pair trawl) trawl methods only. WCSI, Cook Strait and ECSI are for June to September only.

(a) All target species tows

Area	Number of vessels			Number of tows			Catch (t)		
	All	Observed	Percent	All	Observed	Percent	All	Observed	Percent
Chatham Rise	53	19	35.8	5 873	657	11.2	36 531	5 505	15.1
Cook Strait	27	3	11.1	1 224	31	2.5	15 260	445	2.9
ECNI	45	1	2.2	2 538	1	-	1 040	-	-
ECSI	17	4	23.5	272	46	16.9	3 305	894	27.1
Macquarie	1	1	100.0	3	1	33.3	-	-	-
Puysegur	20	13	65.0	179	43	24.0	955	322	33.7
Sub–Antarctic	36	26	72.2	2 845	482	16.9	14 098	3 564	25.3
WCNI	17	1	5.9	114	1	0.9	9	-	-
WCSI	39	18	46.2	3 907	1 025	26.2	55 321	20 833	37.7
All areas combined	104	34	32.7	18 626	2 335	12.5	131 549	32 153	24.4

(b) Target hoki tows

Area	Number of vessels			Number of tows			Catch (t)		
	All	Observed	Percent	All	Observed	Percent	All	Observed	Percent
Chatham Rise	26	16	61.5	4 333	606	14.0	35 284	5 222	14.8
Cook Strait	20	3	15.0	1 147	31	2.7	15 239	445	2.9
ECNI	16	1	6.2	392	1	0.3	704	-	-
ECSI	14	4	28.6	230	46	20.0	3 200	894	27.9
Macquarie	-	-	-	-	-	-	-	-	-
Puysegur	8	5	62.5	65	18	27.7	673	185	27.4
Sub–Antarctic	17	13	76.5	1 366	276	20.2	11 706	2 930	25.0
WCNI	1	1	100.0	3	1	33.3	-	-	-
WCSI	35	17	48.6	3 254	897	27.6	53 291	19 888	37.3
All areas combined	60	27	45.0	11 580	1 917	16.6	124 981	30 129	24.1

Table 6: Bycatch rates on vessels with Observer Programme observers in the hoki fishery for tows targeting hoki from 1990–91 to 2012–13. The WCSI, Cook Strait, and ECSI data cover the spawning season (June–September) only. -, less than 0.1 t (except for Cook Strait 1994–95 and 1996–97, Puysegur 1997–98 to 2008–09, and ECSI 2006–07 for which there are no observer data). Bycatch rates not calculated where observed hoki catch is less than 100 t. Species include: HAK, Hake; HOK, Hoki; JAV, Javelinfish; LIN, Ling; RAT, Rattails; SBW, Southern blue whiting; SPD, Spiny dogfish; SWA, Silver warehou, and WWA, White warehou.

(a) WCSI

Fishing year	Catch in t (% of hoki catch)				
	HOK	HAK	LIN	SWA	SPD
1990–91	28 670	1 574 (5.5)	243 (0.8)	465 (1.6)	43 (0.1)
1991–92	18 674	152 (0.8)	141 (0.8)	156 (0.8)	98 (0.5)
1992–93	19 095	370 (1.9)	182 (1.0)	138 (0.7)	56 (0.3)
1993–94	32 568	217 (0.7)	167 (0.5)	614 (1.9)	215 (0.7)
1994–95	25 721	840 (3.3)	221 (0.9)	162 (0.6)	192 (0.7)
1995–96	17 706	1 409 (8.0)	279 (1.6)	472 (2.7)	315 (1.8)
1996–97	14 283	648 (4.5)	131 (0.9)	422 (3.0)	59 (0.4)
1997–98	18 655	1 077 (5.8)	327 (1.8)	445 (2.4)	245 (1.3)
1998–99	17 428	1 026 (5.9)	290 (1.7)	220 (1.3)	219 (1.3)
1999–00	18 762	1 081 (5.8)	291 (1.6)	384 (2.0)	110 (0.6)
2000–01	16 433	514 (3.1)	262 (1.6)	295 (1.8)	82 (0.5)
2001–02	16 668	1 460 (8.8)	513 (3.1)	124 (0.7)	119 (0.7)
2002–03	10 191	528 (5.2)	191 (1.9)	96 (0.9)	41 (0.4)
2003–04	8 431	817 (9.7)	507 (6.0)	269 (3.2)	51 (0.6)
2004–05	7 178	344 (4.8)	281 (3.9)	99 (1.4)	38 (0.5)
2005–06	9 525	404 (4.2)	232 (2.4)	97 (1.0)	62 (0.7)
2006–07	9 785	112 (1.1)	79 (0.8)	80 (0.8)	30 (0.3)
2007–08	7 774	47 (0.6)	73 (0.9)	53 (0.7)	48 (0.6)
2008–09	9 418	84 (0.9)	88 (0.9)	68 (0.7)	32 (0.3)
2009–10	11 619	85 (0.7)	162 (1.4)	65 (0.6)	79 (0.7)
2010–11	9 556	231 (2.4)	189 (2.0)	99 (1.0)	61 (0.6)
2011–12	18 435	301 (1.6)	334 (1.8)	90 (0.5)	244 (1.3)
2012–13	31 844	1 512 (4.7)	821 (2.6)	145 (0.5)	249 (0.8)

(b) Cook Strait

Fishing year	Catch in t (% of hoki catch)				
	HOK	HAK	LIN	SWA	SPD
1992–93	107	- (-)	- (-)	- (-)	1 (0.9)
1993–94	495	- (-)	6 (1.2)	- (-)	1 (0.2)
1995–96	734	- (-)	2 (0.3)	- (-)	13 (1.8)
1997–98	3 435	- (-)	7 (0.2)	- (-)	55 (1.6)
1998–99	4 881	1 (-)	19 (0.4)	- (-)	97 (2.0)
1999–00	3 243	- (-)	10 (0.3)	- (-)	106 (3.3)
2000–01	4 361	- (-)	16 (0.4)	1 (-)	87 (2.0)
2001–02	2 032	- (-)	6 (0.3)	- (-)	45 (2.2)
2002–03	2 436	- (-)	6 (0.2)	- (-)	104 (4.3)
2003–04	2 486	- (-)	4 (0.2)	- (-)	39 (1.6)
2004–05	2 176	- (-)	4 (0.2)	2 (0.1)	38 (1.7)
2005–06	1 080	- (-)	2 (0.2)	- (-)	15 (1.4)
2006–07	2 124	- (-)	11 (0.5)	2 (0.1)	84 (4.0)
2007–08	3 437	- (-)	8 (0.2)	1 (-)	63 (1.8)
2008–09	2 290	- (-)	3 (0.1)	- (-)	27 (1.2)
2009–10	3 393	- (-)	5 (0.1)	- (-)	28 (0.8)
2010–11	1 637	- (-)	- (-)	2 (0.1)	13 (0.8)
2011–12	1 551	- (-)	4 (0.3)	7 (0.5)	27 (1.7)
2012–13	956	- (-)	3 (0.3)	- (-)	6 (0.6)

Table 6: continued.

(c) Puysegur

Fishing year	Catch in t (% of hoki catch)				
	HOK	HAK	LIN	SWA	SPD
1990–91	986	3 (0.3)	25 (2.5)	1 (0.1)	1 (0.1)
1991–92	1 025	27 (2.6)	431 (42.0)	2 (0.2)	4 (0.4)
1992–93	231	2 (0.9)	60 (26.0)	- (-)	- (-)
1993–94	938	- (-)	8 (0.9)	7 (0.7)	6 (0.6)
1994–95	226	- (-)	8 (3.5)	- (-)	- (-)
1995–96	719	2 (0.3)	33 (4.6)	3 (0.4)	2 (0.3)
1996–97	454	- (-)	6 (1.3)	3 (0.7)	3 (0.7)
1998–99	226	4 (1.8)	25 (11.1)	6 (2.7)	9 (4.0)
1999–00	369	- (-)	25 (6.8)	17 (4.6)	7 (1.9)
2000–01	573	5 (0.9)	18 (3.1)	211 (36.8)	6 (1.0)
2001–02	561	- (-)	20 (3.6)	34 (6.1)	1 (0.2)
2002–03	527	2 (0.4)	28 (5.3)	16 (3.0)	2 (0.4)
2003–04	549	- (-)	32 (5.8)	14 (2.6)	2 (0.4)
2004–05	1 237	1 (0.1)	20 (1.6)	1 (0.1)	11 (0.9)
2005–06	372	2 (0.5)	104 (28.0)	- (-)	1 (0.3)
2006–07	10	- (-)	4 (40.0)	- (-)	- (-)
2009–10	31	- (-)	- (-)	1 (3.2)	- (-)
2010–11	1	- (-)	- (-)	- (-)	- (-)
2011–12	301	6 (2.0)	19 (6.3)	5 (1.7)	- (-)
2012–13	231	3 (1.3)	14 (6.1)	9 (3.9)	- (-)

(d) Sub-Antarctic

Fishing year	Catch in t (% of hoki catch)									
	HOK	HAK	LIN	SWA	SPD	JAV	RAT	SBW	WWA	
1990–91	1 960	203 (10.4)	90 (4.6)	- (-)	3 (0.2)	16 (0.8)	14 (0.7)	1 (0.1)	3 (0.2)	
1991–92	3 562	332 (9.3)	249 (7.0)	9 (0.3)	15 (0.4)	47 (1.3)	39 (1.1)	6 (0.2)	35 (1.0)	
1992–93	3 468	676 (19.5)	252 (7.3)	5 (0.1)	10 (0.3)	30 (0.9)	21 (0.6)	- (-)	22 (0.6)	
1993–94	1 929	226 (11.7)	171 (8.9)	11 (0.6)	15 (0.8)	11 (0.6)	10 (0.5)	- (-)	5 (0.3)	
1994–95	882	24 (2.7)	64 (7.3)	- (-)	15 (1.7)	14 (1.6)	12 (1.4)	3 (0.3)	8 (0.9)	
1995–96	1 080	32 (3.0)	146 (13.5)	8 (0.7)	6 (0.6)	9 (0.8)	15 (1.4)	- (-)	22 (2.0)	
1996–97	717	10 (1.4)	25 (3.5)	1 (0.1)	- (-)	4 (0.6)	3 (0.4)	- (-)	- (-)	
1997–98	1 893	127 (6.7)	190 (10.0)	3 (0.2)	20 (1.1)	66 (3.5)	59 (3.1)	1 (0.1)	28 (1.5)	
1998–99	4 784	134 (2.8)	257 (5.4)	26 (0.5)	20 (0.4)	74 (1.5)	78 (1.6)	- (-)	18 (0.4)	
1999–00	5 470	213 (3.9)	340 (6.2)	162 (3.0)	47 (0.9)	186 (3.4)	65 (1.2)	5 (0.1)	25 (0.5)	
2000–01	4 286	99 (2.3)	439 (10.2)	237 (5.5)	58 (1.4)	78 (1.8)	50 (1.2)	9 (0.2)	26 (0.6)	
2001–02	3 908	154 (3.9)	194 (5.0)	35 (0.9)	97 (2.5)	308 (7.9)	94 (2.4)	35 (0.9)	27 (0.7)	
2002–03	2 032	83 (4.1)	373 (18.4)	22 (1.1)	81 (4.0)	99 (4.9)	47 (2.3)	21 (1.0)	20 (1.0)	
2003–04	781	37 (4.7)	326 (41.7)	54 (6.9)	171 (21.9)	36 (4.6)	16 (2.0)	16 (2.0)	14 (1.8)	
2004–05	391	24 (6.1)	189 (48.3)	5 (1.3)	6 (1.5)	71 (18.2)	15 (3.8)	1 (0.3)	10 (2.6)	
2005–06	1 172	14 (1.2)	118 (10.1)	68 (5.8)	63 (5.4)	29 (2.5)	14 (1.2)	- (-)	70 (6.0)	
2006–07	1 225	16 (1.3)	225 (18.4)	82 (6.7)	85 (6.9)	50 (4.1)	18 (1.5)	1 (0.1)	85 (6.9)	
2007–08	3 105	101 (3.3)	1 004 (32.3)	13 (0.4)	30 (1.0)	176 (5.7)	28 (0.9)	61 (2.0)	76 (2.4)	
2008–09	3 070	93 (3.0)	361 (11.8)	52 (1.7)	83 (2.7)	130 (4.2)	40 (1.3)	37 (1.2)	39 (1.3)	
2009–10	3 260	73 (2.2)	309 (9.5)	26 (0.8)	73 (2.2)	166 (5.1)	93 (2.9)	7 (0.2)	37 (1.1)	
2010–11	2 981	34 (1.1)	221 (7.4)	58 (1.9)	105 (3.5)	61 (2.0)	58 (1.9)	40 (1.3)	56 (1.9)	
2011–12	3 172	46 (1.5)	424 (13.4)	2 (0.1)	46 (1.5)	64 (2.0)	48 (1.5)	12 (0.4)	31 (1.0)	
2012–13	6 064	58 (1.0)	647 (10.7)	226 (3.7)	132 (2.2)	197 (3.2)	129 (2.1)	10 (0.2)	39 (0.6)	

Table 6: continued.

(e) Chatham Rise and ECSI (excluding ECSI from June–September).

Fishing year	Catch in t (% of hoki catch)								
	HOK	HAK	LIN	SWA	SPD	JAV	RAT	WWA	
1990–91	3 328	132 (4.0)	157 (4.7)	210 (6.3)	24 (0.7)	142 (4.3)	102 (3.1)	2 (0.1)	
1991–92	5 011	64 (1.3)	145 (2.9)	28 (0.6)	5 (0.1)	70 (1.4)	129 (2.6)	16 (0.3)	
1992–93	1 321	59 (4.5)	12 (0.9)	9 (0.7)	3 (0.2)	38 (2.9)	11 (0.8)	2 (0.2)	
1993–94	4 835	162 (3.4)	124 (2.6)	16 (0.3)	18 (0.4)	85 (1.8)	115 (2.4)	6 (0.1)	
1994–95	2 156	36 (1.7)	75 (3.5)	22 (1.0)	14 (0.6)	65 (3.0)	66 (3.1)	2 (0.1)	
1995–96	5 331	136 (2.6)	146 (2.7)	128 (2.4)	49 (0.9)	118 (2.2)	197 (3.7)	23 (0.4)	
1996–97	1 762	112 (6.4)	75 (4.3)	116 (6.6)	10 (0.6)	87 (4.9)	130 (7.4)	4 (0.2)	
1997–98	8 948	212 (2.4)	243 (2.7)	91 (1.0)	71 (0.8)	439 (4.9)	315 (3.5)	24 (0.3)	
1998–99	7 713	99 (1.3)	273 (3.5)	81 (1.1)	129 (1.7)	343 (4.4)	327 (4.2)	26 (0.3)	
1999–00	3 837	64 (1.7)	114 (3.0)	125 (3.3)	135 (3.5)	222 (5.8)	159 (4.1)	23 (0.6)	
2000–01	5 476	143 (2.6)	262 (4.8)	217 (4.0)	97 (1.8)	385 (7.0)	339 (6.2)	55 (1.0)	
2001–02	4 607	94 (2.0)	221 (4.8)	48 (1.0)	120 (2.6)	382 (8.3)	381 (8.3)	32 (0.7)	
2002–03	2 356	68 (2.9)	211 (9.0)	138 (5.9)	47 (2.0)	431 (18.3)	336 (14.3)	39 (1.7)	
2003–04	2 460	52 (2.1)	157 (6.4)	242 (9.8)	58 (2.4)	250 (10.2)	265 (10.8)	51 (2.1)	
2004–05	4 820	52 (1.1)	180 (3.7)	134 (2.8)	106 (2.2)	531 (11.0)	339 (7.0)	94 (2.0)	
2005–06	5 120	48 (0.9)	131 (2.6)	259 (5.1)	93 (1.8)	394 (7.7)	315 (6.2)	104 (2.0)	
2006–07	5 535	80 (1.4)	155 (2.8)	195 (3.5)	39 (0.7)	500 (9.0)	165 (3.0)	75 (1.4)	
2007–08	5 532	77 (1.4)	120 (2.2)	149 (2.7)	74 (1.3)	405 (7.3)	319 (5.8)	35 (0.6)	
2008–09	4 376	49 (1.1)	94 (2.1)	71 (1.6)	45 (1.0)	351 (8.0)	286 (6.5)	14 (0.3)	
2009–10	5 726	68 (1.2)	134 (2.3)	244 (4.3)	48 (0.8)	541 (9.4)	429 (7.5)	22 (0.4)	
2010–11	5 973	52 (0.9)	142 (2.4)	221 (3.7)	46 (0.8)	382 (6.4)	314 (5.3)	26 (0.4)	
2011–12	7 902	42 (0.5)	185 (2.3)	236 (3.0)	107 (1.4)	329 (4.2)	351 (4.4)	31 (0.4)	
2012–13	10 940	108 (1.0)	390 (3.6)	339 (3.1)	94 (0.9)	755 (6.9)	820 (7.5)	64 (0.6)	

(f) ECSI, June–September.

Fishing year	Catch in t (% of hoki catch)								
	HOK	HAK	LIN	SWA	SPD	JAV	RAT	WWA	
2000–01	5	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	
2001–02	97	- (-)	1 (1.0)	- (-)	- (-)	- (-)	1 (1.0)	- (-)	
2002–03	914	22 (2.4)	8 (0.9)	20 (2.2)	5 (0.5)	6 (0.7)	18 (2.0)	2 (0.2)	
2003–04	939	2 (0.2)	4 (0.4)	1 (0.1)	1 (0.1)	4 (0.4)	6 (0.6)	2 (0.2)	
2004–05	280	- (-)	1 (0.4)	- (-)	- (-)	1 (0.4)	2 (0.7)	- (-)	
2005–06	505	5 (1.0)	- (-)	35 (6.9)	1 (0.2)	1 (0.2)	3 (0.6)	- (-)	
2007–08	72	2 (2.8)	1 (1.4)	2 (2.8)	- (-)	2 (2.8)	9 (12.5)	2 (2.8)	
2008–09	311	- (-)	- (-)	- (-)	- (-)	- (-)	1 (0.3)	- (-)	
2009–10	41	- (-)	1 (2.4)	- (-)	- (-)	1 (2.4)	18 (43.9)	2 (4.9)	
2010–11	413	2 (0.5)	1 (0.2)	- (-)	- (-)	- (-)	4 (1.0)	2 (0.5)	
2011–12	355	1 (0.3)	1 (0.3)	10 (2.8)	- (-)	2 (0.6)	15 (4.2)	3 (0.8)	
2012–13	1 451	7 (0.5)	4 (0.3)	99 (6.8)	4 (0.3)	3 (0.2)	17 (1.2)	- (-)	

Table 7: Number of 2012–13 hoki length frequencies and otoliths by observer trips, target species, and monthly timing. Length frequencies with errors, missing data or outside the sample period (e.g. non-spawning in a spawning area) have been removed. Note: 11 length frequencies excluded as were from large vessels inside the 25 n.mile line, which may have position errors.

(a) WCSI observer samples

Trip	Month	Target species	Number of	
			Length frequencies	Otoliths
1	May/Jun	HOK	17	2
2	May/Jun	HAK/HOK	19	1
3	Jun	HOK	28	1
4	May/Jun	HAK/HOK	20	1
5	Jun/Jul	HOK	41	-
6	Jun	HOK	26	2
7	Jun	HOK	38	5
8	Jun	HOK	4	-
9	Jun/Jul	HAK/HOK	21	-
10	Jun/Jul	HAK/HOK	18	-
11	Jun/Jul	HAK/HOK	13	-
12	Jun/Jul	HAK/HOK	14	2
13	Jun/Jul	HOK	19	9
14	JunJulAug	HAK/HOK	34	2
15	Jun/Jul	HAK/HOK	26	2
16	Jul	HOK	19	-
17	Jul	HOK	15	4
18	Jul	HOK	39	24
19	Jul	HOK	25	1
20	Jul	HOK	12	1
21	Jul	HOK	18	2
22	Jul	HOK	16	-
23	Jul/Aug	HOK	55	17
24	Jul/Aug	HOK	26	-
25	Jul	HOK	13	-
26	Jul/Aug	HAK/HOK	14	1
27	Jul	HOK	17	-
28	Jul/Aug	HOK	19	-
29	Jul/Aug	HOK	32	20
30	Jul/Aug	HOK	40	21
31	Jul/Aug	HOK	32	-
32	Jul/Aug	HAK/HOK	34	5
33	Jul/Aug	HOK	29	3
34	Aug	HOK	15	-
35	Jul/Aug	HOK	16	1
36	Aug	HOK	9	-
37	Aug	HOK	16	4
38	Aug	HAK/HOK	17	-
39	Aug	HAK/HOK	15	2
40	Aug	HAK/HOK	17	13
41	Aug/Sep	HAK/HOK	22	-
42	Aug/Sep	HOK	22	-
43	Aug/Sep	HAK/HOK	20	25
44	Aug	HOK	4	9
45	Aug/Sep	HOK	19	-
46	Sep	HAK	4	-
47	Sep	HAK	9	-
48	Sep	HAK/HOK	11	-
49	Sep	HAK	5	-
50	Sep	HAK/HOK	9	-
51	Sep	HAK/HOK	12	-
TAN1308	-	-	-	601
Total	-	-	1035	781
		HAK(130), HOK(905)	(1017 outside, 18 inside)	

Table 7: continued.

(b) Cook Strait observer samples. Note: 25 length frequencies and 420 otoliths were also collected in Cook Strait during an acoustic survey in August by a NIWA scientist.

Trip	Month	Target species	Number of	
			Length frequencies	Otoliths
1	May	HOK	5	12
2	May/Jun	HOK	16	74
3	Jul/Sep	HOK	14	10
4	Jul/Sep	HOK	9	68
5	Sep	HOK	6	-
Total	-	-	50	164

Table 7: continued.

(c) Chatham Rise and ECSI observer data; Chatham Rise includes ECSI non-spawning data.

Trip	Month	Target species	Number of length frequencies		Number of otoliths
			Chatham Rise	ECSI spawning	
1	Oct	SWA	1	-	-
2	Oct/Nov	HOK/SWA	7	-	12
3	Oct/Nov	HOK	40	-	94
4	Oct	HOK/SWA	2	-	-
5	Oct/Nov	HAK/HOK/SWA	9	-	16
6	Oct	HOK	13	-	32
7	Oct	HOK	2	-	4
8	Oct/Nov	HOK/SWA	16	-	40
9	Nov	SWA	3	-	2
10	Oct/Nov/Dec	HOK/WWA	60	-	137
11	Dec	HOK	29	-	51
12	Nov/Dec	HOK	8	-	18
13	Nov/Dec	HOK	18	-	-
14	Nov/Jan	BAR/HOK/LIN	16	-	23
15	Dec/Jan	HOK	9	-	21
16	Nov/Jan	HOK/SQU	12	-	12
17	Nov/Jan	HOK/SWA	6	-	10
18	Nov/Dec	HOK/SWA	11	-	25
19	Dec/Jan	HOK	29	-	48
20	Jan	HOK	1	-	3
21	Dec/Jan	HOK/SWA	36	-	54
22	Jan	HOK	16	-	38
23	Jan	HOK	5	-	12
24	Jan	HOK	3	-	4
25	Jan	HOK/SPE	17	-	36
26	Jan	HOK	4	-	12
27	Feb	BAR	2	-	2
28	Feb	BAR	2	-	-
29	Jan	HOK	1	-	2
30	Jan/Feb	HOK/WWA	49	-	95
31	Feb	BAR	3	-	1
32	Feb	BAR	4	-	1
33	Mar	BAR	4	-	-
34	Mar	BAR	1	-	-
35	Mar	HOK	3	-	5
36	Apr	HOK	1	-	2
37	Apr/May/Jun	HOK	64	-	102
38	May/Jun	HOK	89	-	171
39	Jun	HOK	18	-	43
40	Jun	HOK	1	-	3
41	Jun	BAR/HOK/LIN	3	-	2
42	May	HAK/HOK	5	-	-
43	Jul	HOK	7	1	20
44	Sep	HOK	2	12	5
45	Aug	HOK	-	1	-
46	Aug	HOK	-	2	-
47	Sep	HAK/HOK	10	30	32
48	Sep	HOK	4	-	12
49	Sep	LIN	1	-	-
50	Sep	HAK/HOK	10	-	23
Total	-	-	657	46	1225

Table 7: continued.**(d) Sub-Antarctic observer data**

Trip	Month	Target species	Number of	
			Length frequencies	Otoliths
1	Oct	HOK/SWA	2	-
2	Oct	SBW	3	-
3	Oct	SBW	1	-
4	Oct	HAK/WWA	4	4
5	Oct/Nov	BOE/LIN	14	3
6	Nov	HOK	2	2
7	Nov	HOK	8	30
8	Nov	HAK/WWA	9	22
9	Nov	LIN	1	2
10	Nov	HOK	10	38
11	Nov	HOK/LIN	10	-
12	Dec/Jan	HOK/SQU/SWA	8	20
13	Nov/Dec/Jan	HOK/SQU/SWA	17	36
14	Dec/Jan	SQU/SWA	9	30
15	Nov/Dec	HOK/SWA	8	20
16	Dec	SWA	3	10
17	Nov/Dec/Jan	HAK/SQU/WWA	26	29
18	Dec	HOK/LIN/SWA	11	35
19	Dec	SWA/WWA	4	12
20	Dec	HOK/LIN	3	5
21	Jan/Feb	SQU/SWA	2	2
22	Jan/Feb	HOK/SQU	4	12
23	Jan	HOK	1	5
24	Jan	SQU	1	2
25	Jan/Feb	HOK/SQU	5	4
26	Jan/Feb	HOK/SQU	7	22
27	Feb	SQU	4	-
28	Jan	SQU	1	-
29	Jan	SQU	1	5
30	Feb	SQU	1	-
31	Feb	HAK/SQU/SWA	7	11
32	Feb	SQU	1	-
33	Mar	SQU	3	1
34	Mar	SQU	2	-
35	Mar	SQU	3	-
36	Mar/Apr	HOK/SWA	44	160
37	Mar	SQU/SWA	2	4
38	Mar	SQU	1	-
39	Mar/Apr	HOK	2	10
40	Mar	SQU	2	-
41	Mar	SQU	1	-
42	Mar/Apr	SQU/WWA	4	8
43	Apr	SQU	2	2
44	Apr	SQU	2	2
45	Apr	SQU	1	-
46	Apr	SQU	1	1
47	Apr	SQU	3	3
48	Apr	SQU	2	-
49	Apr/May	HOK	62	245
50	Jun	SQU	1	2
51	May	SQU	1	2
52	May	SWA	1	5
53	May/Jun	HOK	35	119
54	May/Jun	SCI	8	-
55	May	SQU/WWA	2	2
56	May	SQU	1	1
57	Jun	SCI	1	-
58	May/Jun	HOK	35	122
59	Jun	HOK	26	102
60	Jun	HOK	7	5
61	Jul	LIN/WWA	6	19
62	Sep	SBW	12	-
63	Sep	HOK/LIN	7	27
64	Sep	SBW	1	-
65	Sep	SBW	2	-
66	Sep	SBW	8	-
67	Sep	HOK	1	-
Total	-	-	480	1203

Table 8: Stratification for the 2013 WCSI and Cook Strait length frequencies.

(a) Number of WCSI hoki length frequency data and catch by week from inside and outside the 25 n. mile line.

Week	Date	Number of length frequencies		Catch (t)	
		Inside	Outside	Inside	Outside
18	18–20 May	3	-	2.5	0.1
19	21–27 May	7	-	8.1	4.3
20	28 May–3 Jun	7	20	176.2	2.6
21	4–10 Jun	-	42	336.1	21.8
22	11–17 Jun	-	63	544.5	272.6
23	18–24 Jun	-	58	244.2	792.6
24	25 Jun–1 Jul	-	65	775.6	1158.3
25	2–8 Jul	-	62	970.9	973.9
26	9–15 Jul	-	101	826.0	1350.0
27	16–22 Jul	-	103	512.3	2456.2
28	23–29 Jul	-	130	1045.9	5242.8
29	30 Jul–5 Aug	-	121	486.5	5276.6
30	6–12 Aug	-	68	456.2	6737.8
31	13–19 Aug	-	44	300.3	7128.9
32	20–26 Aug	-	38	106.5	5948.4
33	27 Aug–2 Sep	-	46	76.7	3588.3
34	3–9 Sep	-	20	5.1	3276.7
35	10–16 Sep	-	20	68.5	2948.4
36	17–23 Sep	-	16	0.1	1576.0
37	24–30 Sep	-	1	0.3	460.8

(b) Stratification of WCSI hoki fishery length frequency data.

Stratum	Length frequencies		Description	Catch (t)
	Description	Number		
1	18–29 May; Inside line	10	18–29 May; Inside line	512.4
2	28 May–3 Jun; Inside line	7	28 May–30 Jun; Inside line	3361.2
3	28 May–3 Jun; Outside line	20	28 May–3 Jun; Outside line	297.0
4	4–10 Jun; Outside line	42	4–10 Jun; Outside line	792.6
5	11–17 Jun; Outside line	63	11–17 Jun; Outside line	1158.3
6	18–24 Jun; Outside line	58	18–24 Jun; Outside line	973.9
7	25 Jun–1 Jul; Outside line	65	25 Jun–1 Jul; Outside line	1350.0
8	2–8 Jul; Outside line	62	2–8 Jul	2968.5
9	9–15 Jul; Outside line	101	9–15 Jul	6288.7
10	16–22 Jul; Outside line	103	16–22 Jul	5763.1
11	23–29 Jul; Outside line	130	23–29 Jul	7193.9
12	30 Jul–5 Aug; Outside line	121	30 Jul–5 Aug	7429.3
13	6–12 Aug; Outside line	68	6–12 Aug	6054.9
14	13–19 Aug; Outside line	44	13–19 Aug	3665.0
15	20–26 Aug; Outside line	39	20–26 Aug	3281.8
16	27 Aug–2 Sep; Outside line	46	27 Aug–2 Sep	3016.9
17	3–9 Sep; Outside line	20	3–9 Sep	1576.1
18	10–16 Sep; Outside line	20	10–16 Sep	461.1
19	17–30 Sep; Outside line	16	17–30 Sep	40.8

Table 8: continued.

(c) Cook Strait 2013 hoki length frequency data and catch by month and vessel size

Data set	Stratum	Month					Total
		May	Jun	Jul	Aug	Sep	
Catches (t)	Nelson/Picton vessel <30 m	1	291	1483	1985	318	4077
	Nelson/Picton vessel 30–40m	260	-	-	26	81	367
	Nelson/Picton vessel >40 m	611	1 330	2 323	4 053	1 953	10 271
	Wellington	-	39	122	379	247	787
Observer samples	Nelson/Picton vessel <30 m	-	-	-	6	17	23
	Nelson/Picton vessel 30–40m	5	-	-	-	-	5
	Nelson/Picton vessel >40 m	14	2	-	-	6	22

(d) Cook Strait 2013 stratification

Stratum	Vessel size	Date range	Stratum	Number of samples	
			Catch (t)	Market	Observer
1	< 40 m	May–Jun	589.4	-	5
2	< 40 m	Jul–Sep	4701.8	-	23
3	≥ 40m	May–Jun	1941.6	-	16
4*	≥ 40m	Jul–Aug	6663.1	-	25
5	≥ 40m	Sep	2235.2	-	6

* Thomas Harrison samples taken during acoustic survey by NIWA scientist

Table 9: Percentage of female hoki by observer stages on the WCSI for female fish less than or equal to 55 cm (n = 1757) and female fish greater than 55 cm (n = 55 927) for the 2013 spawning season.

	Females ≤ 55 cm	Females > 55 cm
Immature and resting	48.8	8.3
Ripening	39.0	43.0
Ripe	8.5	30.7
Running ripe	2.3	10.6
Spent	1.2	7.5

Table 10: Strata for the 2012–13 non spawning fisheries based on the tree regression of all data (Observer Programme only), with comparison of the TCEPR, Observer Programme (OP), and otolith data by stratum. The catch for OP is the total catch for the observed tows.

(a) Chatham Rise

Stratum	Depth of net	Longitude	Splitting variable		Mean length (cm)
			Dates		
1	< 573.5 m	< 179.1°	12 Feb–7 Aug		65.0
2	< 453 m	< 179.1°	1 Oct – 11 Feb		63.9
3	453–573.5 m	< 179.1°	1 Oct – 11 Feb		69.9
4	< 573.5 m	< 179.1°	8 Aug – 30 Sep		74.3
5	< 573.5 m	≥ 179.1°			73.3
6	> 573.5 m	< 175.1°			68.9
7	> 573.5 m	≥ 175.1°			78.2

(a) Chatham Rise, continued.

Stratum	Hoki catch (t)		No. of tows sampled		No. of otoliths	No. of fish Measured
	TCEPR	OP	TCEPR	OP		
	1	11 477.3	1 338.4	1 694		
2	1 750.7	262.8	484	54	64	4 646
3	11 075.9	2 125.3	1 471	250	462	26 190
4	1 352.4	399.3	199	25	65	2 873
5	4 075.8	348.3	841	50	83	4 773
6	1 889.8	170.8	372	25	30	2 439
7	4 907.9	757.7	806	92	161	10 017

(b) Sub-Antarctic

Stratum	Splitting variables		Mean length (cm)	Hoki catch (t)		No. of tows sampled		No. of otoliths	No. of fish Measured
	Depth of net	Dates		TCEPR	OP	TCEPR	OP		
							R		
1	< 573.5	1 Oct 2012 – 4 Mar 2013	66.8	2 044	722	619	145	264	9 475
2	< 573.5	5 Mar 2013 – 30 Sep 2013	73.5	3 524	1 254	823	173	403	12 562
3	573.5–696.8	-	78.9	5 730	1 264	990	129	391	10 994
4	>696.8	-	88.0	2 779	322	374	33	92	2 960

Table 11: Relative biomass estimates of hoki on the Chatham Rise from *Tangaroa* trawl surveys, January 1992–2014. The CV is the coefficient of variation as % (in parentheses).

Survey	+ hoki			2+ hoki			3++ hoki		Total hoki	
	Year-class	'000 t	CV	Year-class	'000 t	CV	'000 t	CV	'000 t	CV
1992	1990	2.8	(28)	1989	1.2	(18)	116.1	(8)	120.2	(10)
1993	1991	32.9	(33)	1990	2.6	(25)	150.1	(9)	185.6	(10)
1994	1992	14.6	(20)	1991	44.7	(18)	86.2	(9)	145.6	(10)
1995	1993	6.6	(13)	1992	44.9	(11)	69.0	(9)	120.4	(8)
1996	1994	27.6	(24)	1993	15.0	(13)	106.6	(10)	152.8	(10)
1997	1995	3.2	(40)	1994	62.7	(12)	92.1	(8)	158.0	(8)
1998	1996	4.5	(33)	1995	6.9	(18)	75.6	(11)	86.7	(11)
1999	1997	25.6	(30)	1996	16.5	(19)	67.0	(10)	109.1	(12)
2000	1998	14.4	(32)	1997	28.2	(21)	29.1	(9)	71.7	(12)
2001	1999	0.4	(75)	1998	24.2	(18)	35.7	(9)	60.3	(10)
2002	2000	22.4	(26)	1999	1.2	(21)	50.7	(12)	74.4	(11)
2003	2001	0.5	(46)	2000	27.2	(15)	20.4	(9)	52.6	(9)
2004	2002	14.4	(33)	2001	5.4	(20)	32.8	(13)	52.7	(13)
2005	2003	17.5	(23)	2002	45.8	(16)	21.2	(11)	84.6	(12)
2006	2004	25.9	(22)	2003	33.6	(19)	39.7	(10)	99.2	(11)
2007	2005	9.1	(28)	2004	32.6	(13)	28.8	(9)	70.5	(8)
2008	2006	15.8	(32)	2005	23.8	(15)	37.2	(8)	76.9	(11)
2009	2007	25.2	(29)	2006	65.2	(17)	53.7	(8)	144.1	(11)
2010	2008	19.3	(31)	2007	28.6	(15)	49.6	(16)	97.5	(15)
2011	2009	26.9	(37)	2008	28.3	(14)	40.7	(8)	93.9	(14)
2012	2010	2.6	(30)	2009	29.1	(17)	55.9	(8)	87.5	(10)
2013	2011	50.9	(25)	2010	1.0	(44)	72.1	(13)	124.1	(15)
2014	2012	5.7	(36.6)	2011	43.3	(14.2)	52.9	(10.9)	101.9	(9.8)

Table 12: Hoki acoustic abundance estimates from the 2013 WCSI by snapshot and stratum using the ‘old’ analysis method (see O’Driscoll et al. (in prep) for details).

Snapshot	Biomass (‘000 t)							CV (%)
	12	4	5A	5B	6	7	Total	
1	43	69	96	64	66	10	349	19
2	130	32	47	81	92	23	404	28
3	–	–	66	27	65	24	181	15
Mean	86	50	70	57	74	19	357	13

Table 13: Acoustic abundance indices for WCSI. Indices were calculated using ‘old’ method, with revised estimates of CV for 2000–12 (see O’Driscoll et al. (in prep) for details).

Year	Biomass (‘000 t)	CV
1988	417	0.60
1989	249	0.38
1990	255	0.40
1991	341	0.73
1992	345	0.49
1993	549	0.38
1997	655	0.60
2000	397	0.28
2012	412	0.34
2013	357	0.35

Table 14: Hoki acoustic abundance estimates from the 2013 Cook Strait survey by snapshot and stratum.

Snapshot	Stratum biomass (‘000 t)							Total (‘000 t)	Snapshot CV
	1	2	3	5A	5B	6	6		
1	39	314	4	15	16	6	395	19	
2	29	184	5	18	18	9	263	12	
3	39	323	5	18	17	9	412	14	
4	27	316	8	28	22	4	404	64	
5	41	145	4	19	14	9	233	19	
6*	15	142	6	14	16	5	197	28	
7	19	590	6	23	19	9	666	53	
8	39	167	4	26	11	20	267	28	
9*	10	115	8	14	10	0	157	43	
Mean	33	291	5	21	17	10	377	17	

* Snapshots 6 and 9 were not included in the mean as they did not meet all survey criteria.

Table 15: Acoustic indices of hoki abundance for Cook Strait 1988–2013. Biomass values use an average ratio of hoki TS to fish weight (calculated from the mean of annual values estimated using Macaulay (2006) TS).

Year	No of snapshots	Biomass ('000 t)	CV
1991	4	191	0.41
1993	4	614	0.52
1994	3	597	0.91
1995	4	411	0.61
1996	5	196	0.57
1997	6	303	0.40
1998	5	170	0.44
1999	6	245	0.36
2001	11	218	0.30
2002	9	308	0.35
2003	9	222	0.34
2005	9	125	0.32
2006	7	128	0.34
2007*	4	225	0.46
2008	7	179	0.30
2009*	5	359	0.39
2011*	6	298	0.35
2013*	7	353	0.30

* Surveys from industry vessels. Indices from 2007, 2009, and 2011 were re-calculated in 2013 to correct for a bug in the conversion program and inconsistencies in the estimation of calibration parameters (see O'Driscoll et al. (in press) for details).

FIGURES

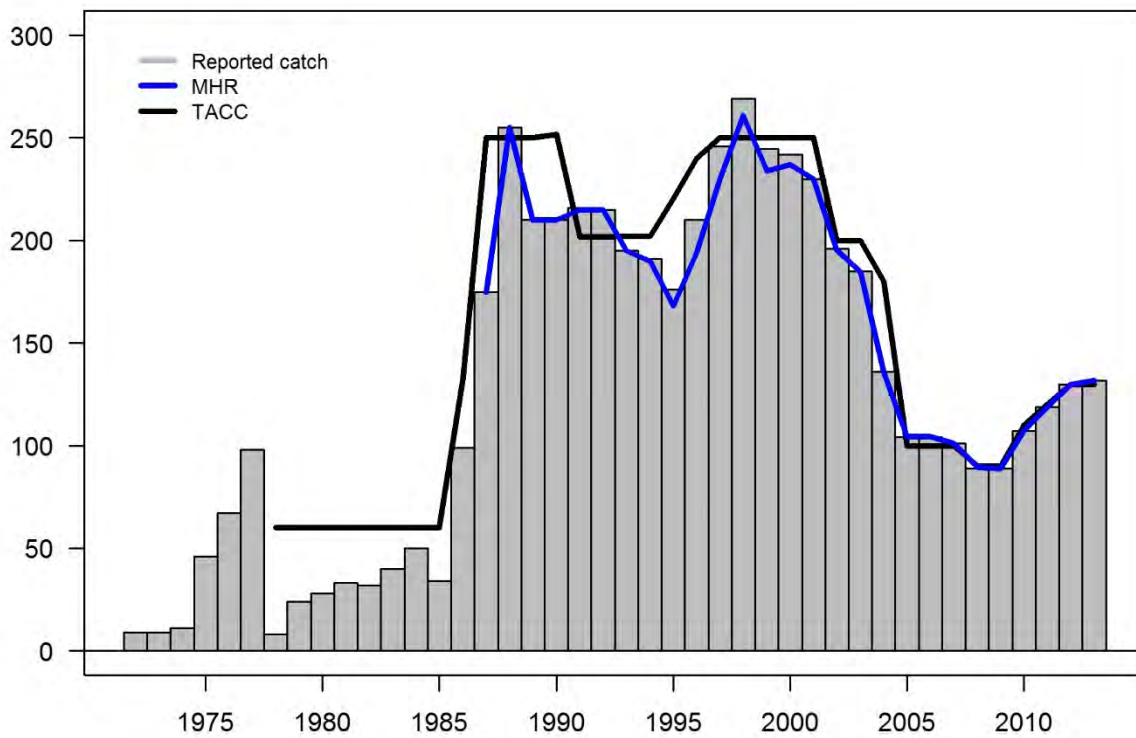


Figure 1: Total New Zealand hoki catch estimated from reported landings for calendar years 1972 to 1983 and fishing years 1983–84 (1984) to 2012–13.

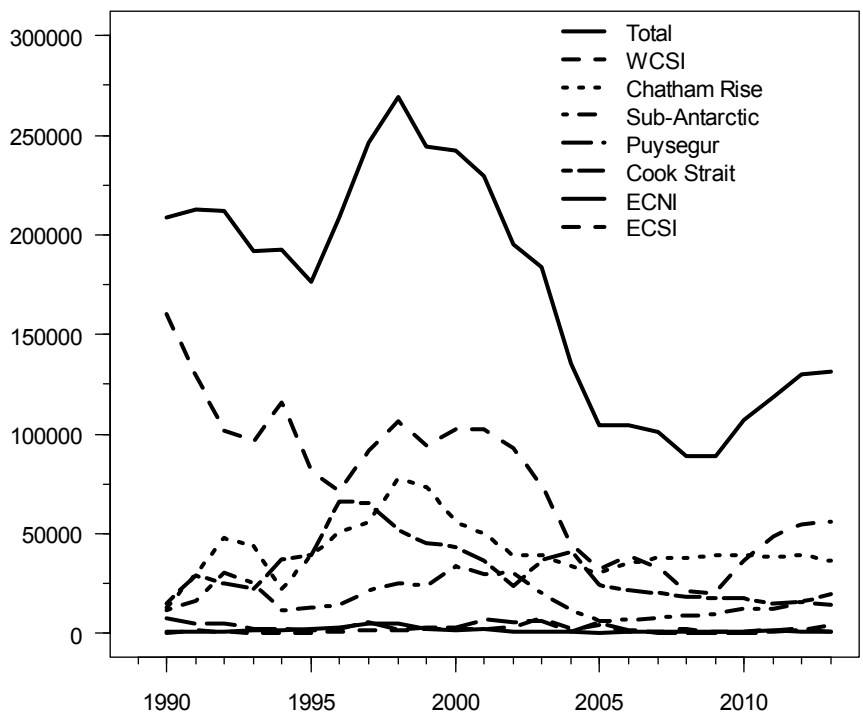
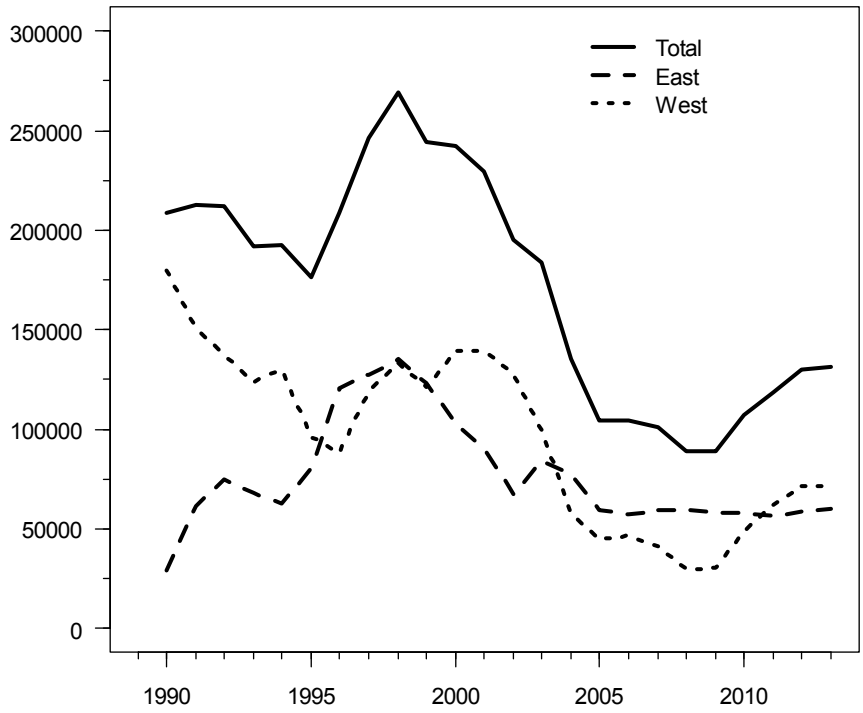


Figure 2a: Estimated total catch (t) of hoki by ‘stock’ area (upper panel) and fishing area (lower panel) from 1988–89 (1989) to 2012–13 (2013). “Eastern” areas include Chatham Rise, east coast South Island (ECSI), Cook Strait, and east coast North Island (ECNI). “Western” areas include west coast South Island (WCSI), Sub-Antarctic, and Puysegur.

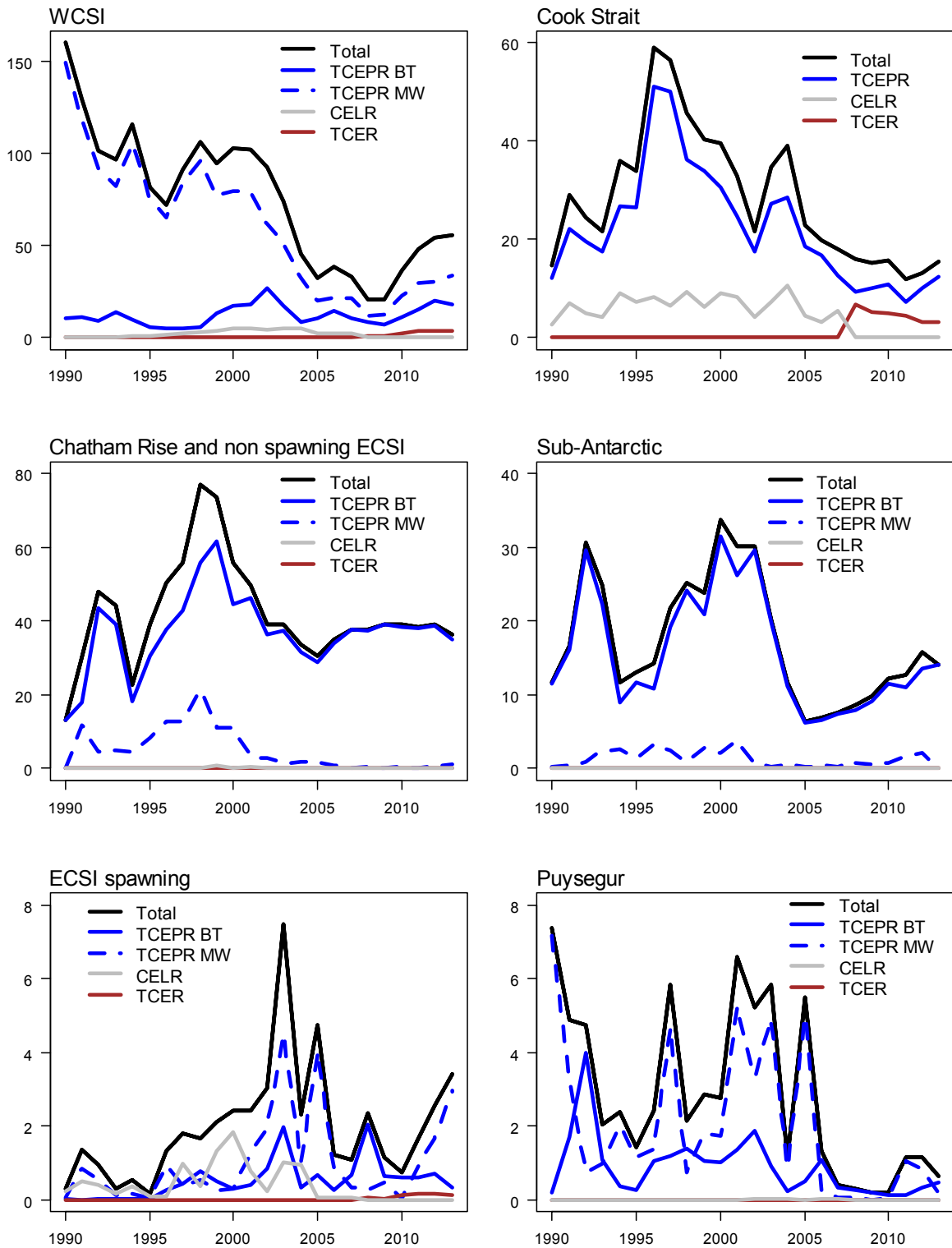


Figure 2b: Total catches and catches by form type by hoki area and fishing year. All areas (except Cook Strait) also show TCEPR data split by MW (midwater trawl) and BT (Bottom trawl). Sub-Antarctic and Puysegur have very little CELR or TCER data. There are no TCER or CELR catches for Sub-Antarctic.

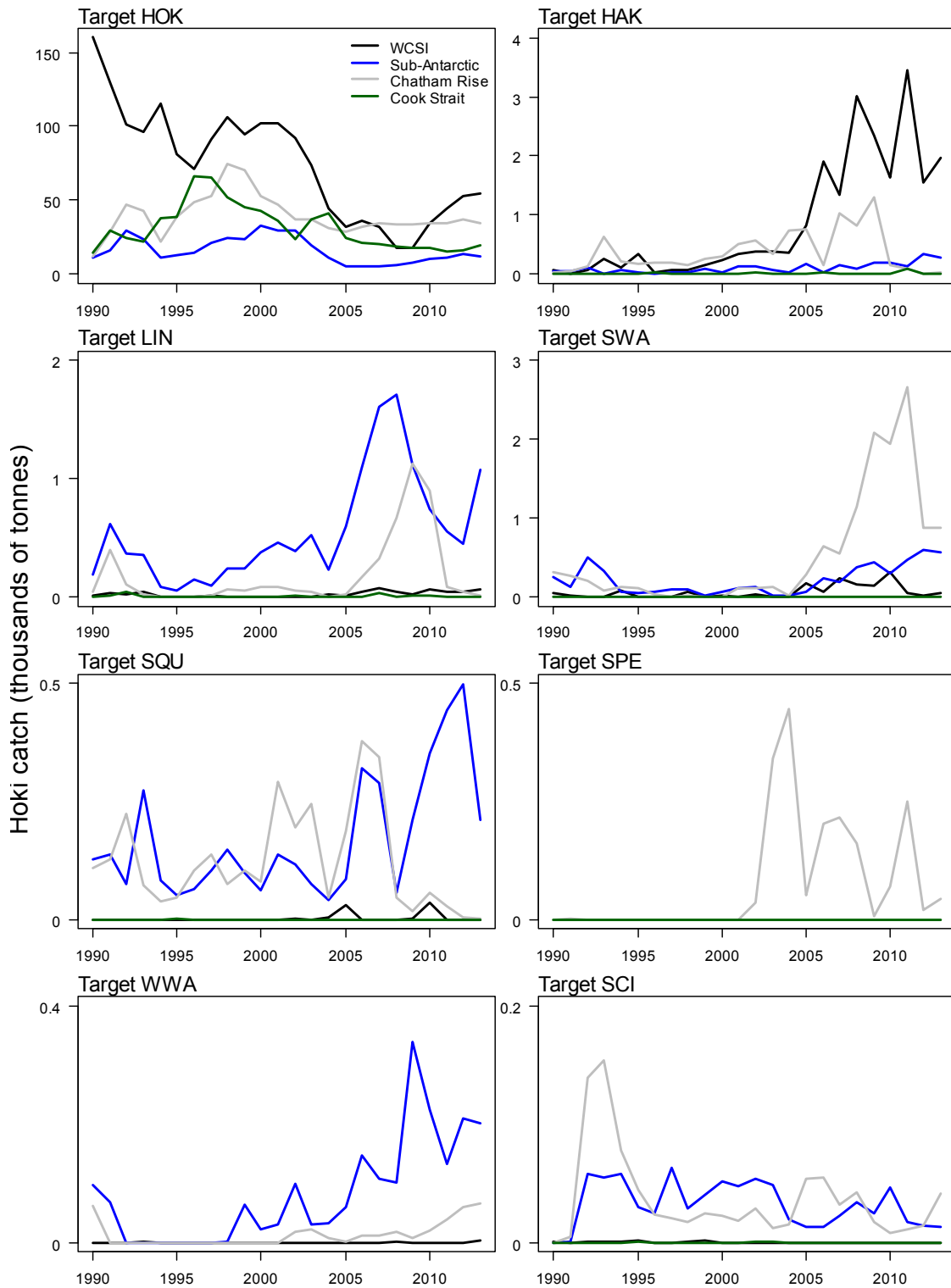


Figure 3: Hoki catch by target species and area for the 1989–90 to 2012–13 fishing years. Hoki catches by target species include HOK, hoki; HAK, hake; LIN, ling; SWA, silver warehou; SQU, arrow squid; SPE, sea perch; WWA, white warehou; and SCI, scampi.

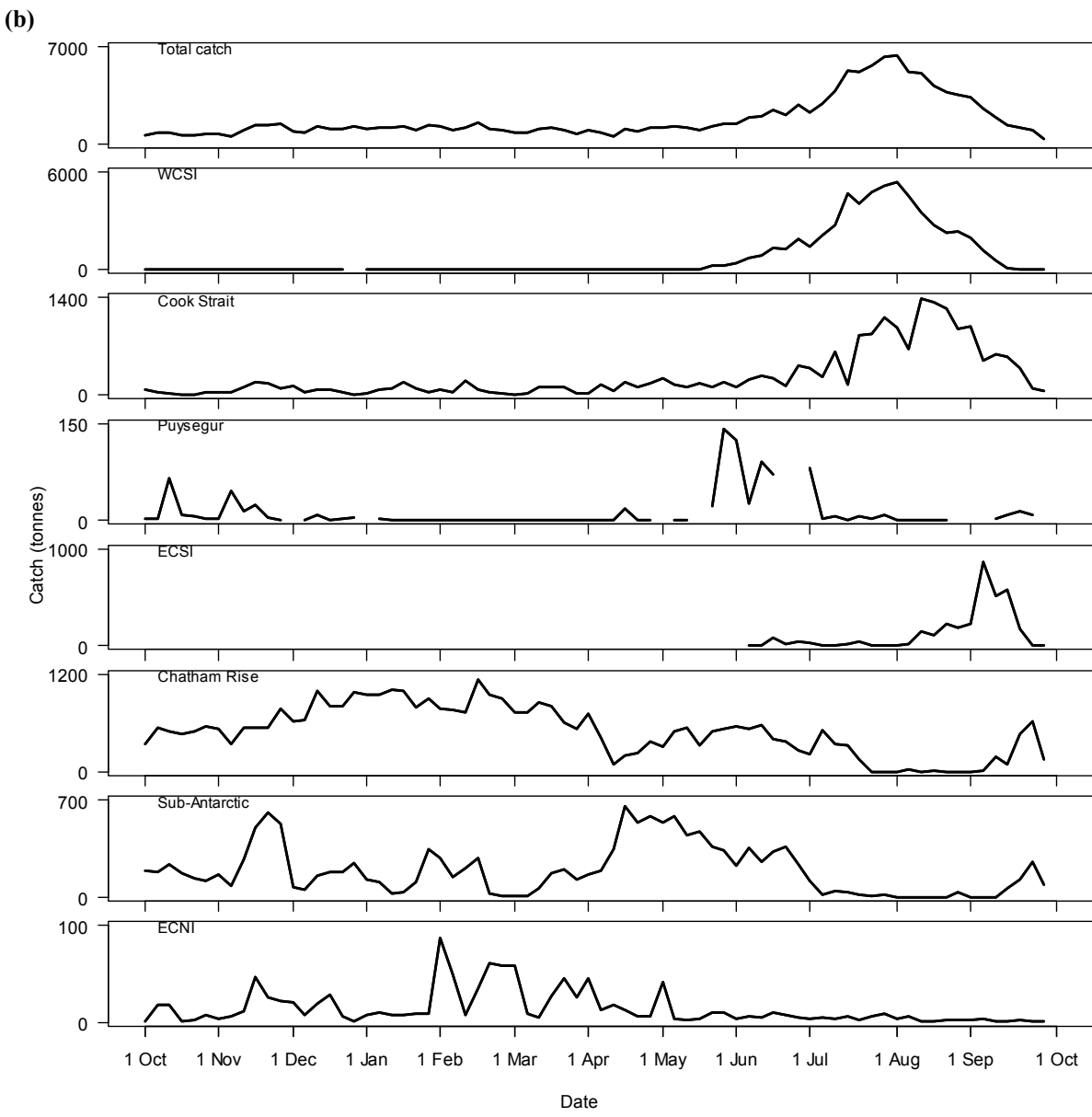
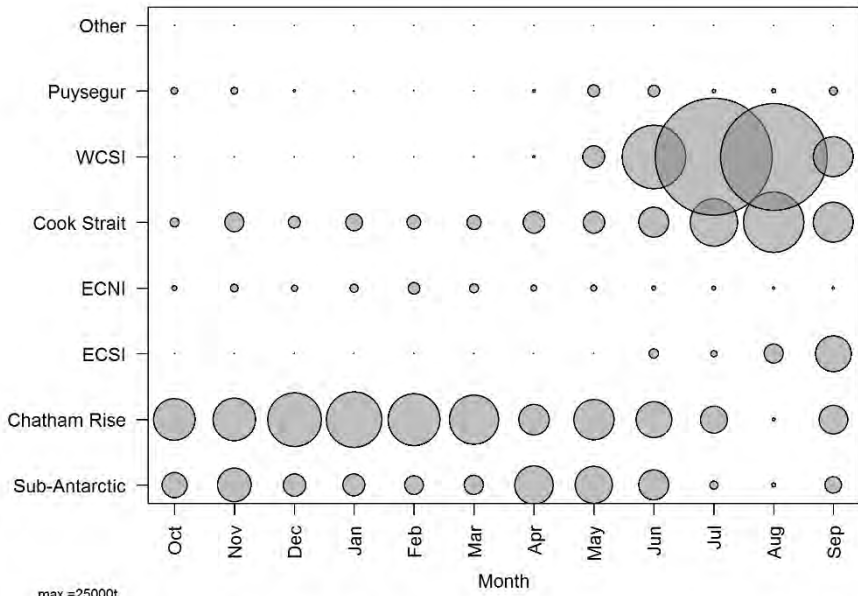


Figure 4: (a) Hoki catch by month and area (maximum circle size is 25 000 t) and (b) distribution of hoki catch (in 5 day bins) by area in the 2012–13 fishing year.

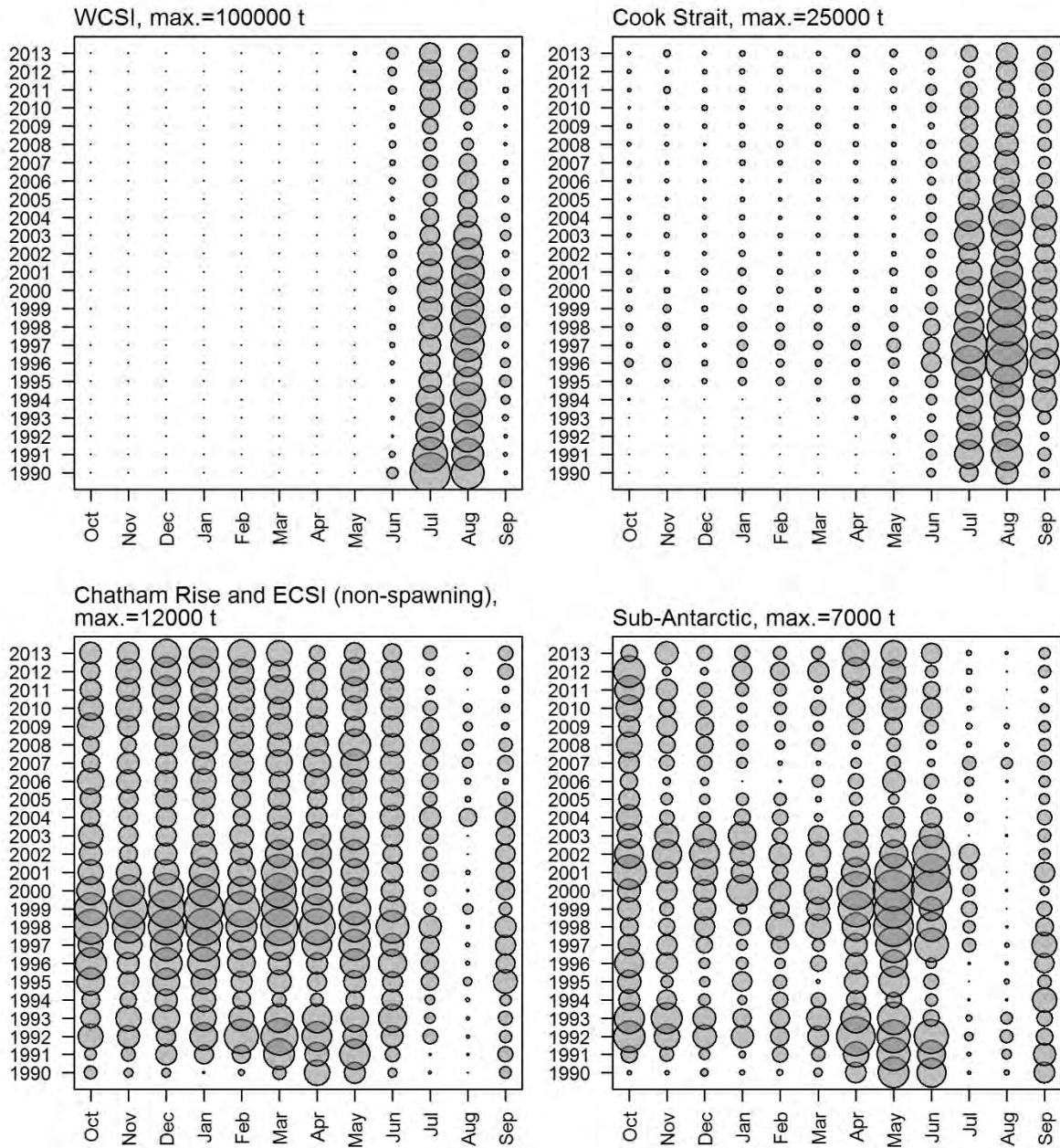


Figure 5: Distribution of hoki catch by month and area for the 1989–90 to 2012–13 fishing years.

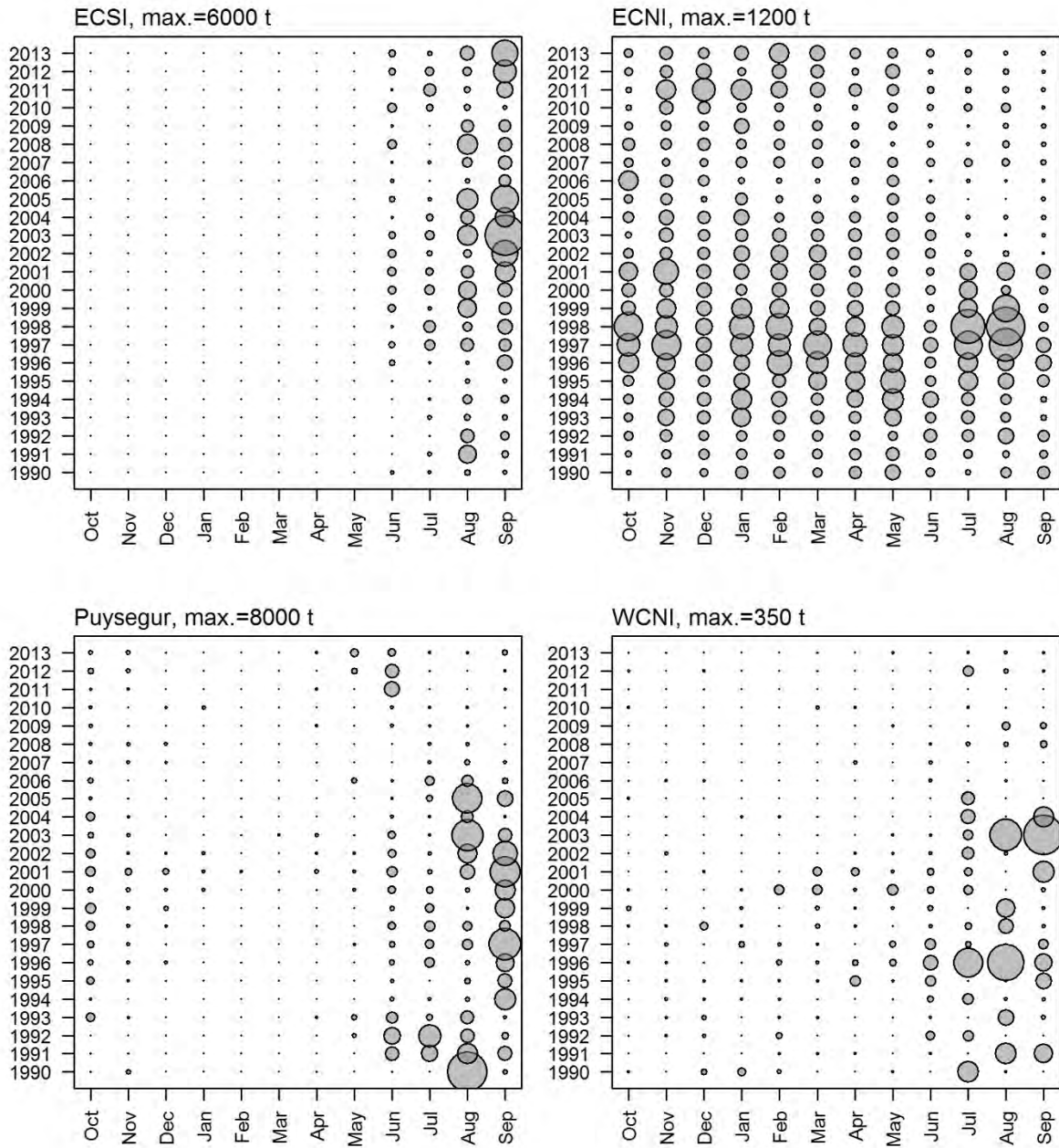


Figure 5 ctd.

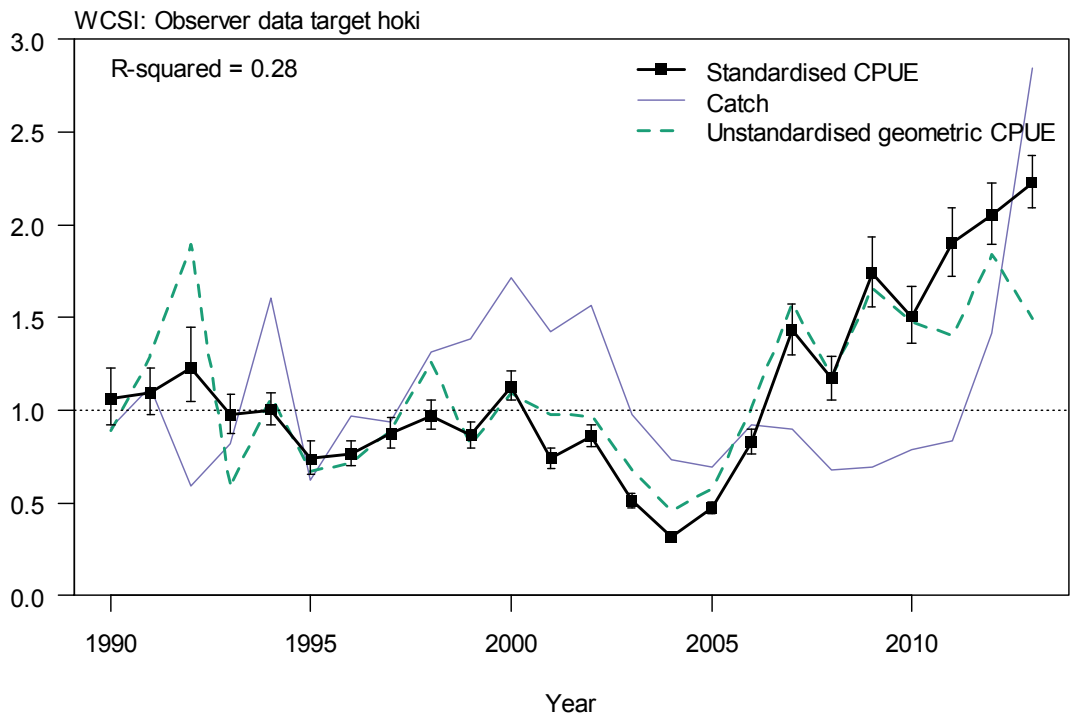
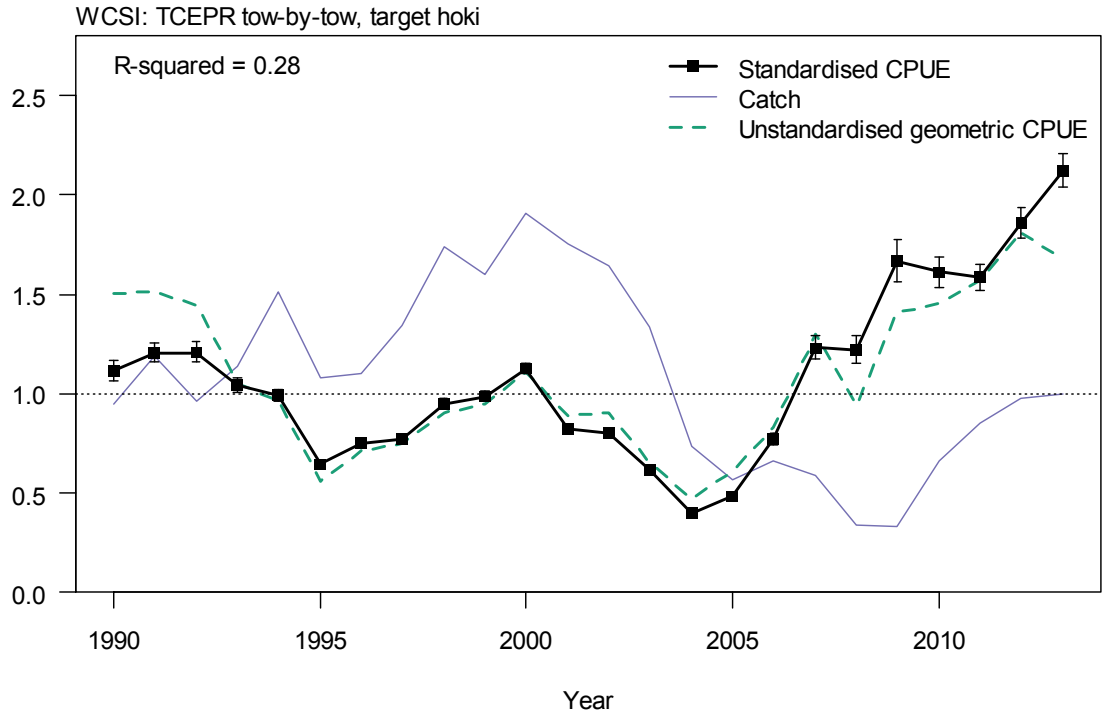


Figure 6a: Model catch, and unstandardised geometric and standardised CPUE indices by area for core data hoki tows for 1990–2013. Datasets for Chatham Rise and ECSI, and Sub-Antarctic included only bottom tows, and Cook Strait included only midwater tows.

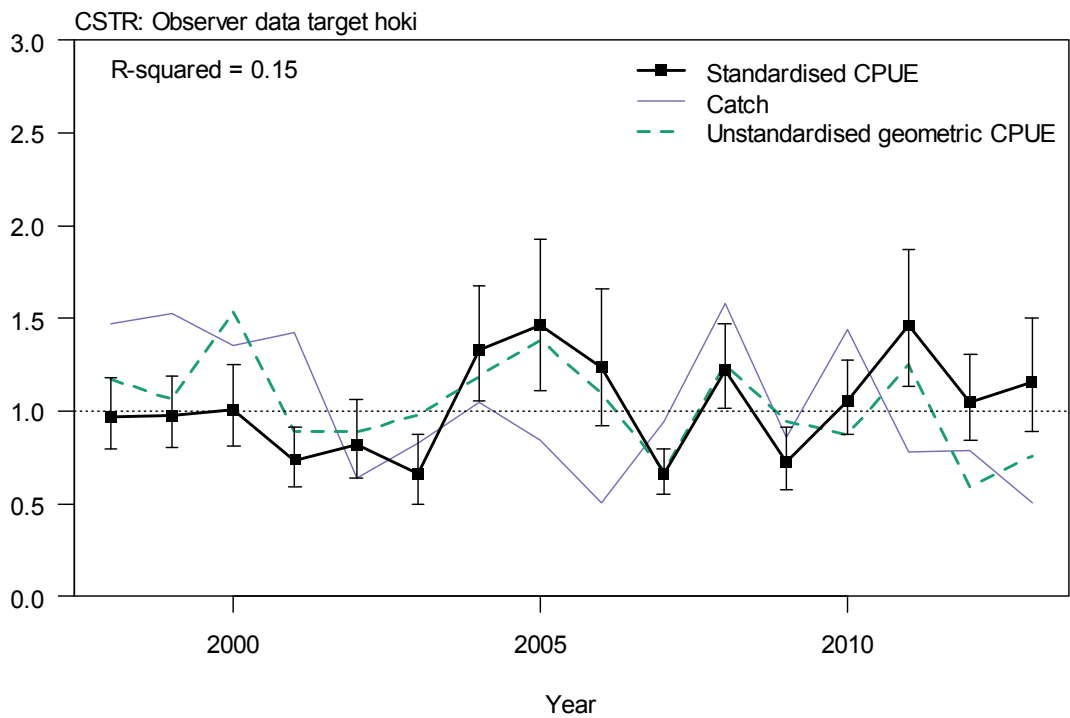
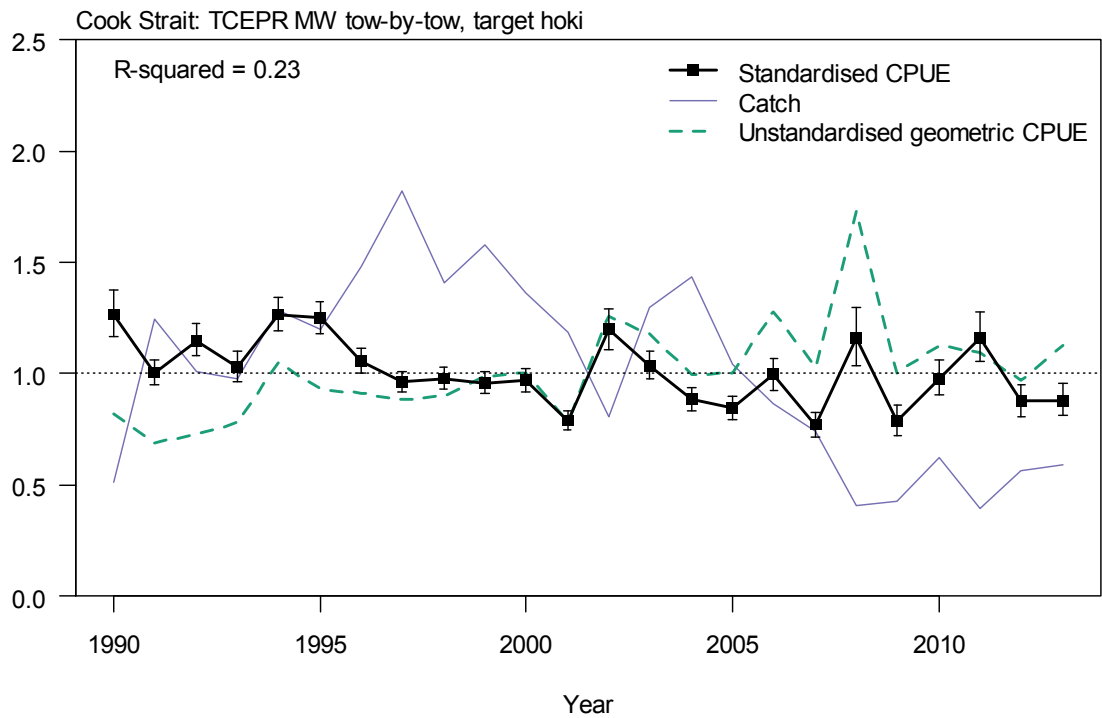


Figure 6a ctd.

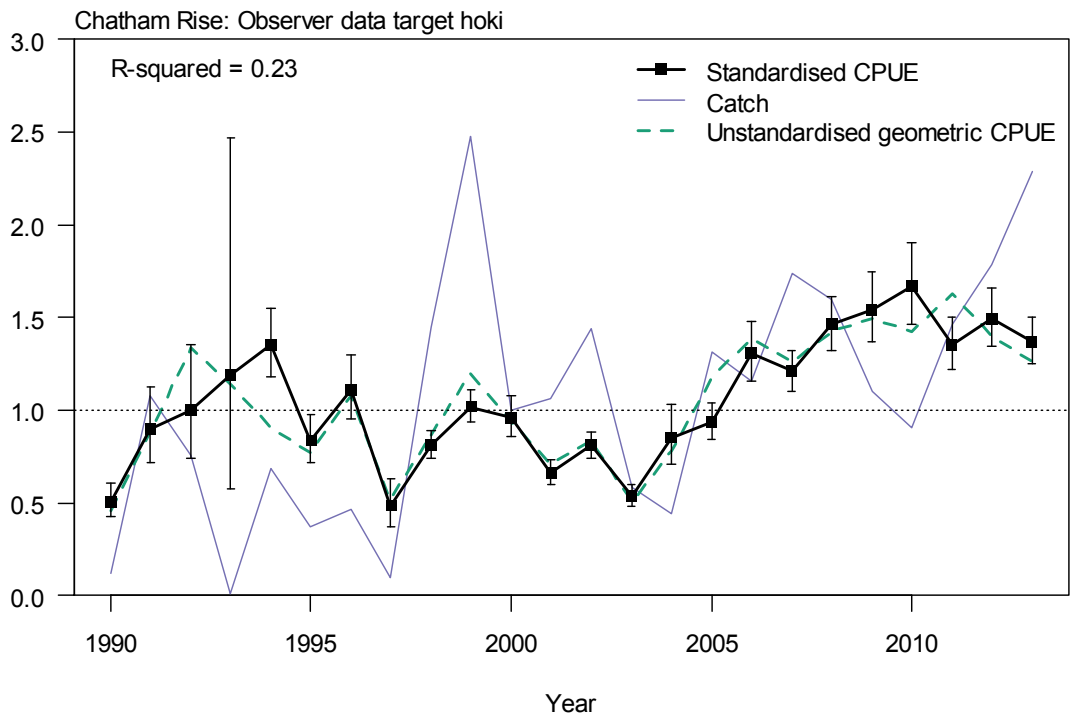
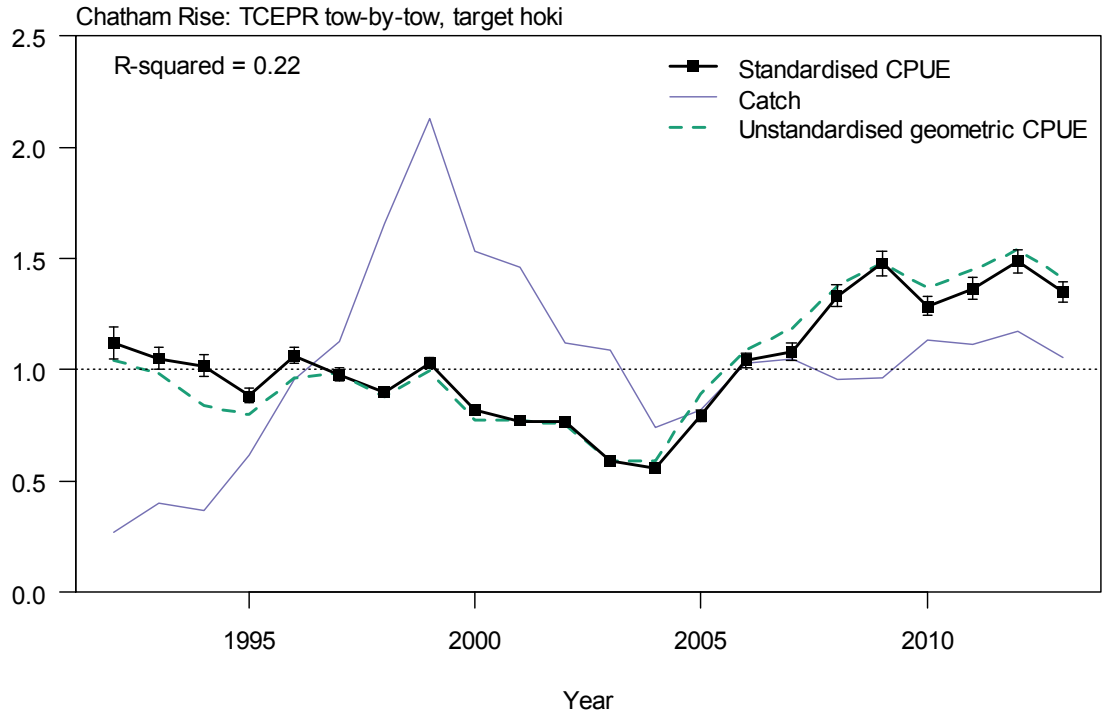


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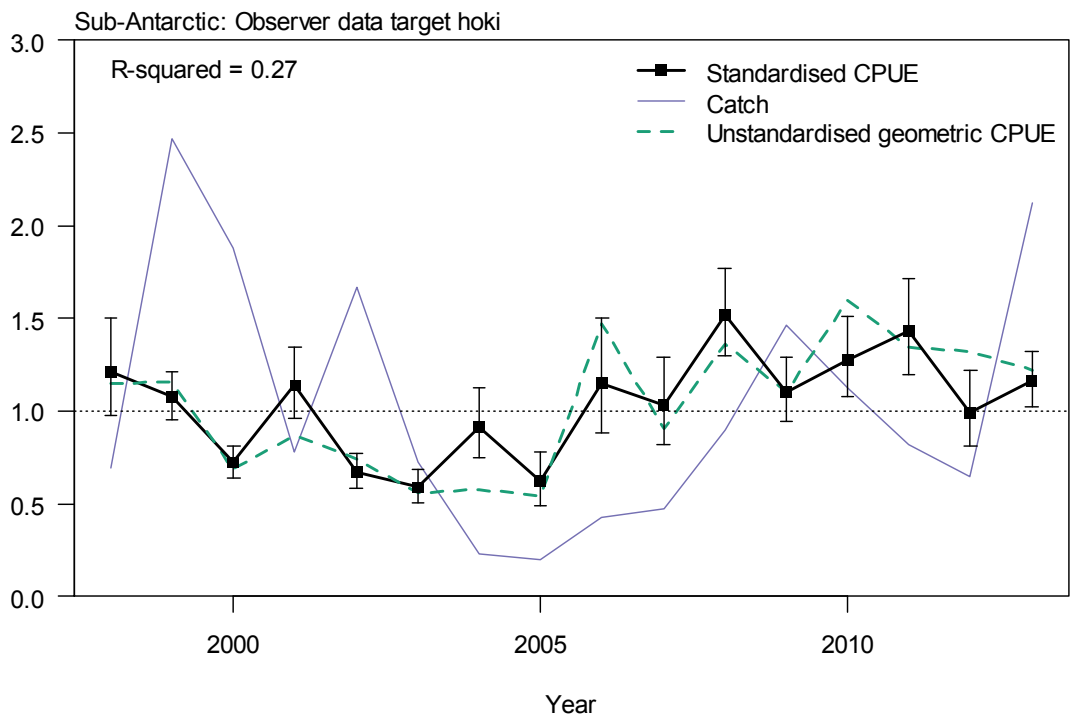
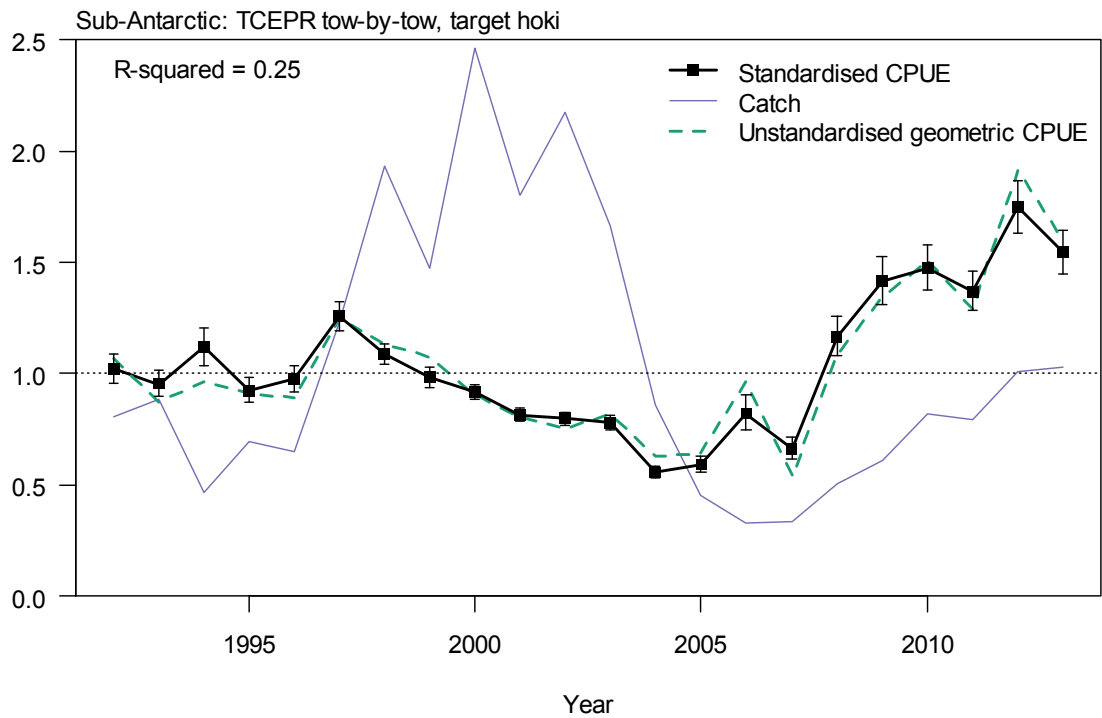


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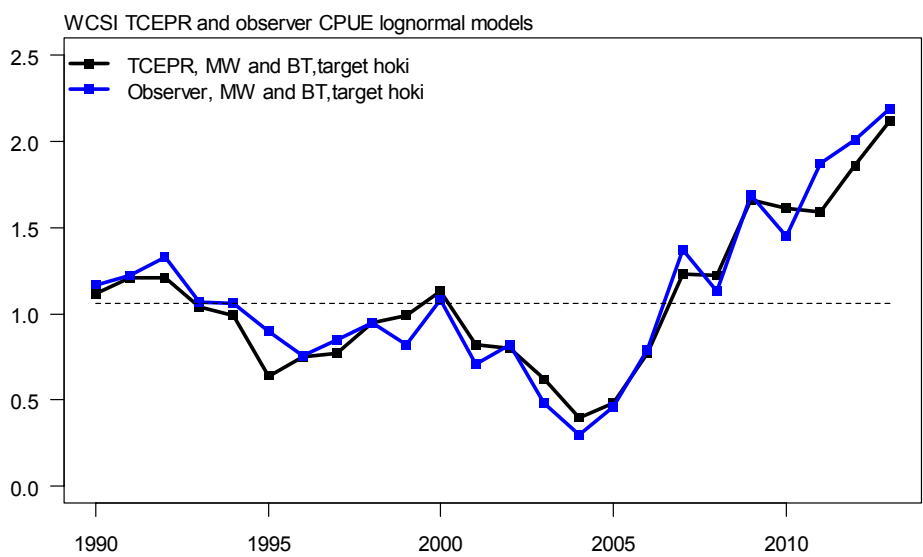
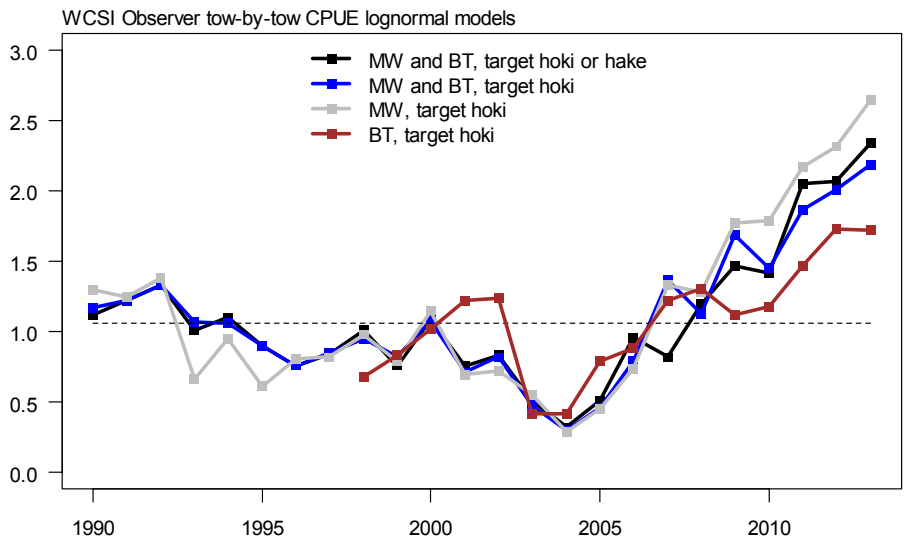
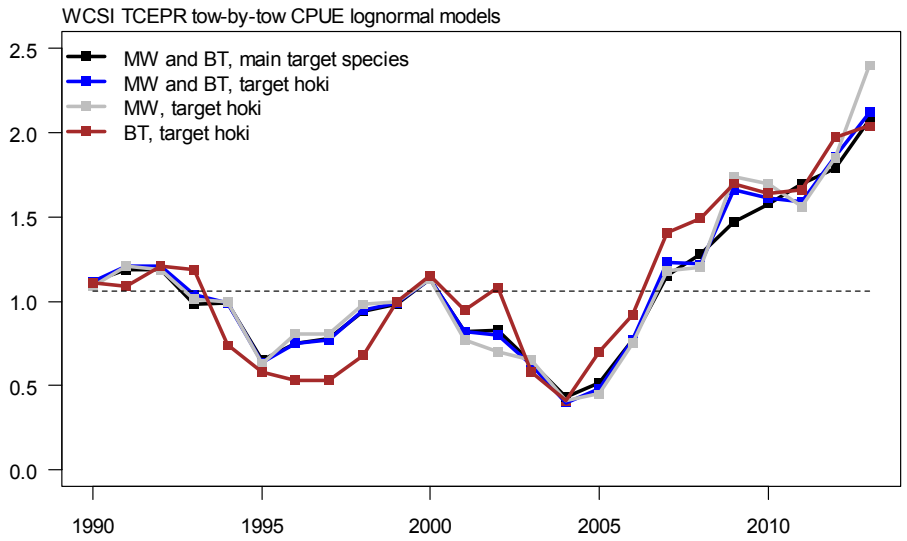


Figure 6b: Comparison of relative standardised CPUE indices from model runs for each area

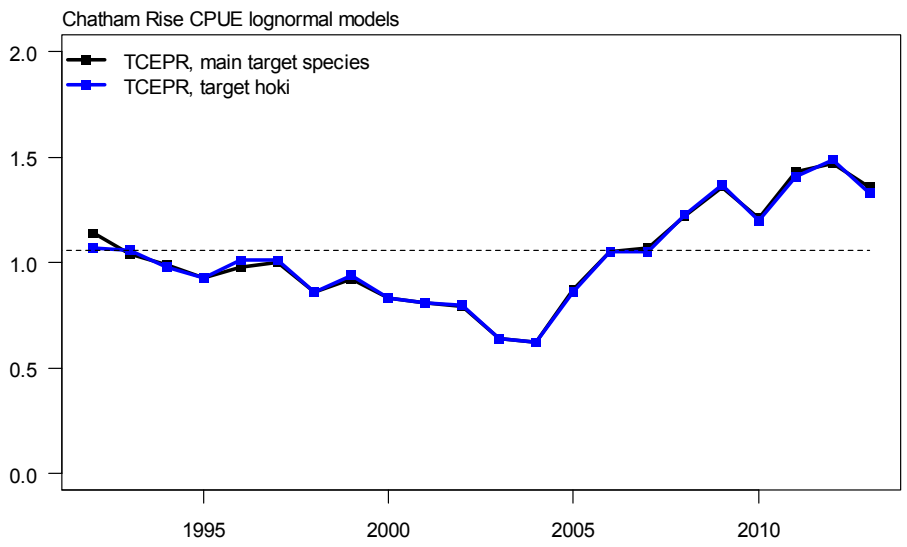
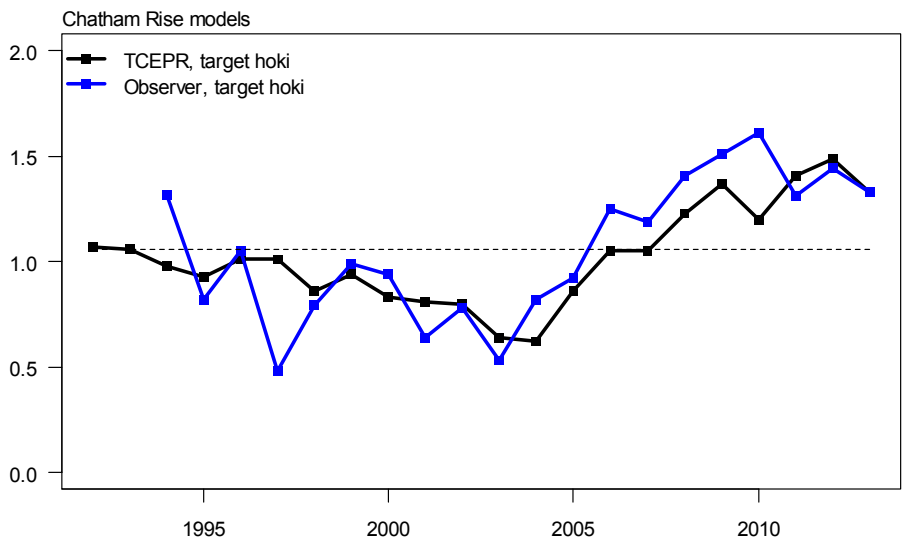
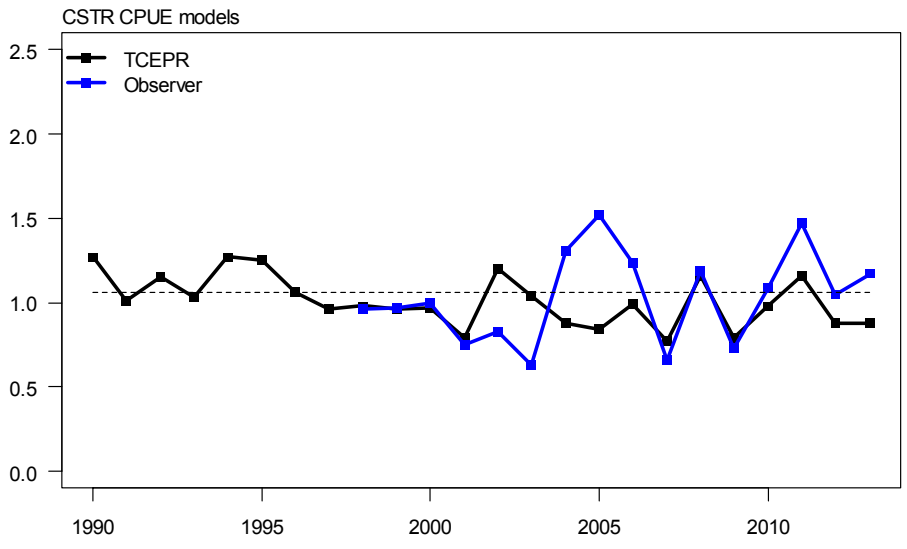


Figure 6b: ctd.

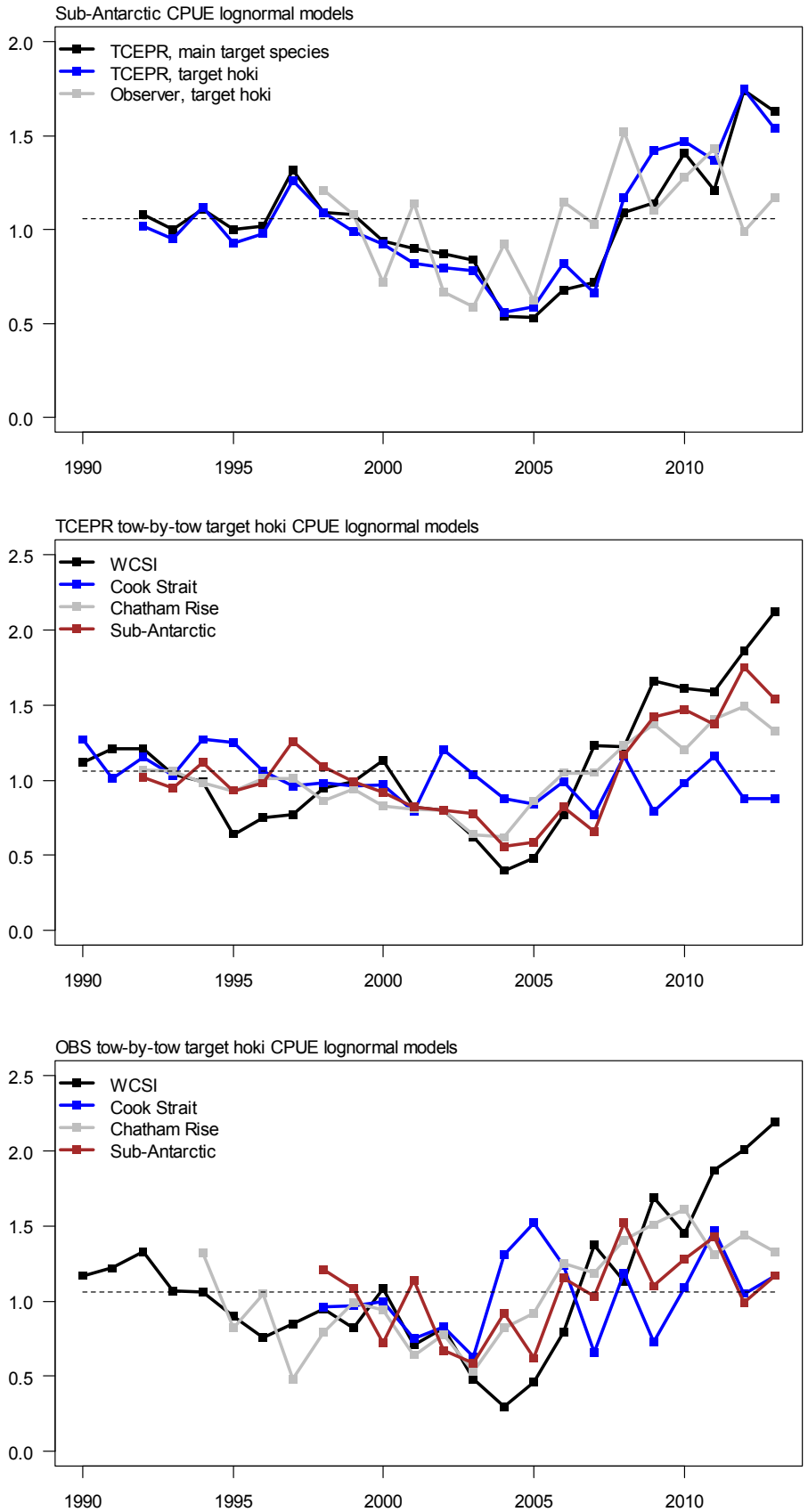


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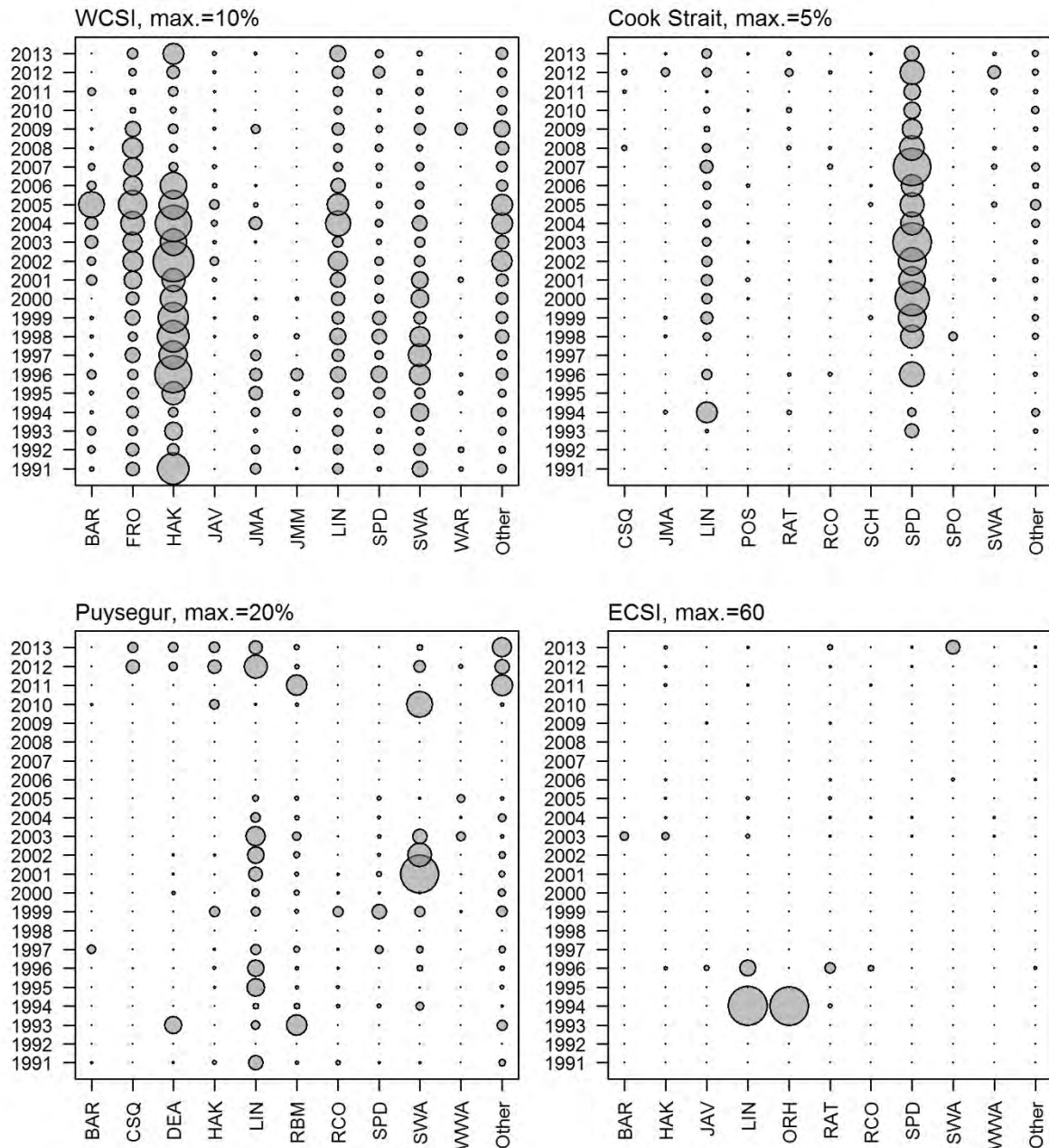


Figure 7a: Bycatch rates on vessels with Observer Programme observers in the hoki fishery for midwater tows targeting hoki from 1990–91 to 2012–13. The data covers the spawning season (June–September) only. Species include: BAR, Barracouta; DEA, Dealfish; CSQ, Leafscale gulper shark; FRO, Frostfish; HAK, Hake; JAV, Javelinfish; JMA, Jack mackerel; JMM, Slender jack mackerel; LIN, Ling; ORH, Orange roughly; POS, Porbeagle shark; RAT, Rattails; RBM, Rays Bream; RCO, Red cod; SCH, School shark; SPD, Spiny dogfish; SPO, Rig; SWA, Silver warehou; WAR, Common warehou, and WWA, White warehou.

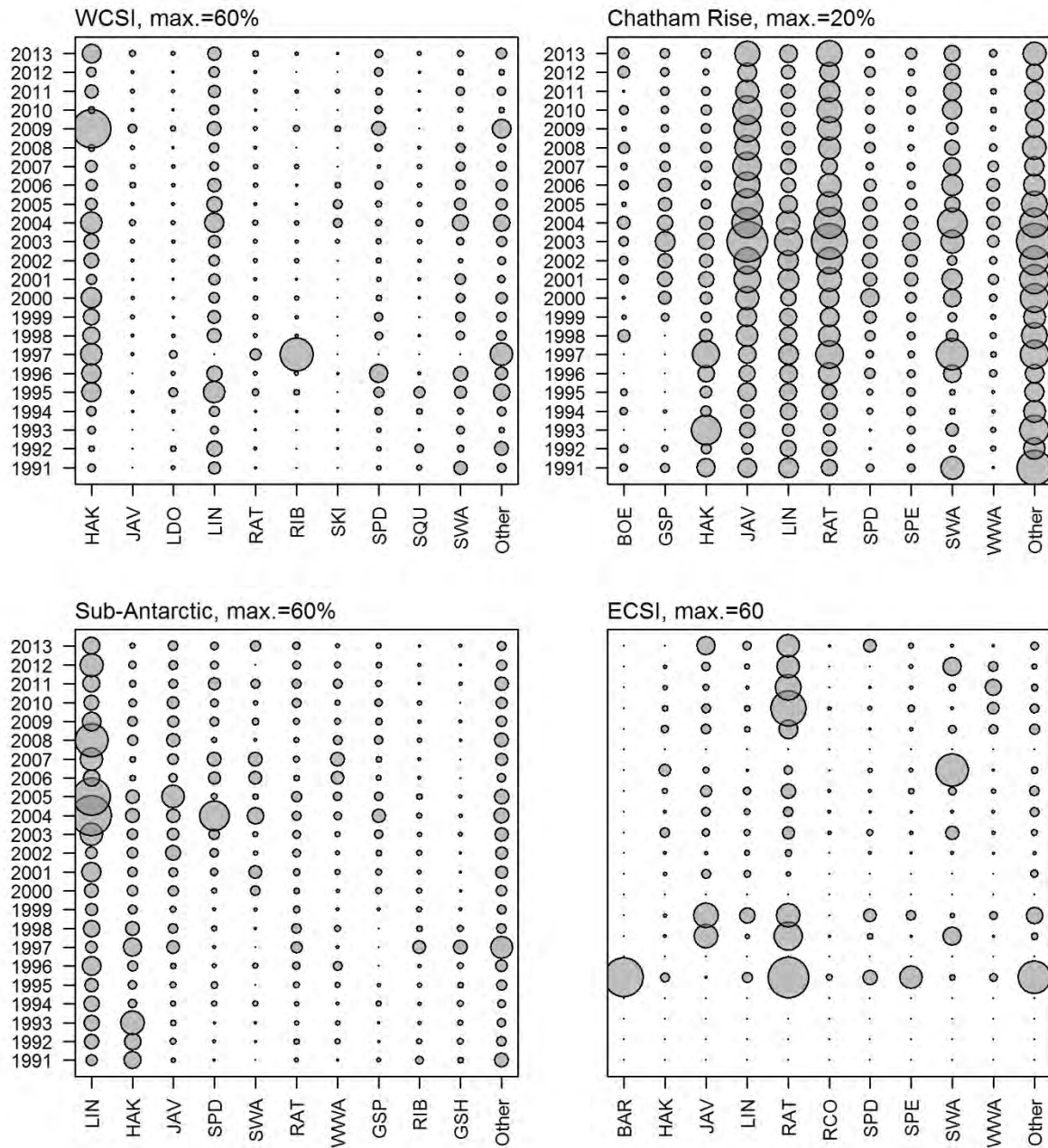


Figure 7b: Bycatch rates on vessels with Observer Programme observers in the hoki fishery for bottom tows targeting hoki from 1990–91 to 2012–13. The data for each area covers all months except for ECSI which covers the spawning season (June–September) only. Species include: BAR, barracouta; BOE, Black oreo; GSH, Ghost shark; GSP, Pale ghost shark; HAK, Hake; JAV, Javelinfish; LDO, Lookdown dory; LIN, Ling; RAT, Rattails; RCO, Red cod; RIB, Ribaldo; SKI, Gemfish; SPD, Spiny dogfish; SPE, Sea perch; SQU, Arrow squid; SWA, Silver warehou, and WWA, White warehou.

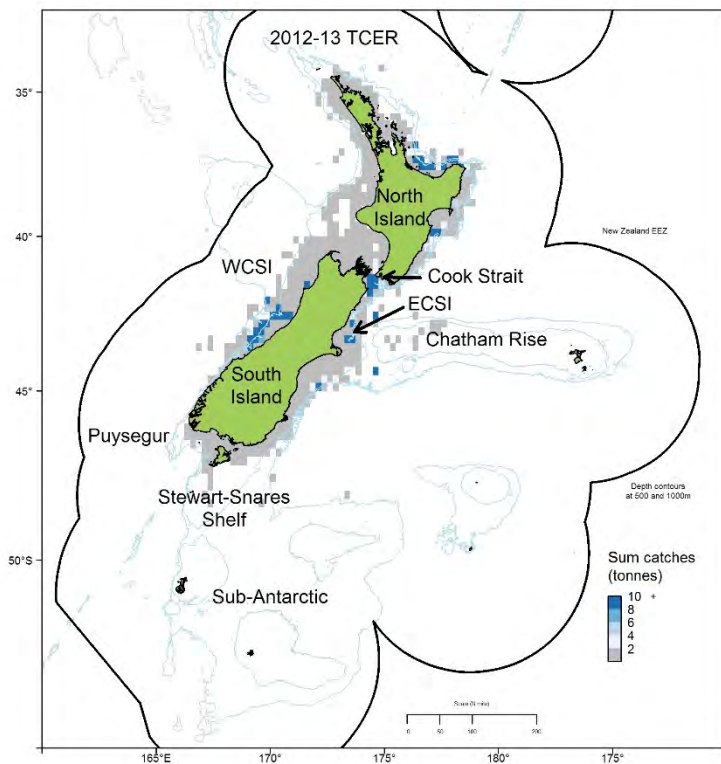
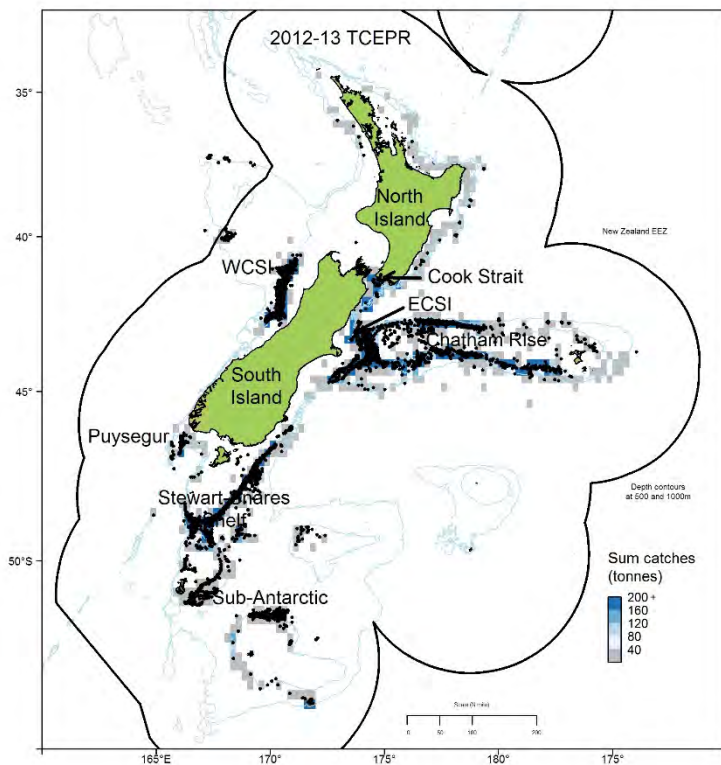


Figure 8: Density plots of all commercial TCEPR and TCER trawls where hoki was caught in the 2012–13 fishing year. TCEPR plot also shows observed positions as black dots.

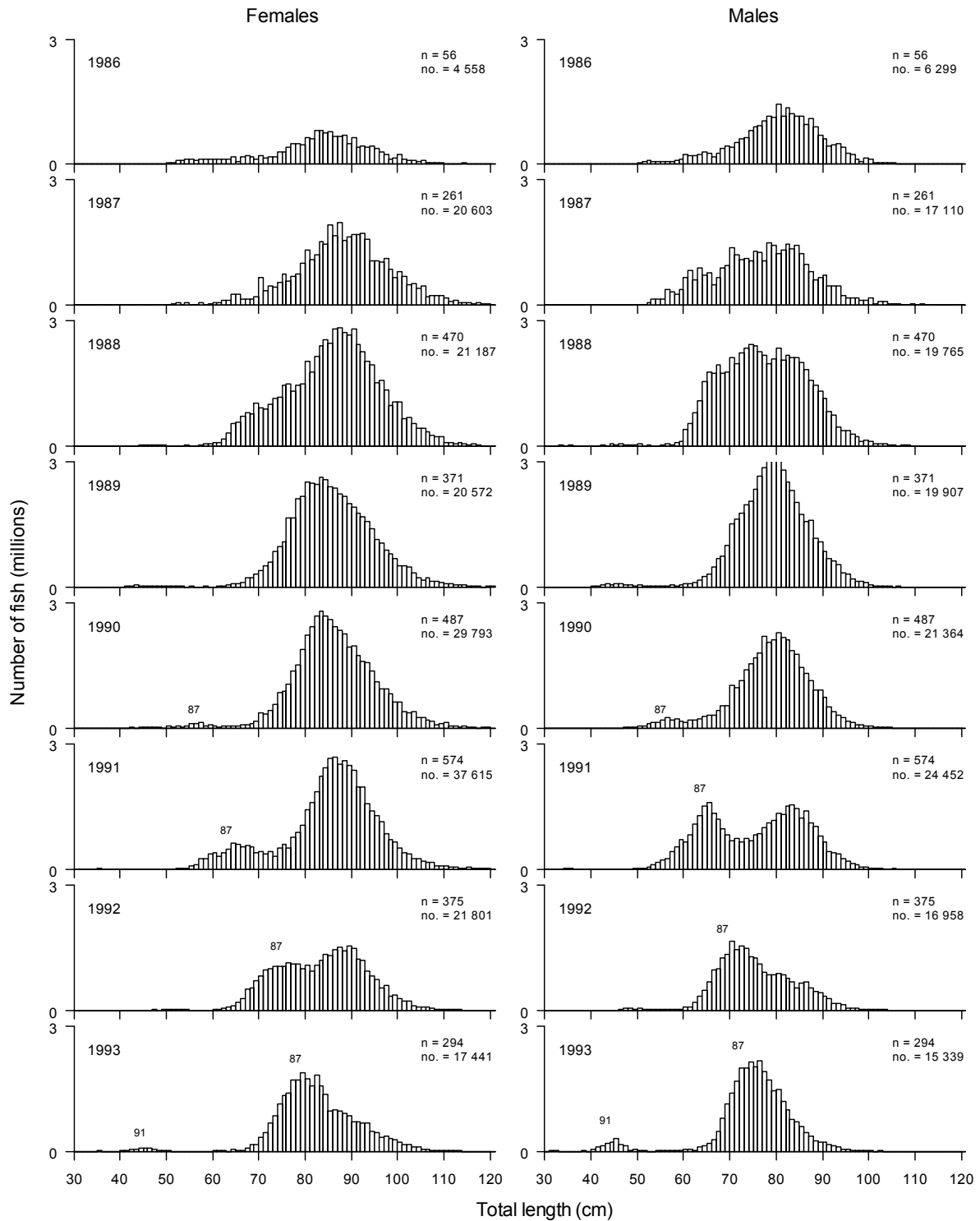


Figure 9: Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 1989 to 1993 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled. Numbers above the histograms mark estimated year-class modes, e.g., 91 = 1991 year-class.

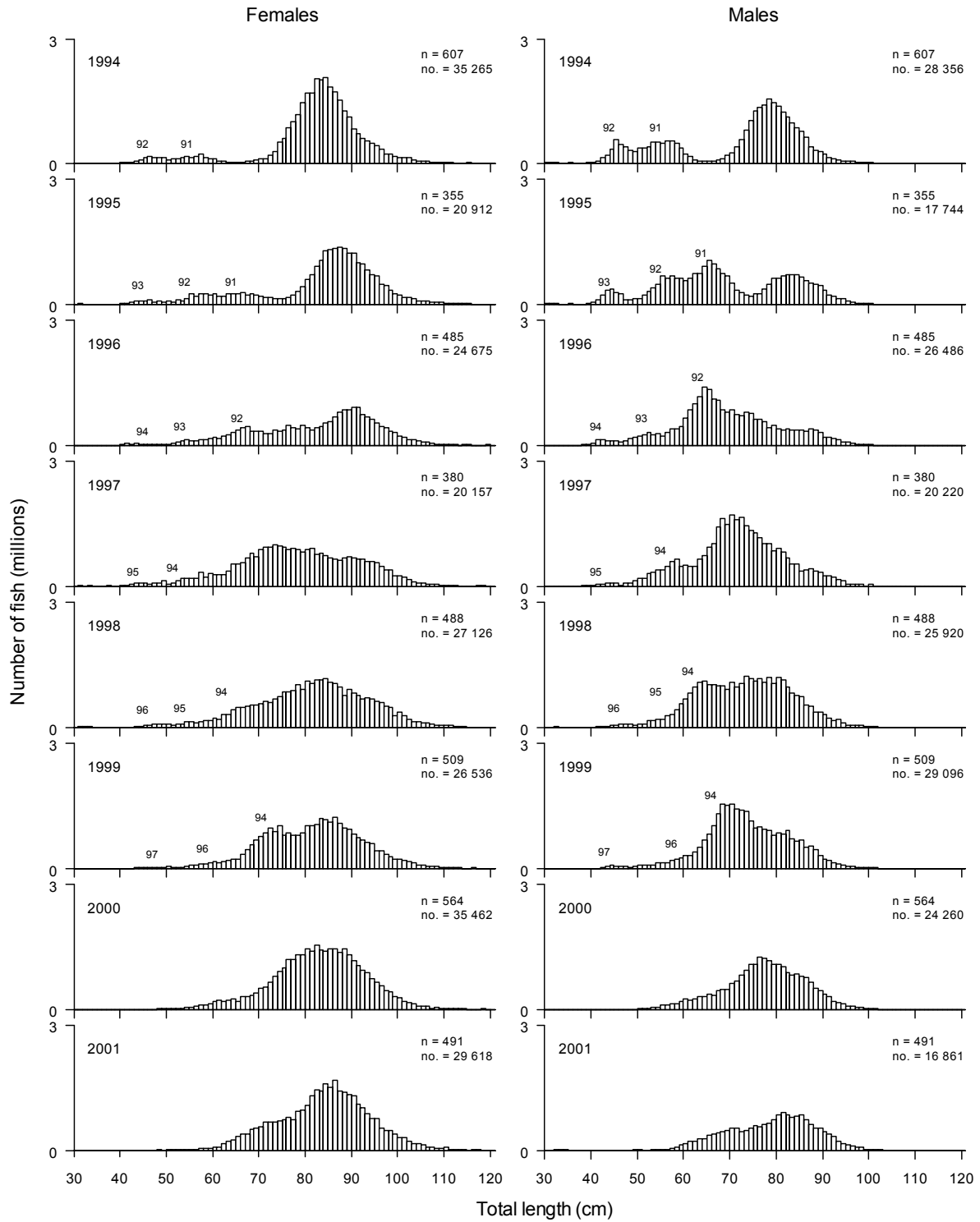


Figure 9 ctd. Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 1994 to 2001 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled. Numbers above the histograms mark estimated year-class modes, e.g., 91 = 1991 year-class.

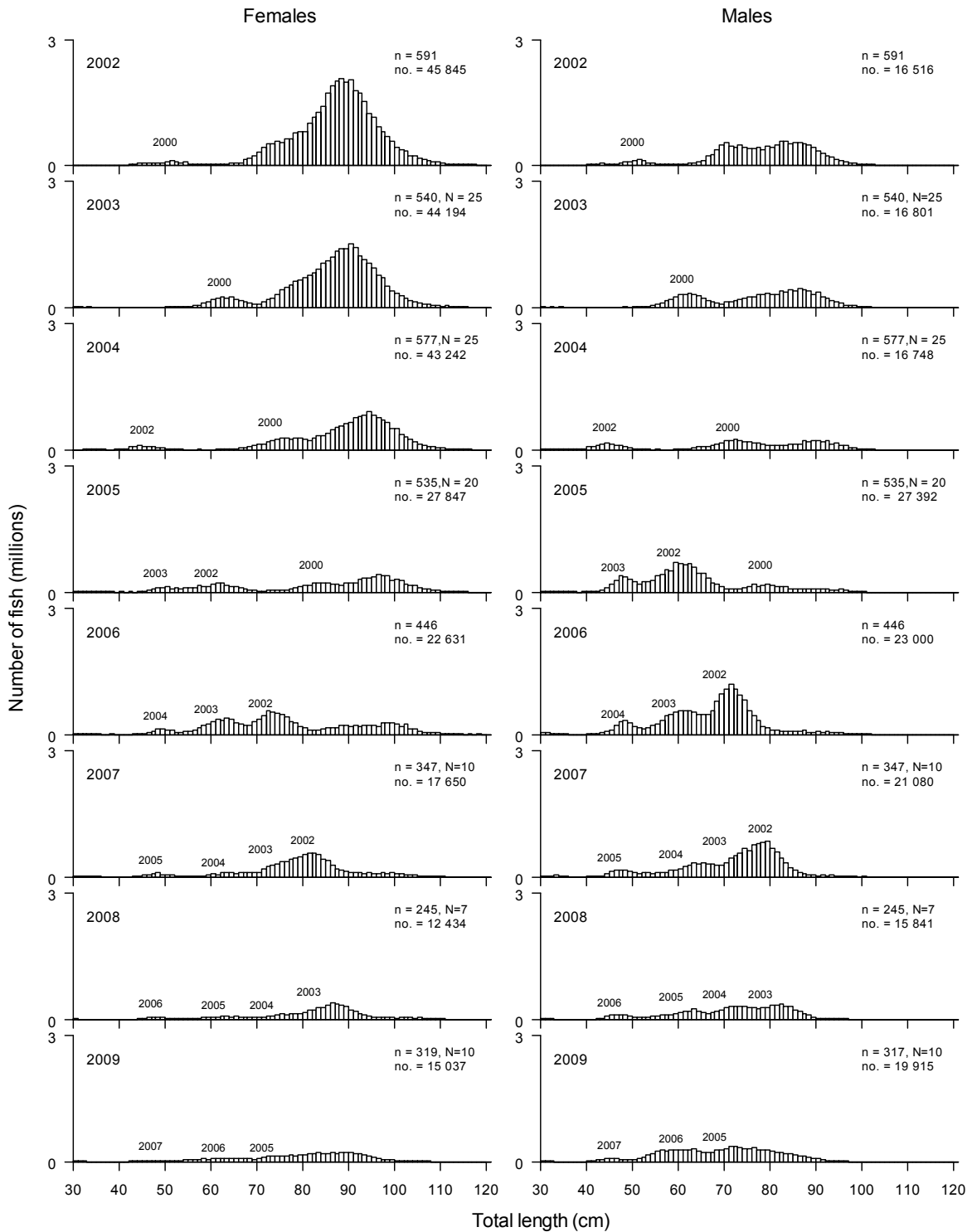


Figure 9 ctd. Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 2002 to 2009. In 2003–05 and 2007–09, Observer Programme data are combined with samples of landings from inside the 25 n. mile line sampled by NIWA. n, number of tows sampled; no., number of fish sampled; N, number of landings sampled. Numbers above the histograms mark estimated year-class modes, e.g., 2004 = 2004 year-class.

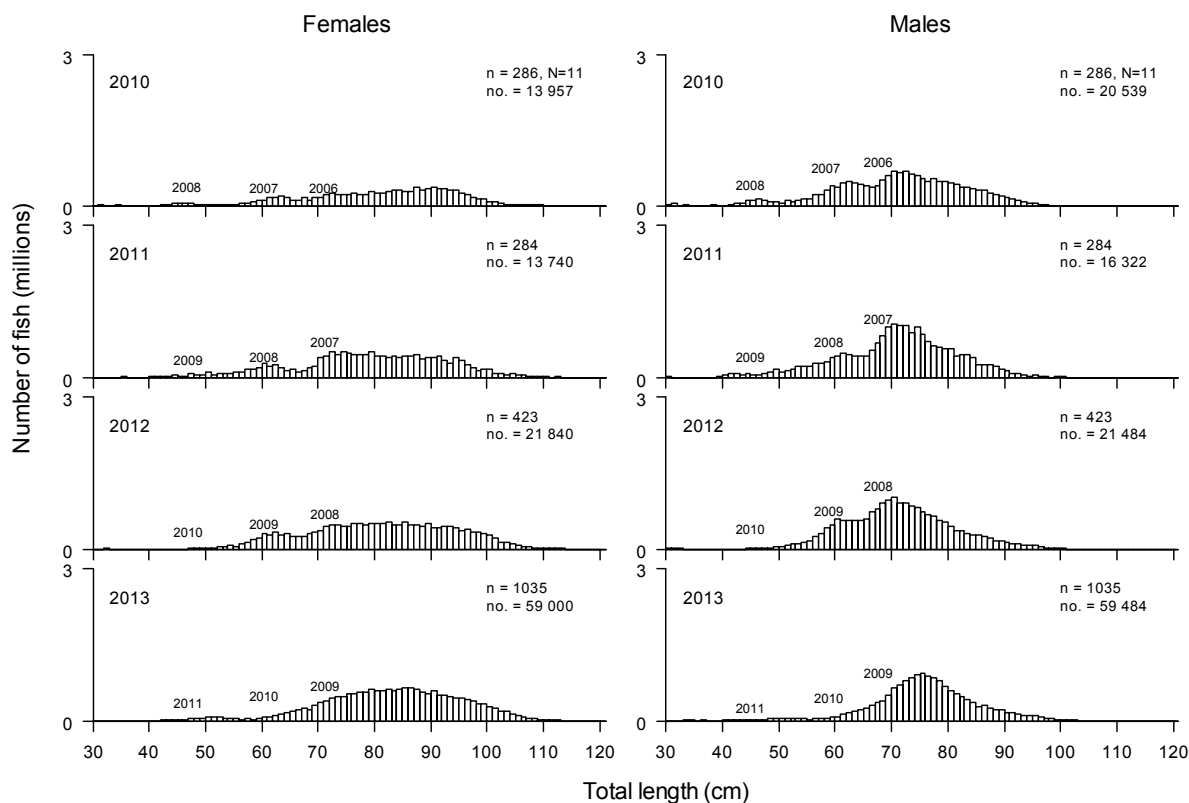


Figure 9 ctd. Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 2010 to 2013. In 2010, Observer Programme data are combined with samples of landings from inside the 25 n. mile line sampled by NIWA, in 2011–2012 there is only Observer data outside the 25 n. mile line, and in 2013 there are Observer data inside side the 25 n. mile line in May–June, and Observer data outside the 25 n. mile line in June–September. n, number of tows sampled; no., number of fish sampled; N, number of landings sampled. Numbers above the histograms mark estimated year-class modes, e.g., 2007 = 2007 year-class.

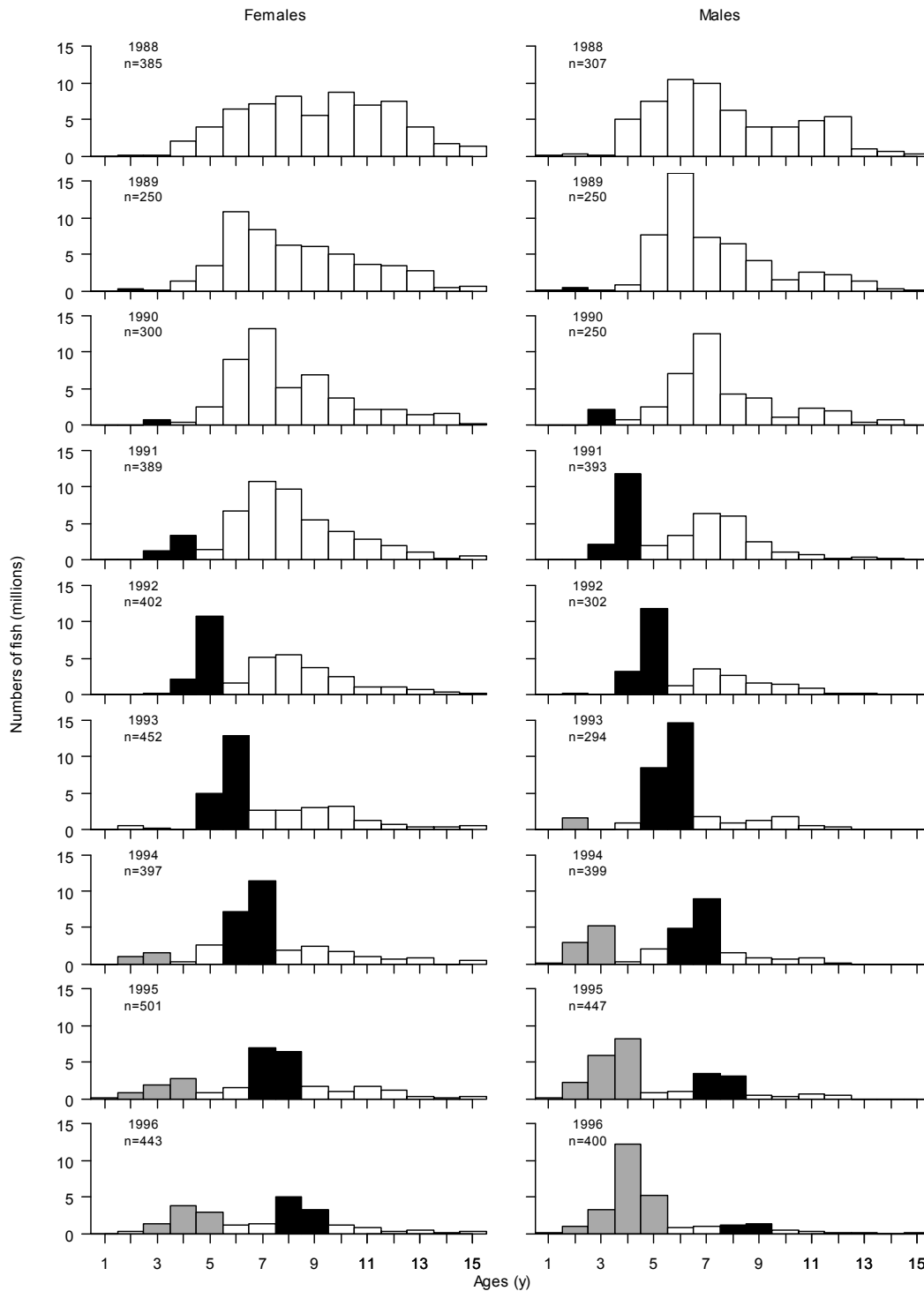


Figure 10: Catch at age of hoki in commercial catches from the west coast South Island spawning fishery from 1988 to 2012. n, number of fish aged. Black bars for the years 1990 to 2000 show 1987 and 1988 year-classes, grey bars show 1991–94 year-classes, and light grey bars in the 2004–2012 seasons represent the 2002 and 2003 year-classes.

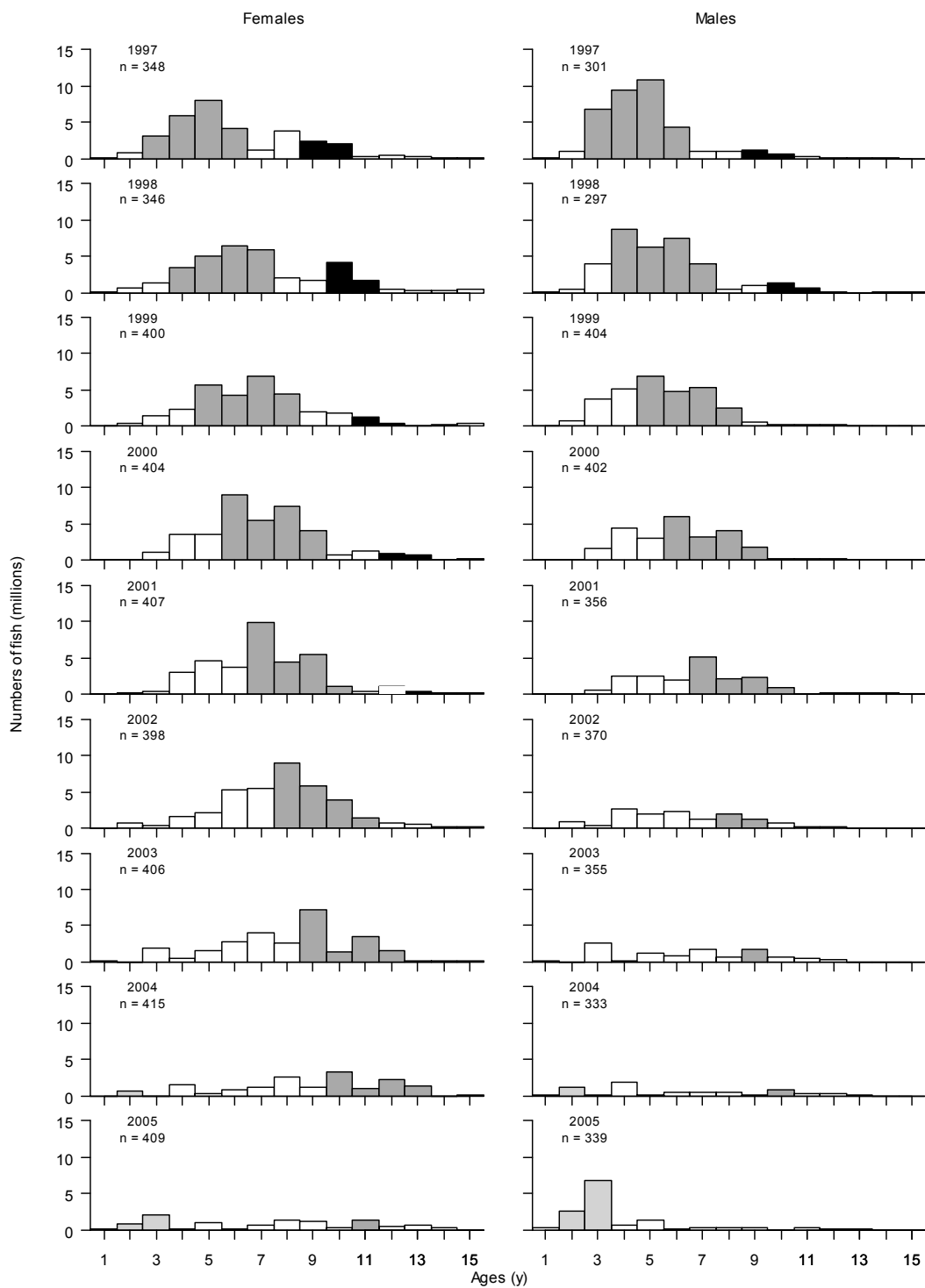


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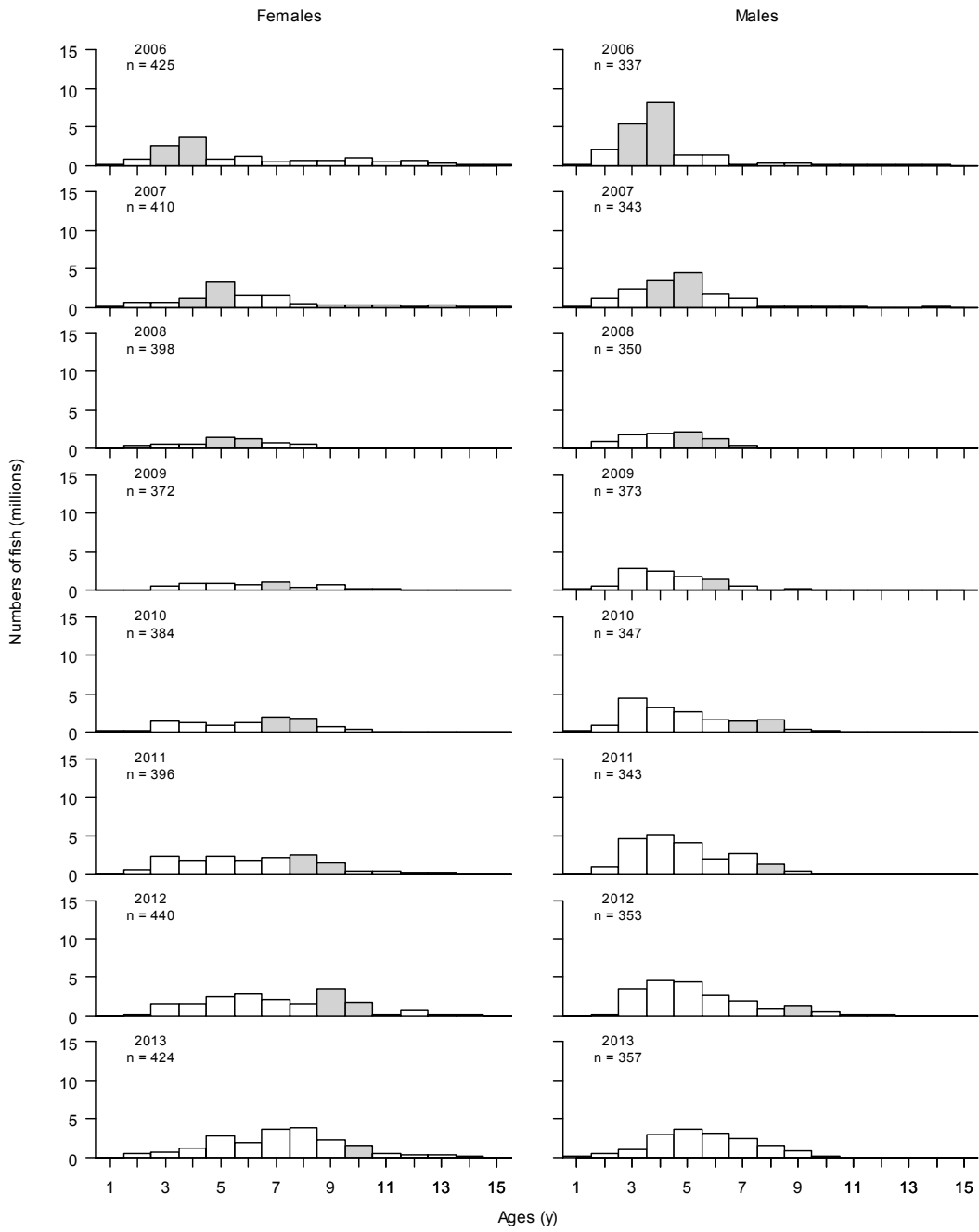


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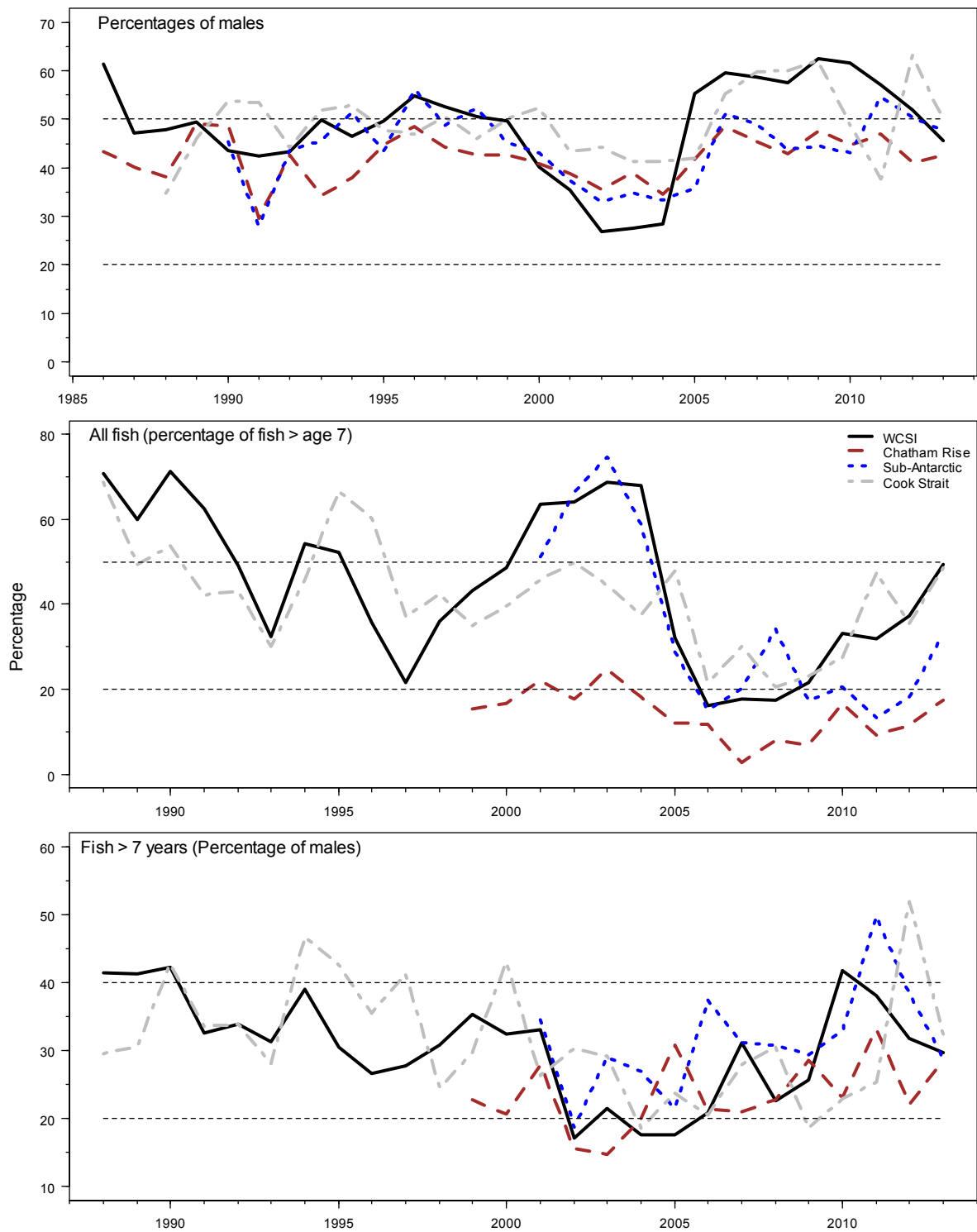


Figure 11a: Percentage of males in the catch, percentage of all fish aged 7 and older in the catch, and percentage of male fish (of those that are over seven and older) in the catch, by area and fishing year.

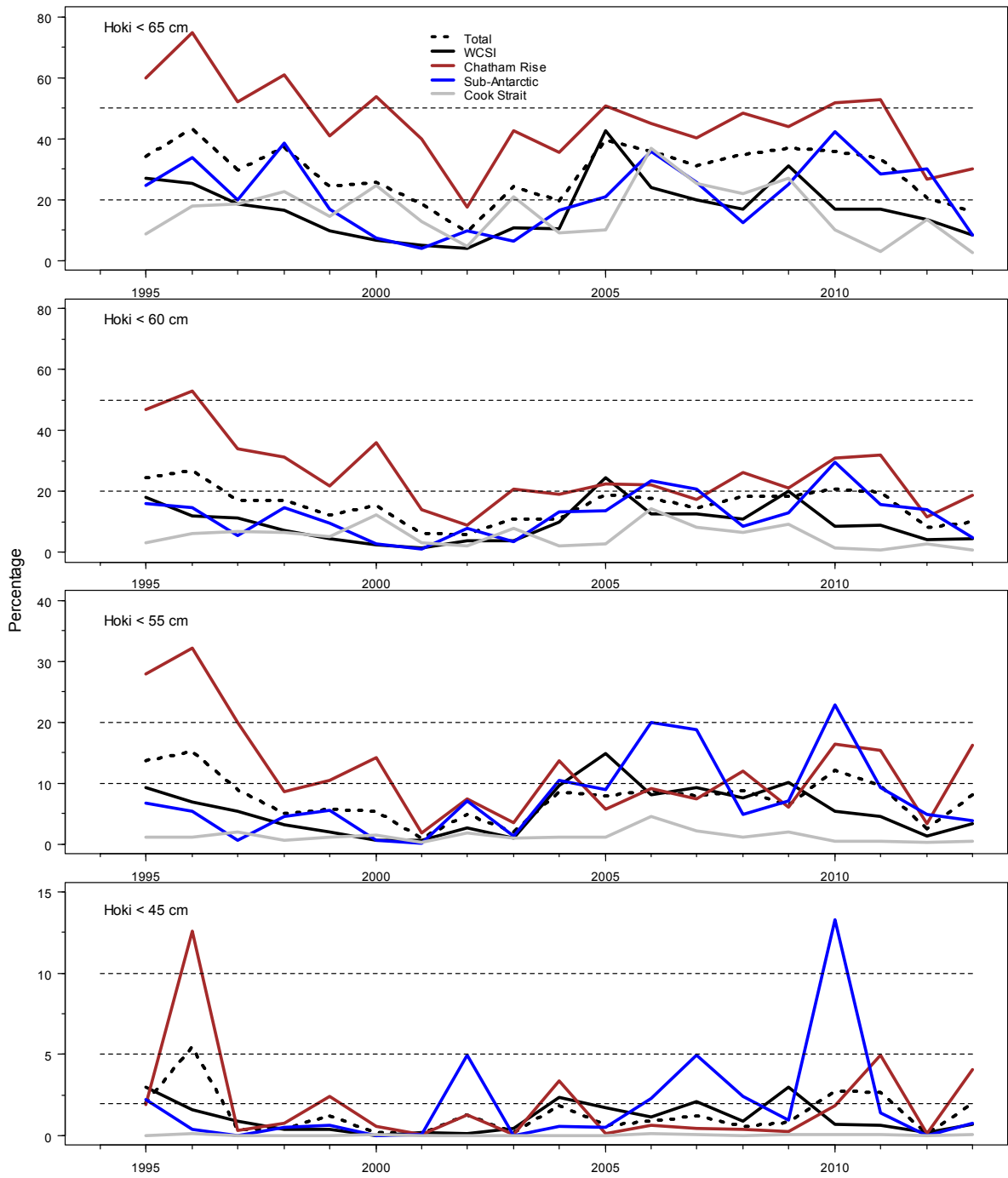


Figure 11b: Percentage of small fish in the catch by area and fishing year.

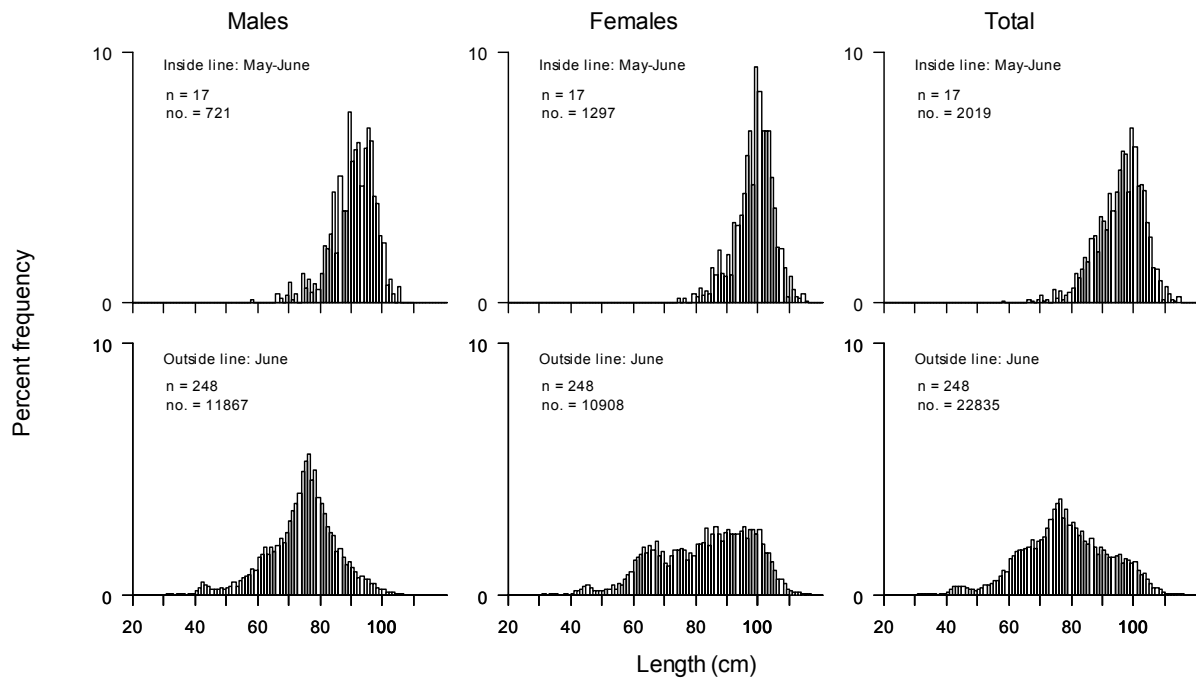


Figure 12: Comparison of length frequencies from inside and outside the 25 n. mile line sampled at sea by the Observer Programme in May-June 2013. n, number of landings or tows sampled; no., number of fish sampled.

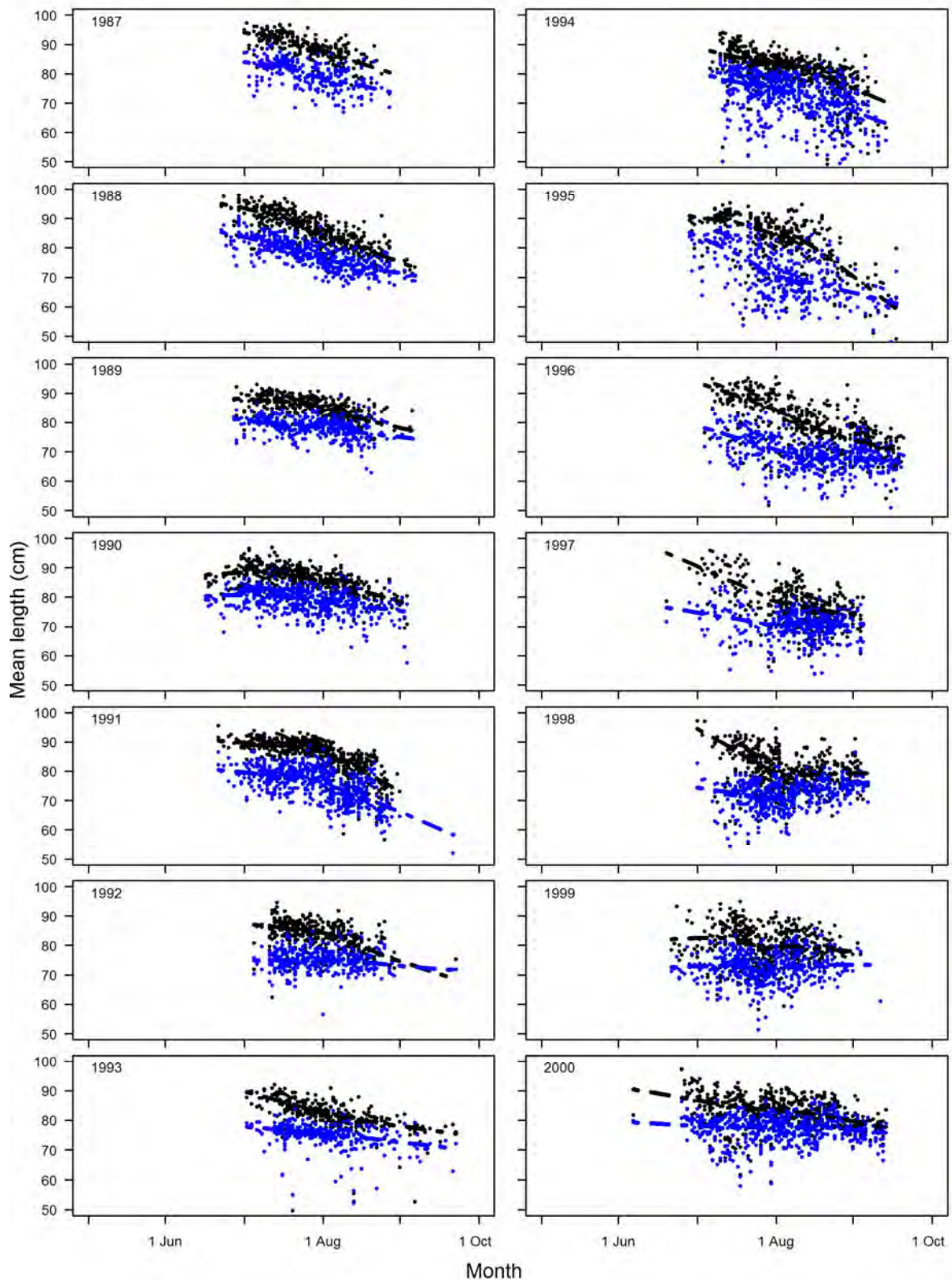


Figure 13: Mean length of female (black) and male (blue) hoki taken in commercial catches from the west coast South Island spawning fishery 1987–2000 sampled at sea by the Observer Programme. Lines are a loess fit.

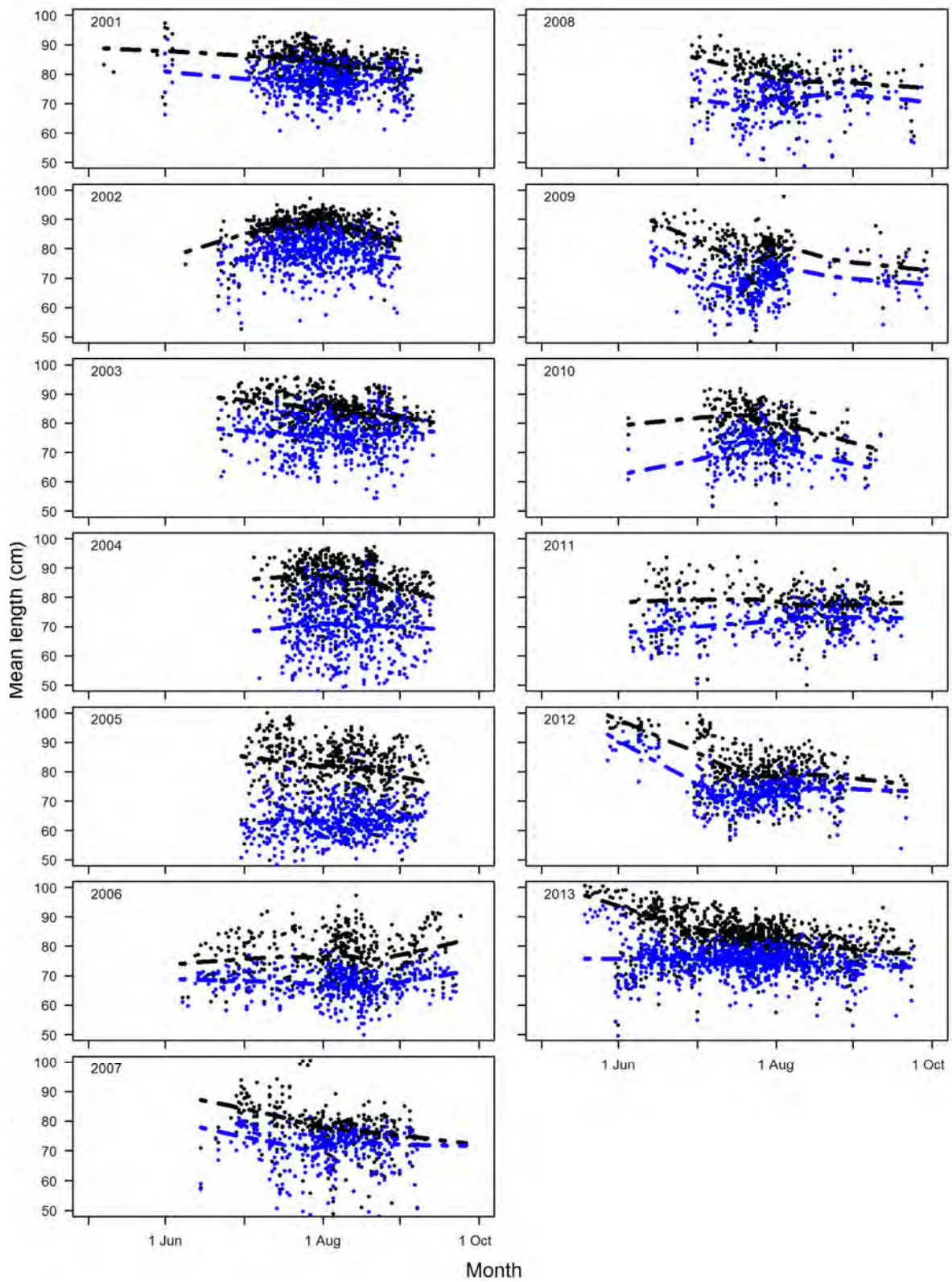


Figure 13 ctd.

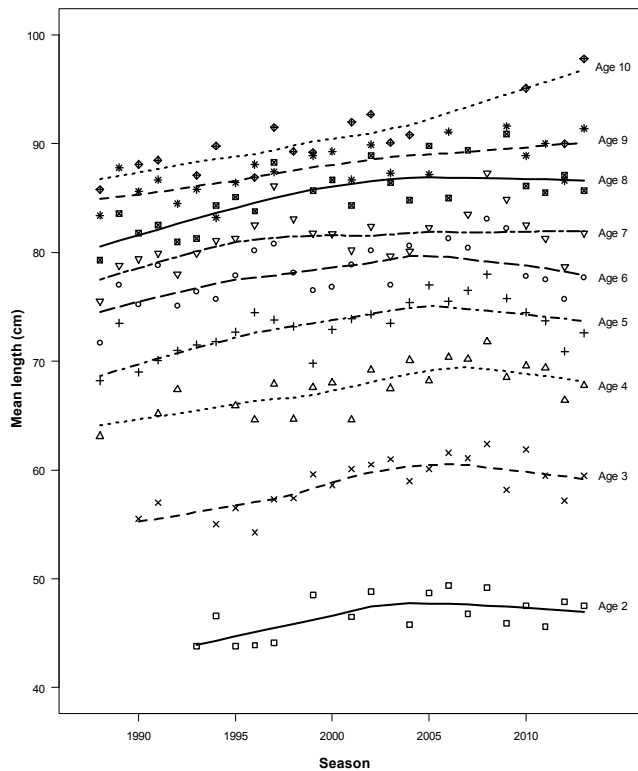
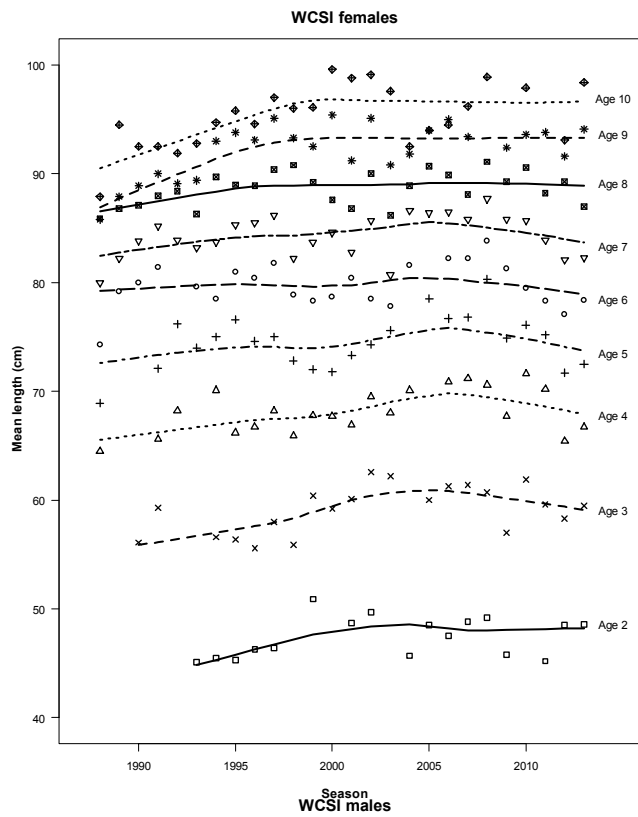


Figure 14: Mean length at age of female and male hoki taken in commercial catches from the west coast South Island spawning fishery 1988–2013 sampled at sea by the Observer Programme. Lines are a loess fit. Points with fewer than ten records are excluded.

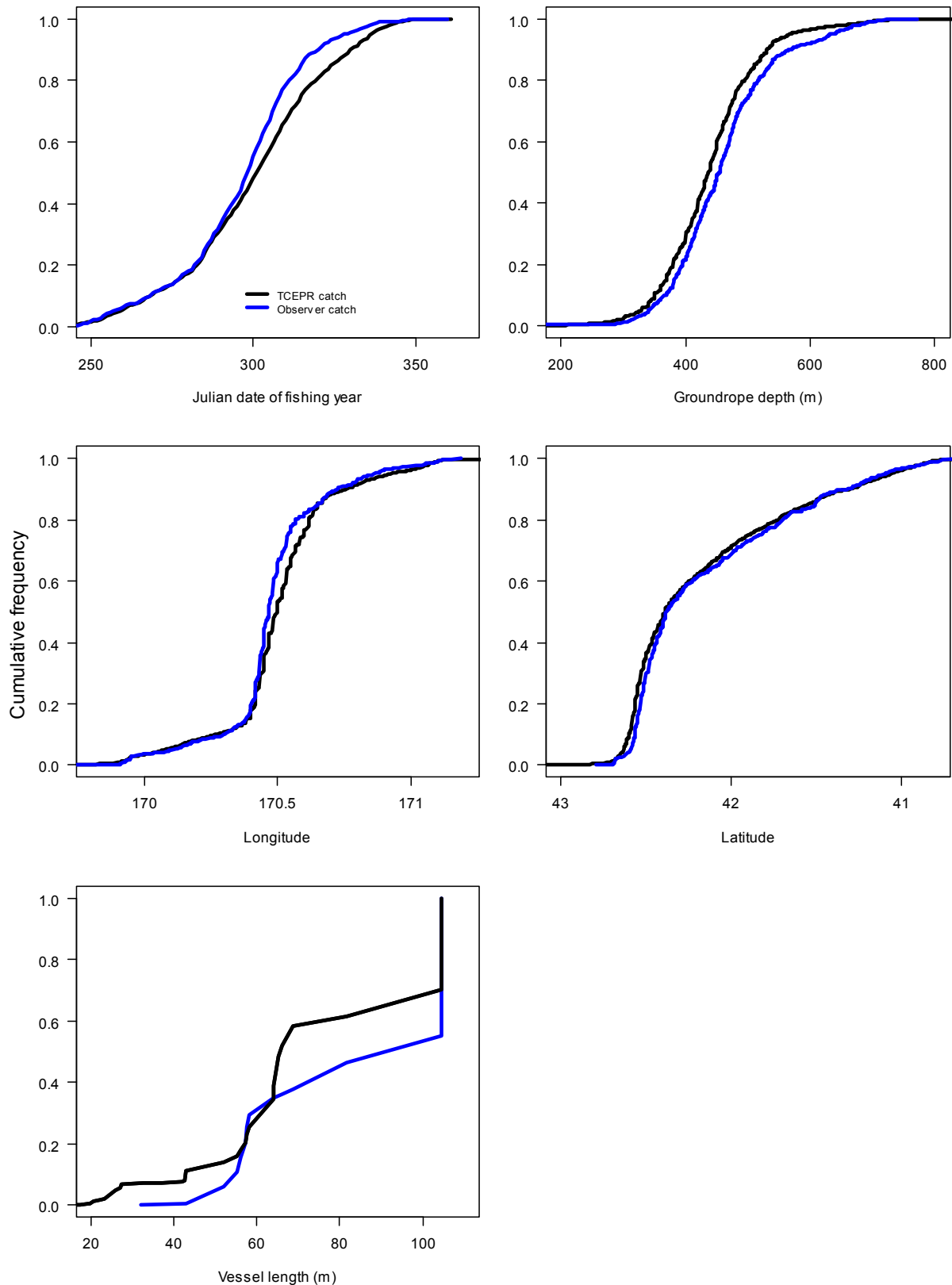


Figure 15: Comparison of WCSI 2012–13 Observer Programme catch coverage with TCEPR catches by day of year, depth, latitude, longitude, and vessel length. If sampling is representative of the fishery, then blue lines (observed catches) should overlay the black lines (TCEPR catch).

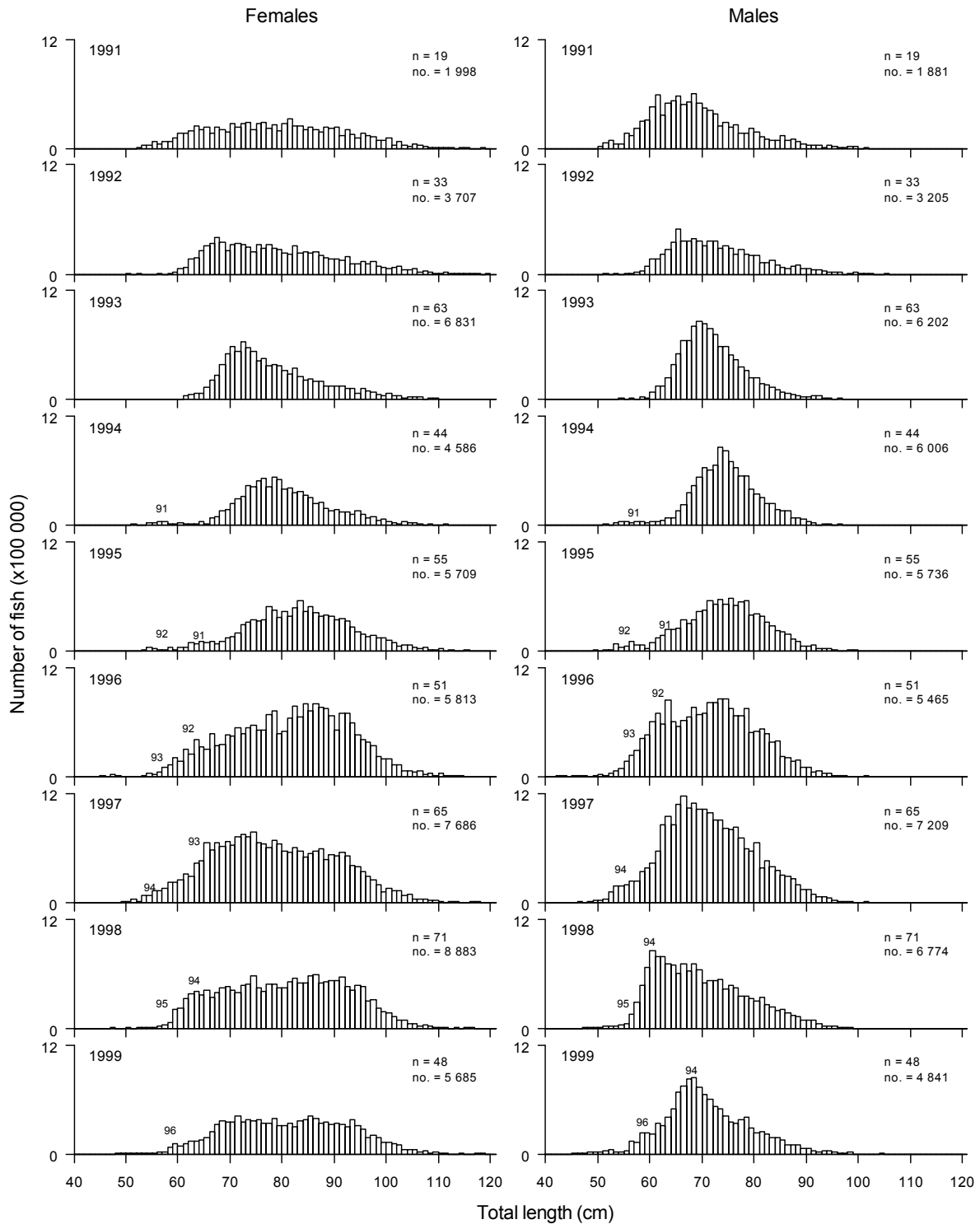


Figure 16: Length frequency of hoki in commercial catches from the Cook Strait spawning fishery from 1991 to 2013 sampled in sheds by the Stock Monitoring Programme and NIWA, and at sea by the Observer Programme. n, number of landings sampled; no., number of fish sampled. Numbers above the histograms mark year-class modes, e.g., 91 = 1991 year-class.

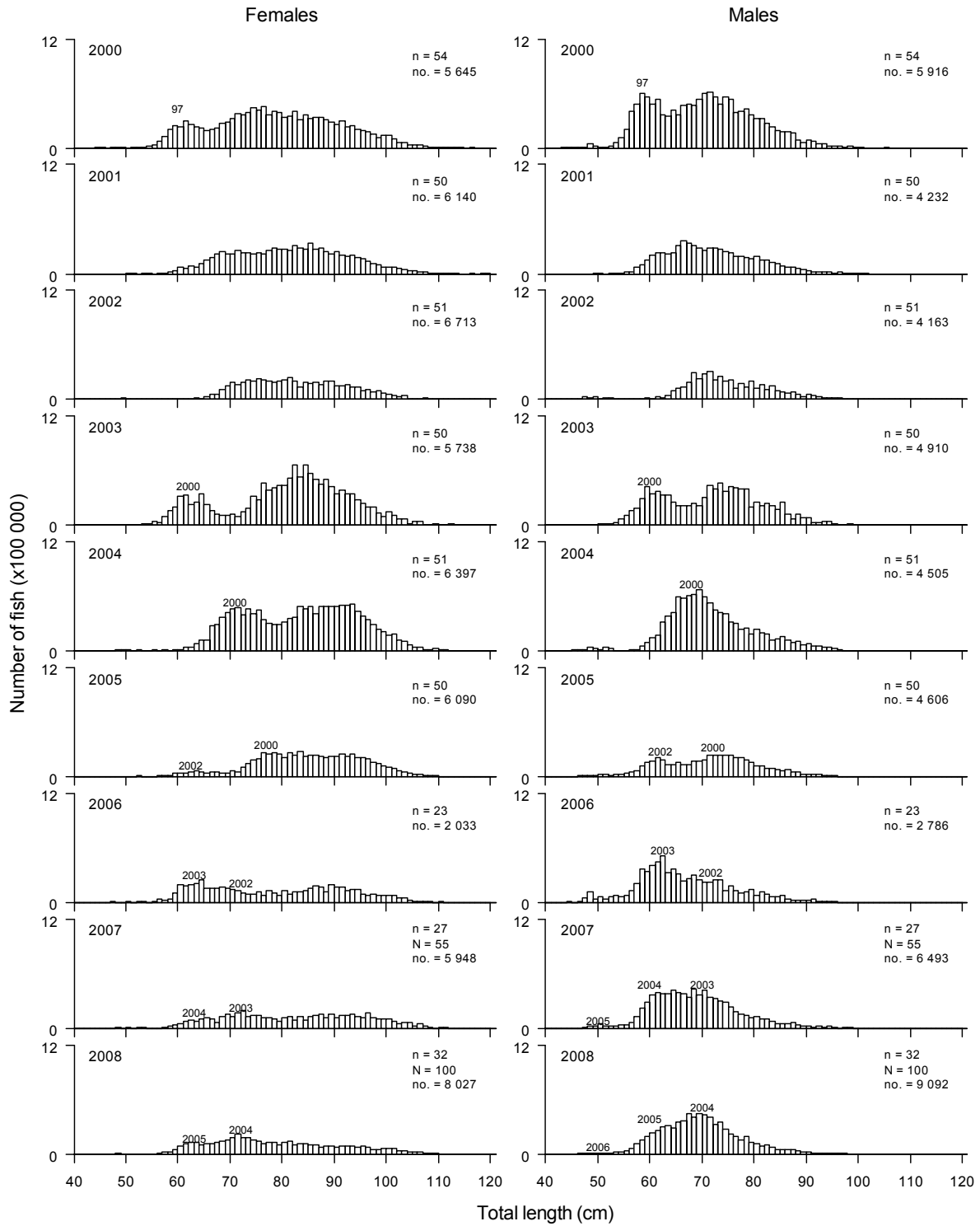


Figure 16 ctd.: 2006 data excludes Nelson vessels at least 40 m which sorted their catch at sea. 2007 and 2008 data includes shed samples (vessels less than 40 m) and observer samples (vessels at least 40 m). n, number of landings sampled; N, number of observed tows; no., number of fish sampled. Numbers above the histograms mark year-class modes, e.g., 97 = 1997 year-class and 2000 = 2000 year-class.

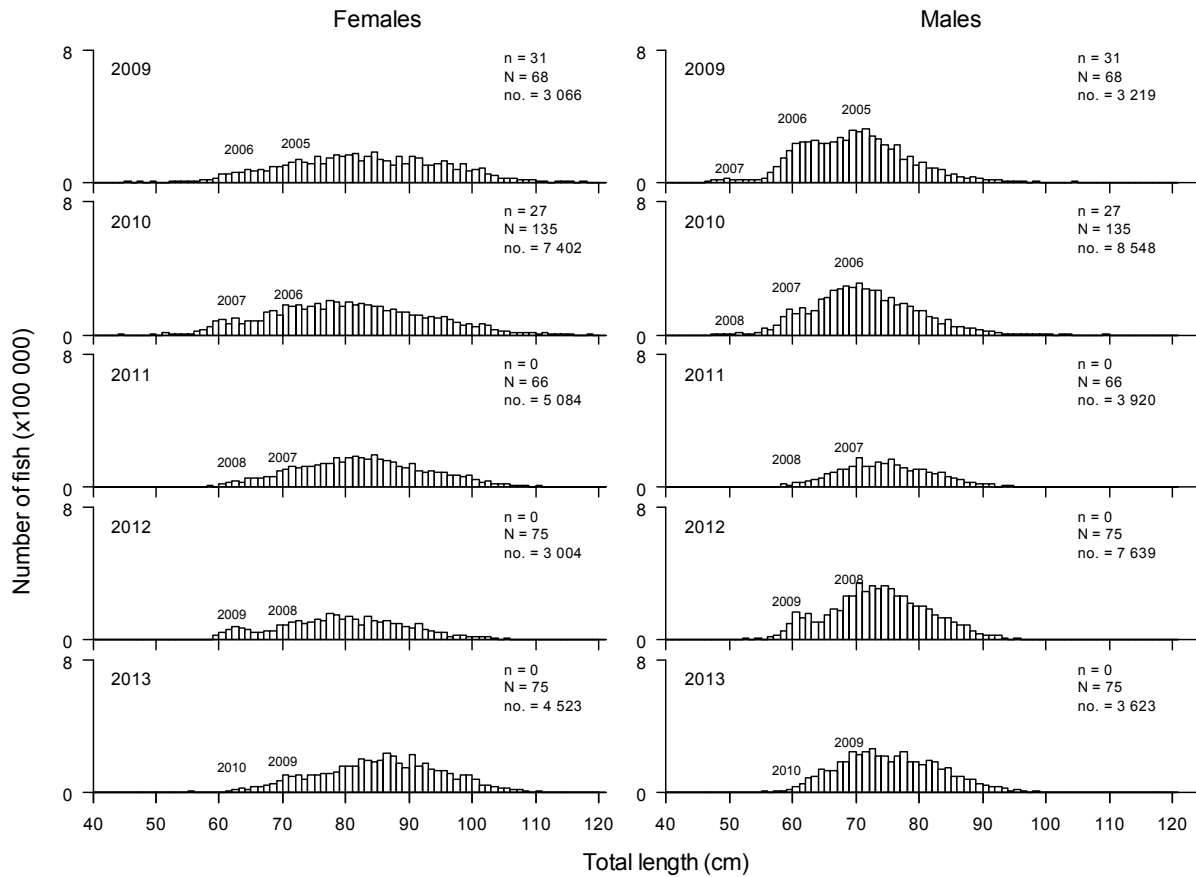


Figure 16 ctd.: 2009 data includes shed samples (vessels less than 40 m) and observer samples (vessels at least 40 m), 2010 data includes shed samples (vessels less than 40 m) and shed and observer samples (vessels at least 40 m) and 2011–2013 data comprise only observer samples. n, number of landings sampled; N, number of observed tows; no., number of fish sampled. Numbers above the histograms mark year-class modes, e.g., 2007 = 2007 year-class.

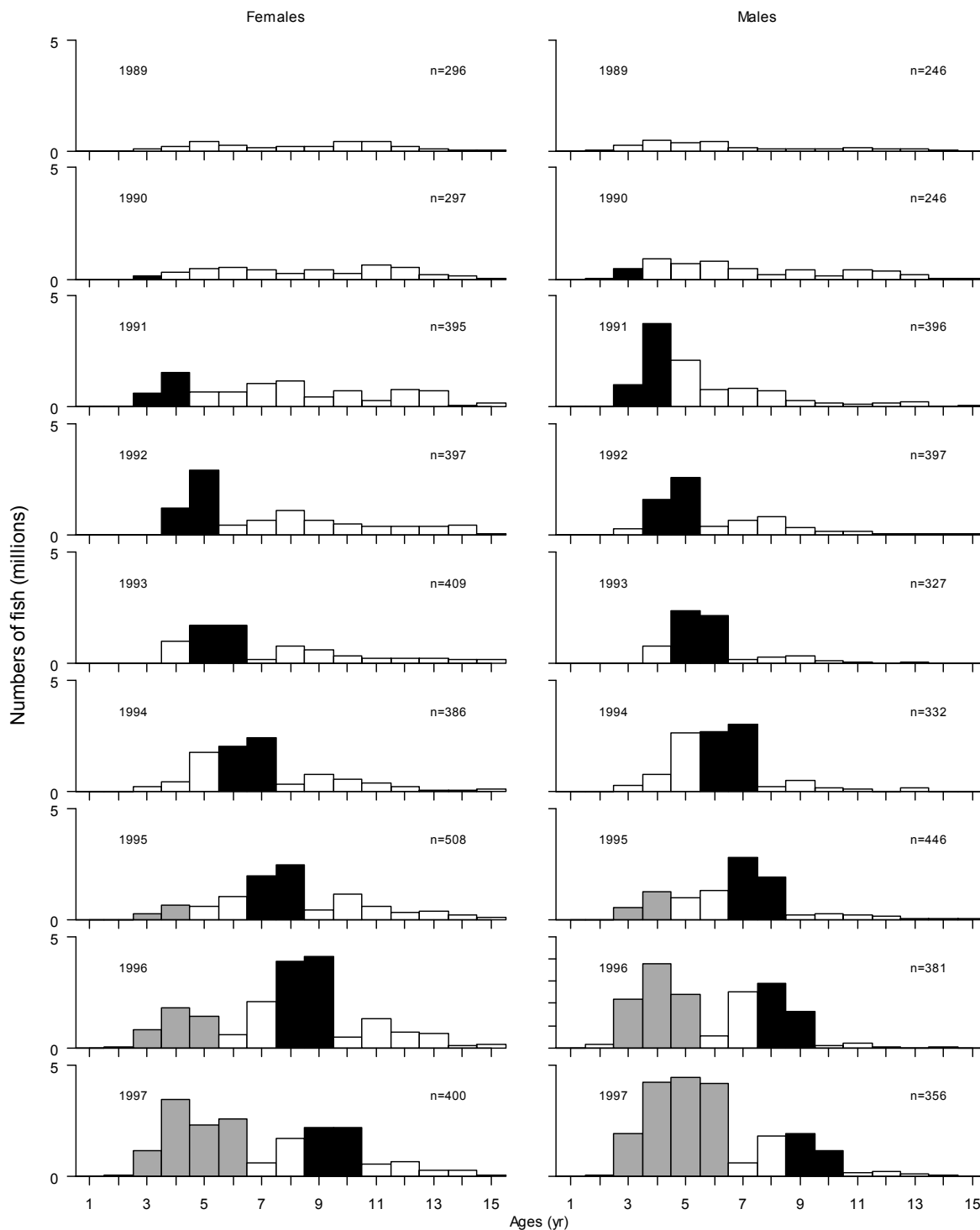


Figure 17: Catch at age of hoki in commercial catches from the Cook Strait spawning fishery from 1988 to 2010 sampled in sheds by the Stock Monitoring Programme and NIWA, and at sea by observers. 2006 data excludes Nelson shed samples from vessels at least 40 m which sorted their catch at sea. 2007–2009 data includes shed samples (vessels less than 40 m) and tows sampled at sea by the Observer Programme (vessels at least 40 m), 2010 data includes shed samples (vessels less than 40 m) and shed and observer samples (vessels at least 40 m), and 2011–2013 data includes observer samples only from vessels longer and shorter than 40 m. n, number of fish aged. Black bars show 1987 and 1988 year-classes in the 1990–2003 seasons; dark grey bars show 1991–94 year-classes, light grey bars show the 2000 year-class, and black bars show the 2002–2003 year-classes from the 2005 season.

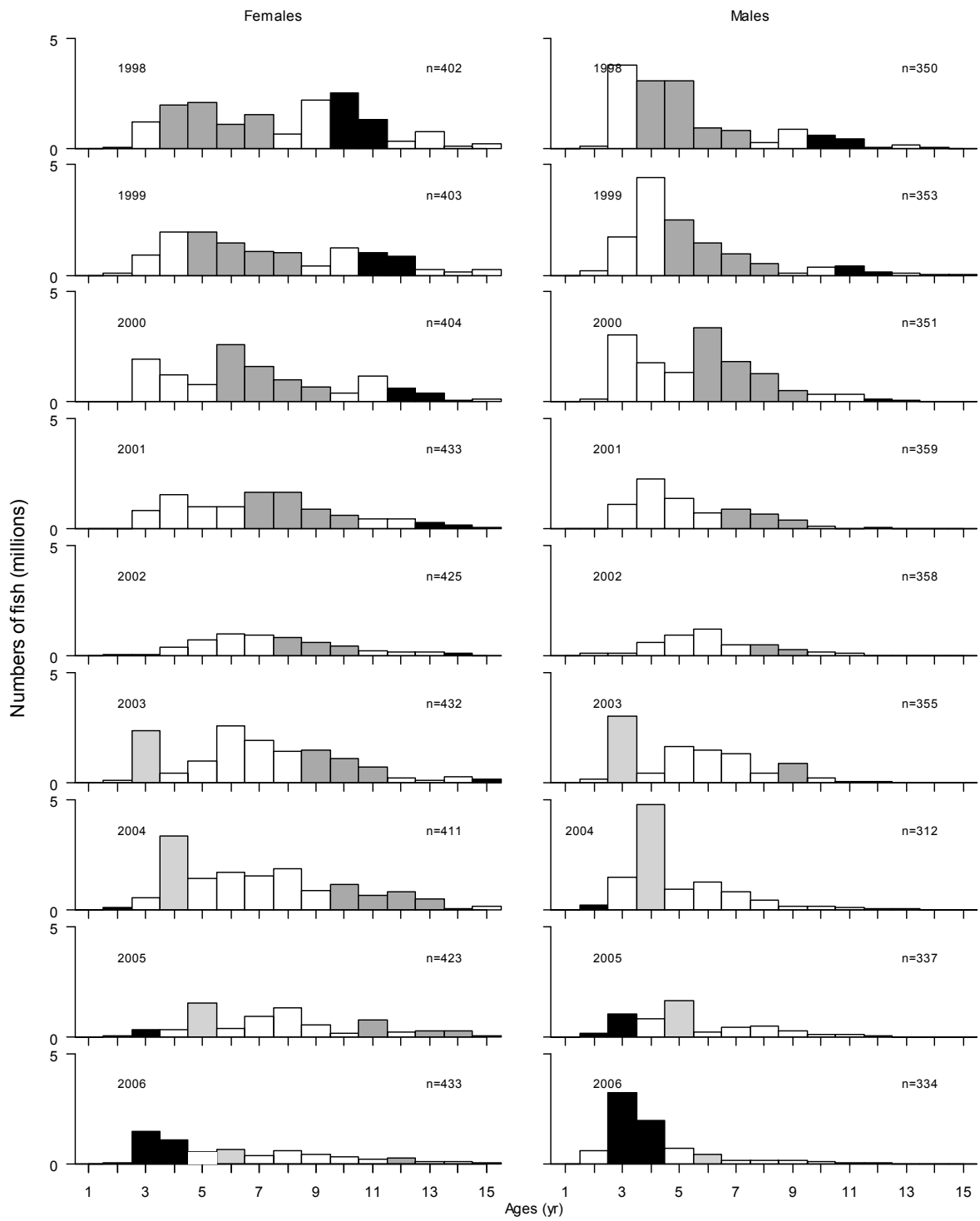


Figure 17 ctd.

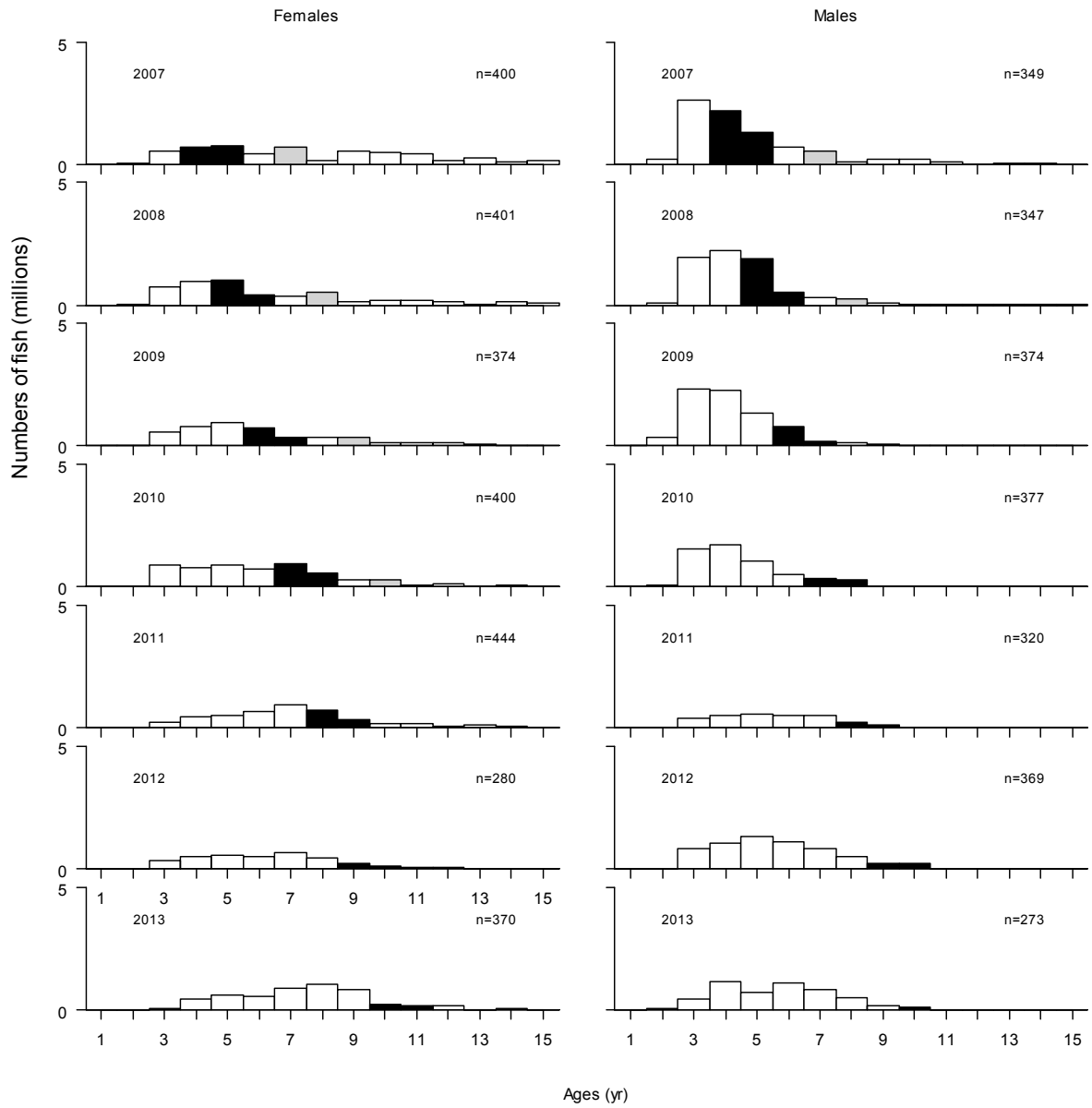


Figure 17 ctd.

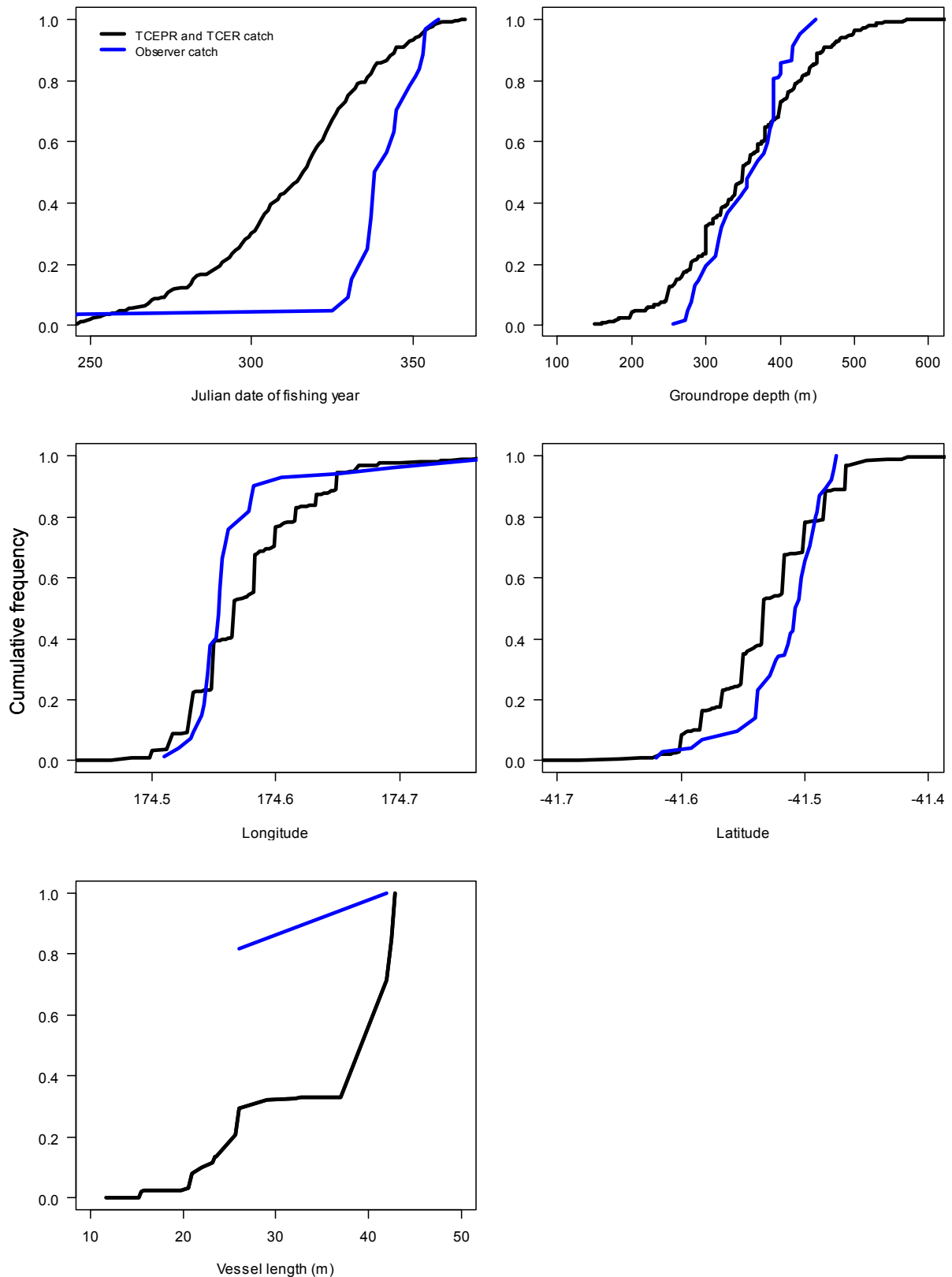


Figure 18: Comparison of Cook Strait 2012–13 Observer Programme catch coverage for TCEPR and TCER catches by day of year, depth, latitude, longitude, and vessel length. If sampling is representative of the fishery, then blue lines (sampled catches) should overlay black lines (catches).

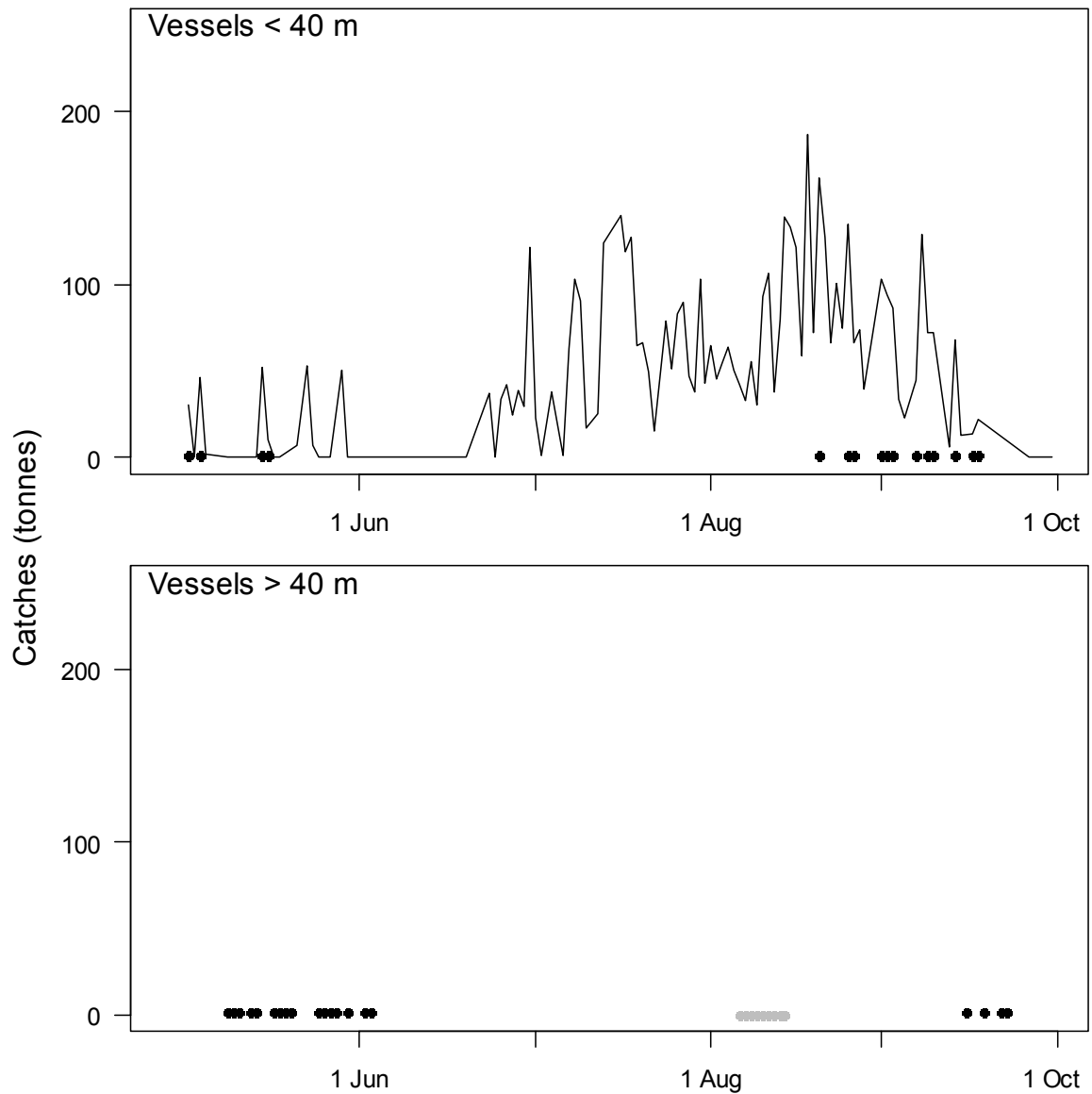


Figure 19: Cook Strait 2012–13 catch by day for vessels less than 40 m and 40 m or longer during the spawning season, showing timing of Observer Programme samples (black dots), and samples collected by a NIWA scientist on a commercial vessel (grey dots).

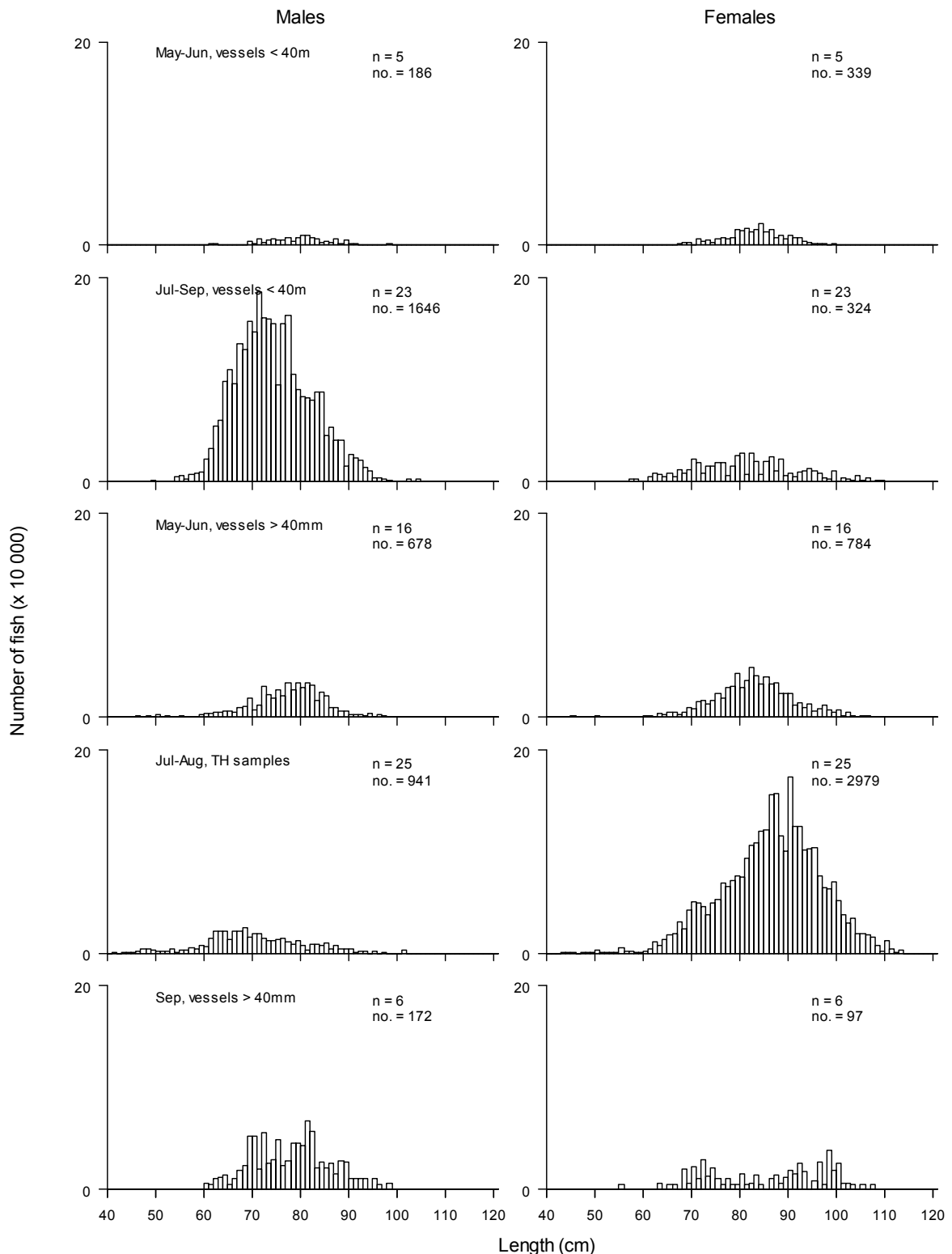


Figure 20: Comparison of Observer Programme length frequencies of hoki taken in commercial catches from Cook Strait during 2013 by month strata. n, number of tows sampled; no., number of fish sampled. TH samples: July–August tows collected by a NIWA scientist on a vessels > 40 m.

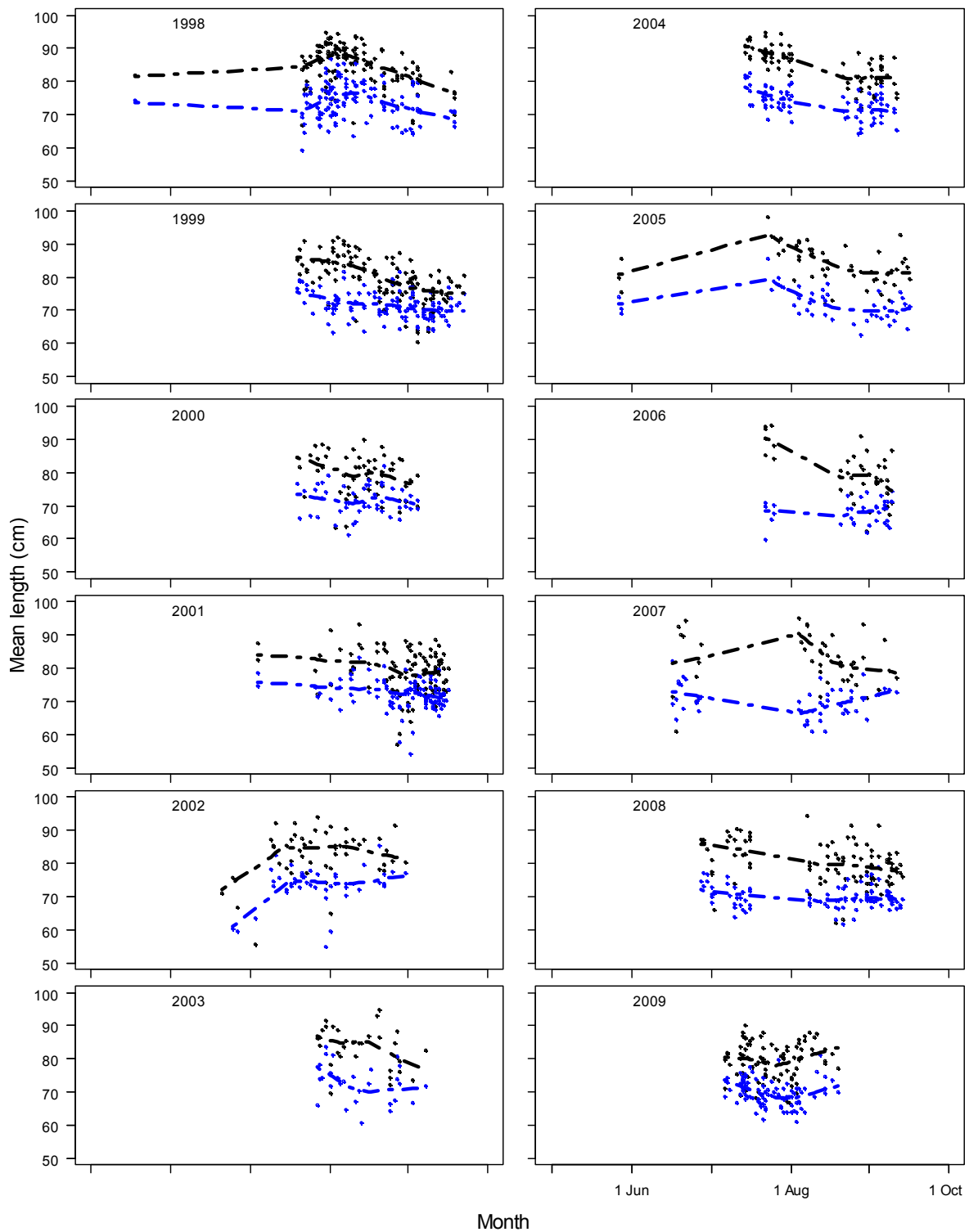


Figure 21: Mean length of female (black) and male (blue) hoki taken in commercial catches from the Cook Strait spawning fishery 1989–2013 from landings sampled by the Observer Programme. Lines are a loess fit.

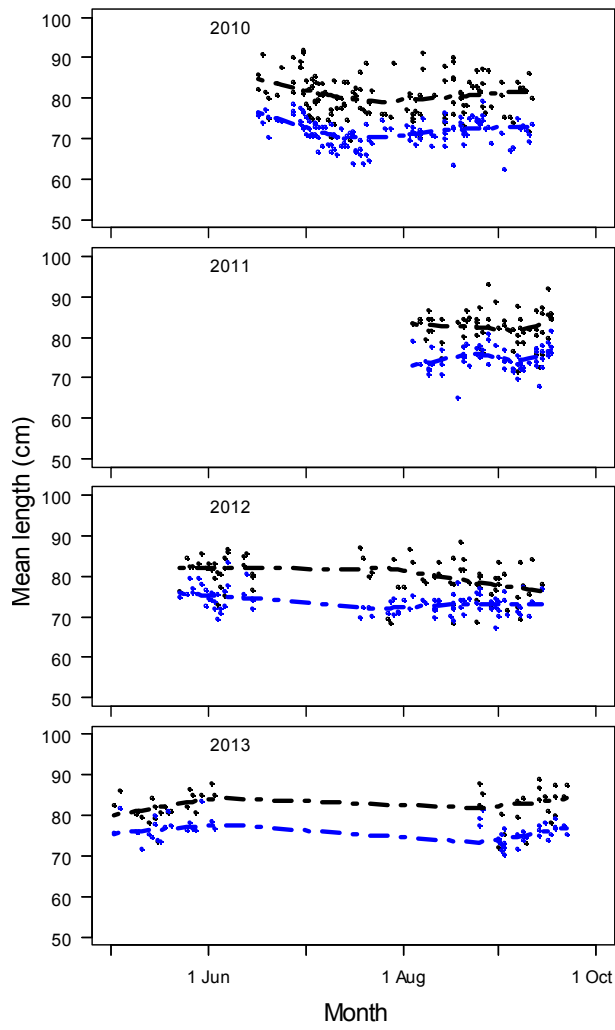


Figure 21 ctd.

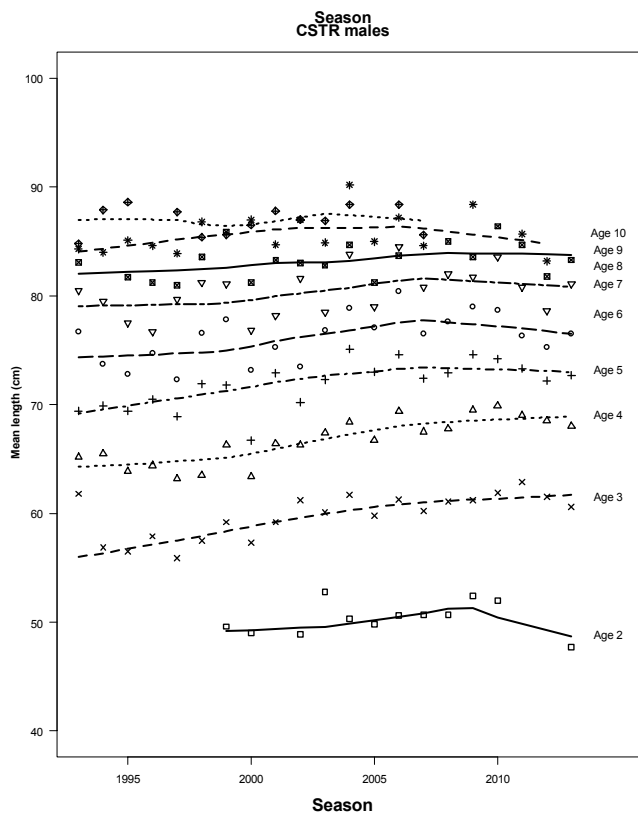
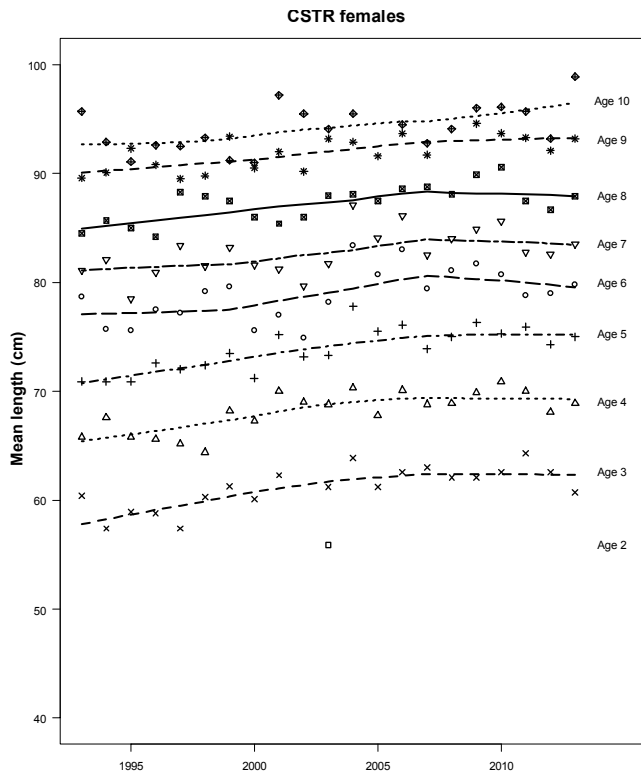


Figure 22: Mean length at age of female and male hoki taken in commercial catches from the Cook Strait spawning fishery 1988–2013 sampled at sea by the Observer Programme. Lines are a loess fit. Points with fewer than ten records are excluded.

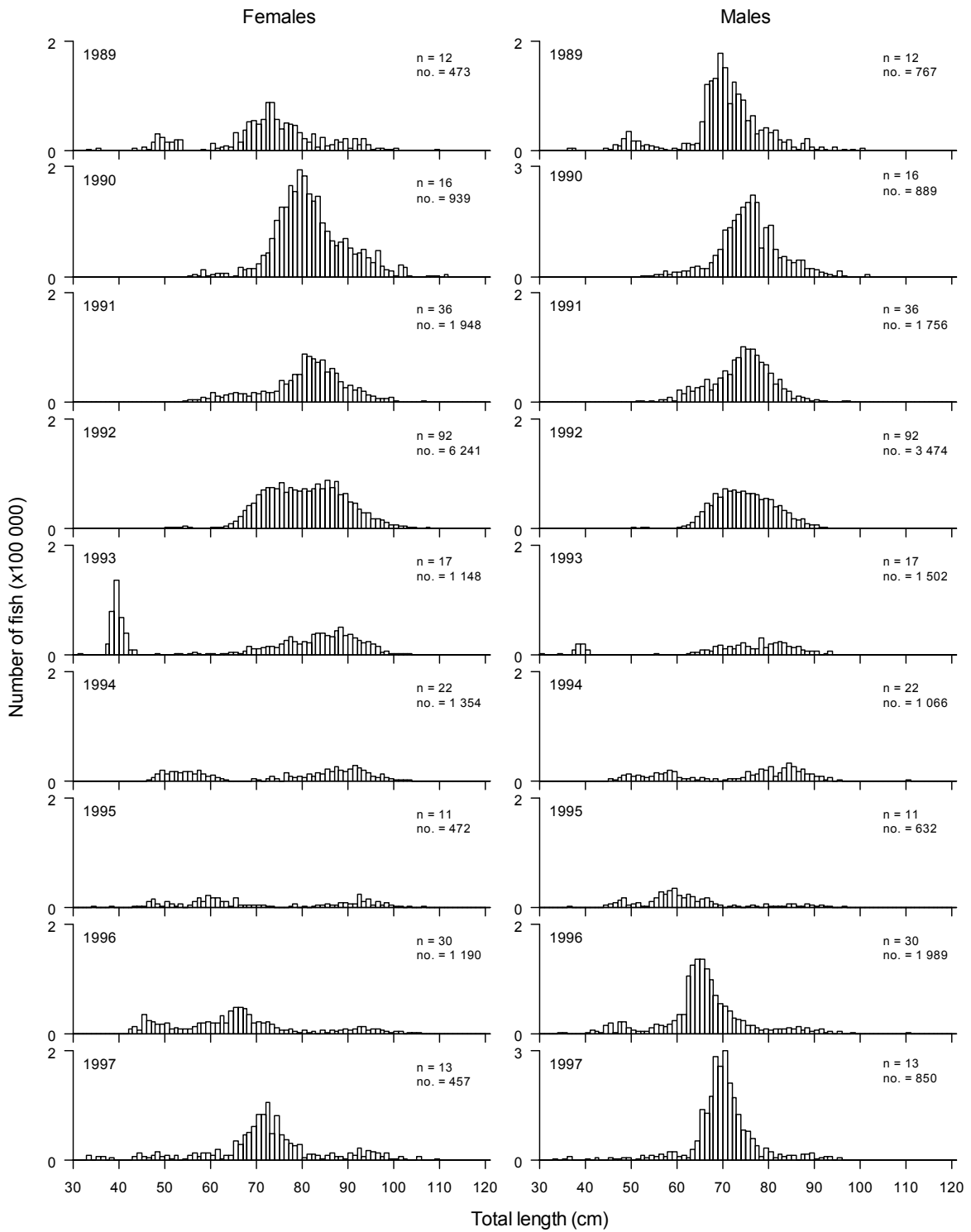


Figure 23: Length frequency of hoki in commercial catches from the Puysegur spawning fishery from 1989 to 1997, and 1999 to 2013 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled.

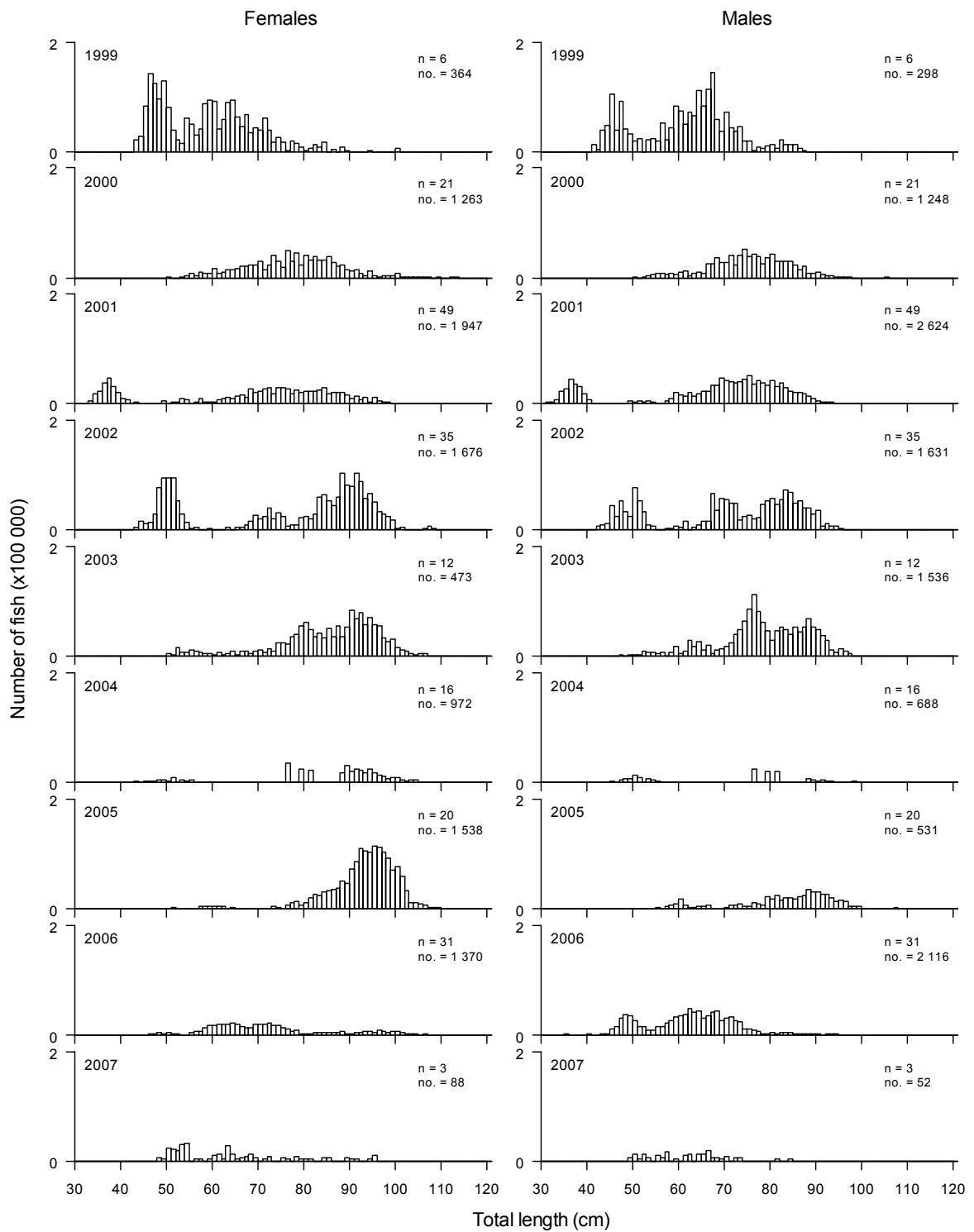


Figure 23 ctd.

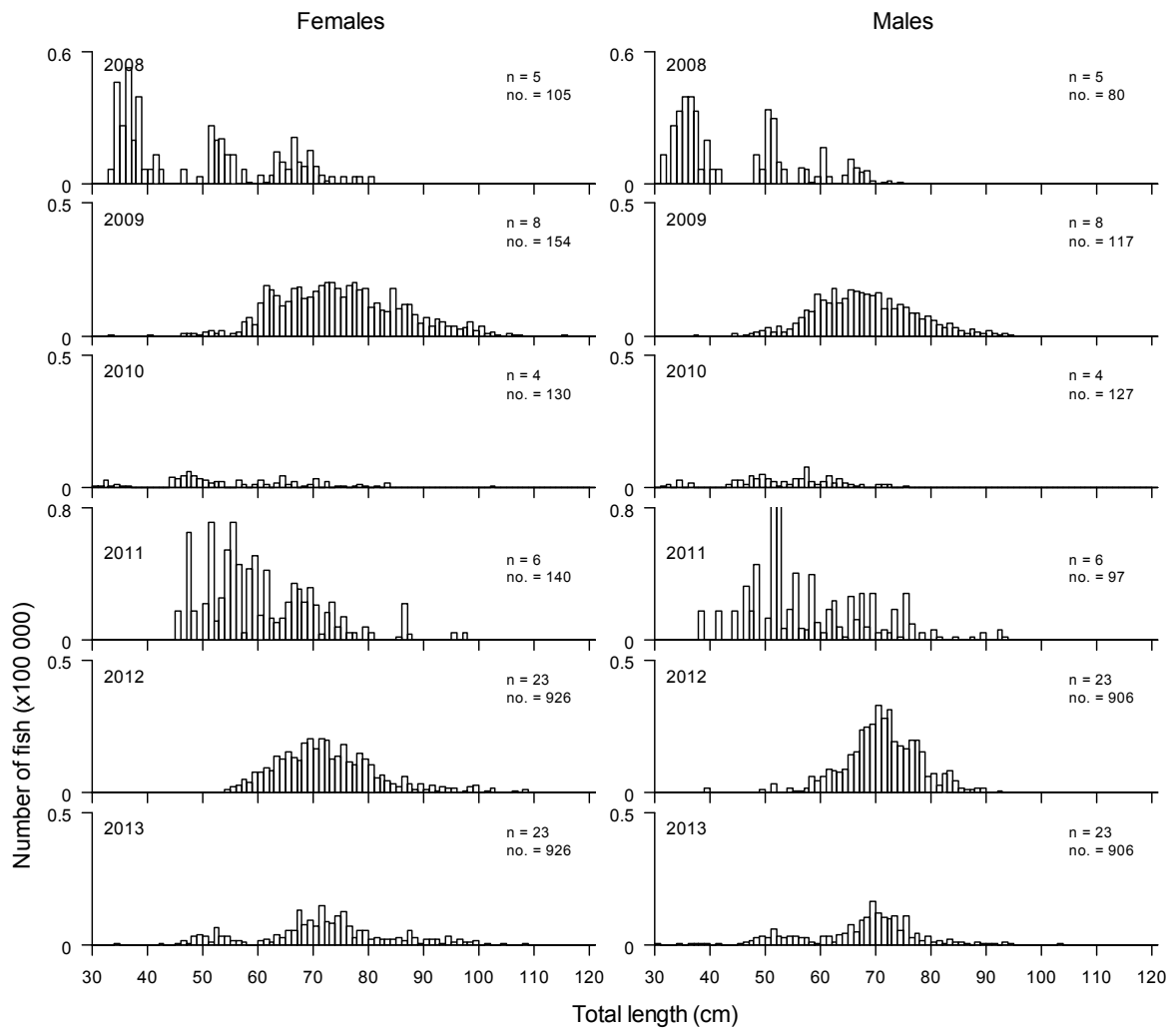


Figure 23 ctd.

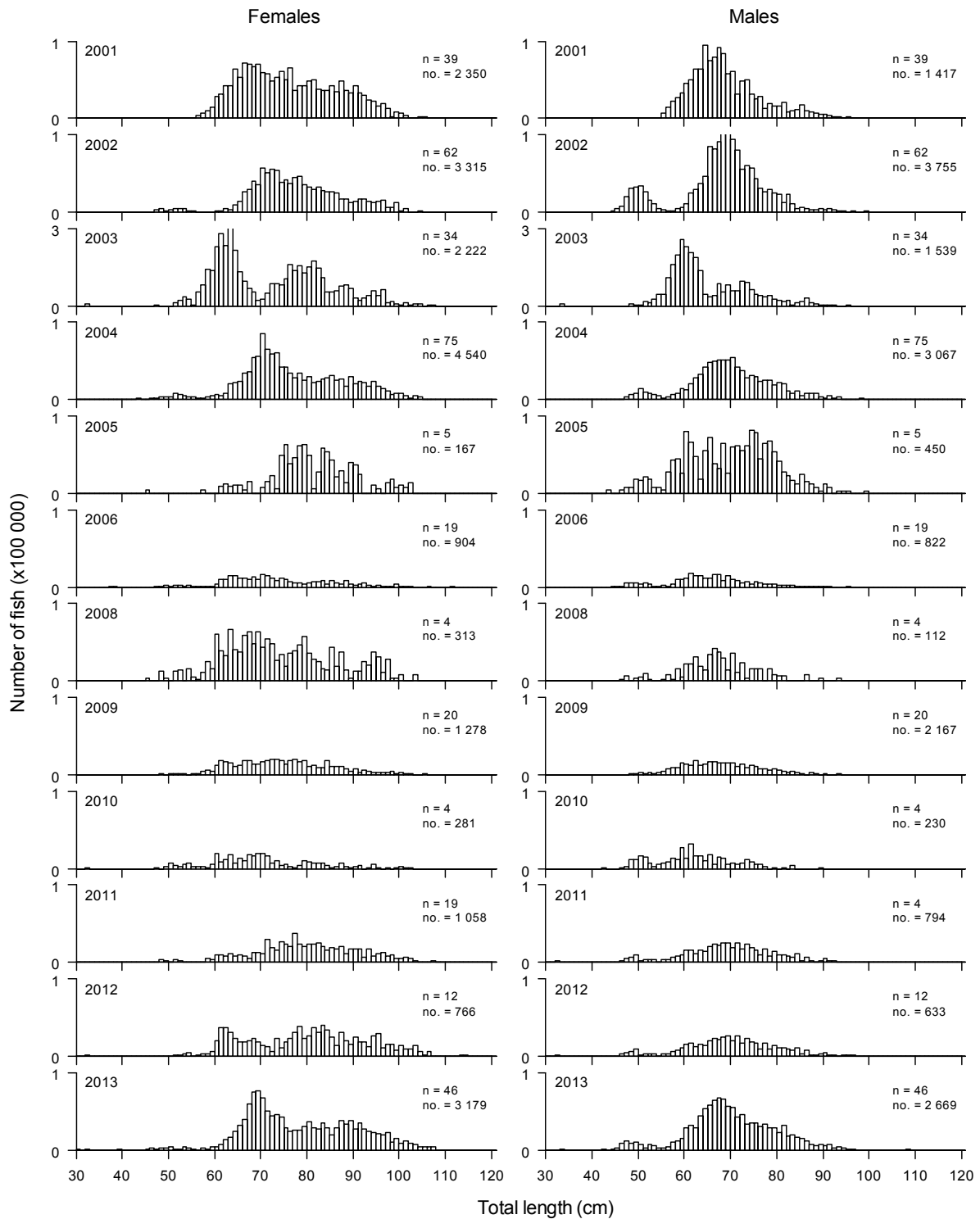


Figure 24: Length frequency of hoki taken in commercial catches from the ECSI spawning fishery from 2001 to 2013 sampled by the Scientific Observer Programme (2001–2006, 2008–2013) and combined with Hoki Management Company data (2001 to 2005). There were no samples in 2007. n, number of tows sampled; no., number of fish sampled.

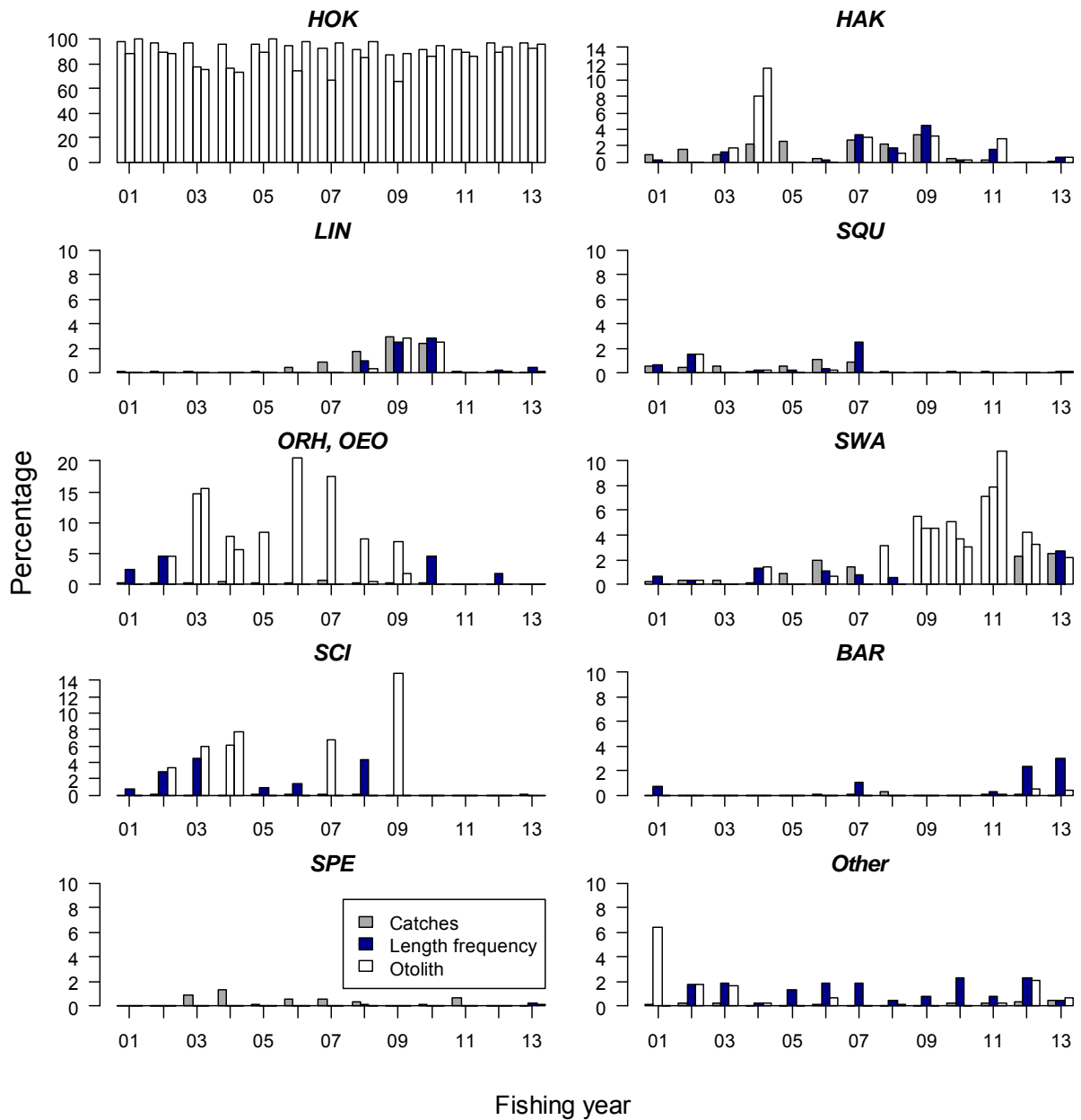


Figure 25: Percentage of hoki TCEPR, CELR and TCER catch, hoki length frequencies and hoki otoliths collected by the Observer Programme, by target species for the Chatham Rise fishery from 2000–01 to 2012–13. Three-letter codes denote target species: HOK, hoki; ORH, orange roughy; OEO, oreos; SQU, squid; SWA, silver warehou; HAK, hake; SCI, scampi; LIN, ling; BAR, barracouta; SPE, sea perch; Other, all other target species combined.

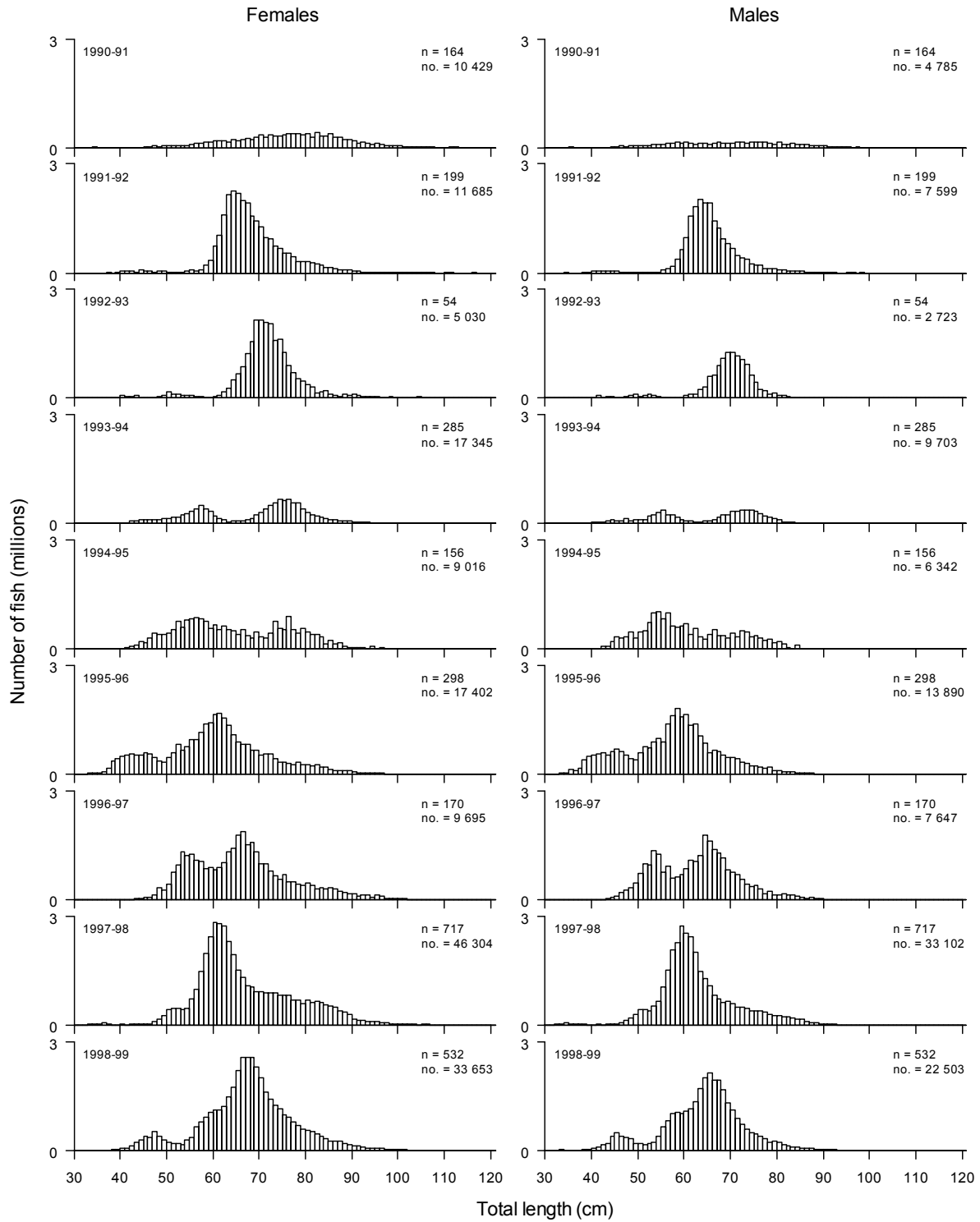


Figure 26: Length frequency of hoki taken in commercial catches from the Chatham Rise fishery from 1990-91 to 2012-13 sampled by the Observer Programme (and combined with Hoki Management Company data in 2000-01 to 2003-04). 2006-07 data include target hoki and hake tows. n, number of tows sampled; no., number of fish sampled.

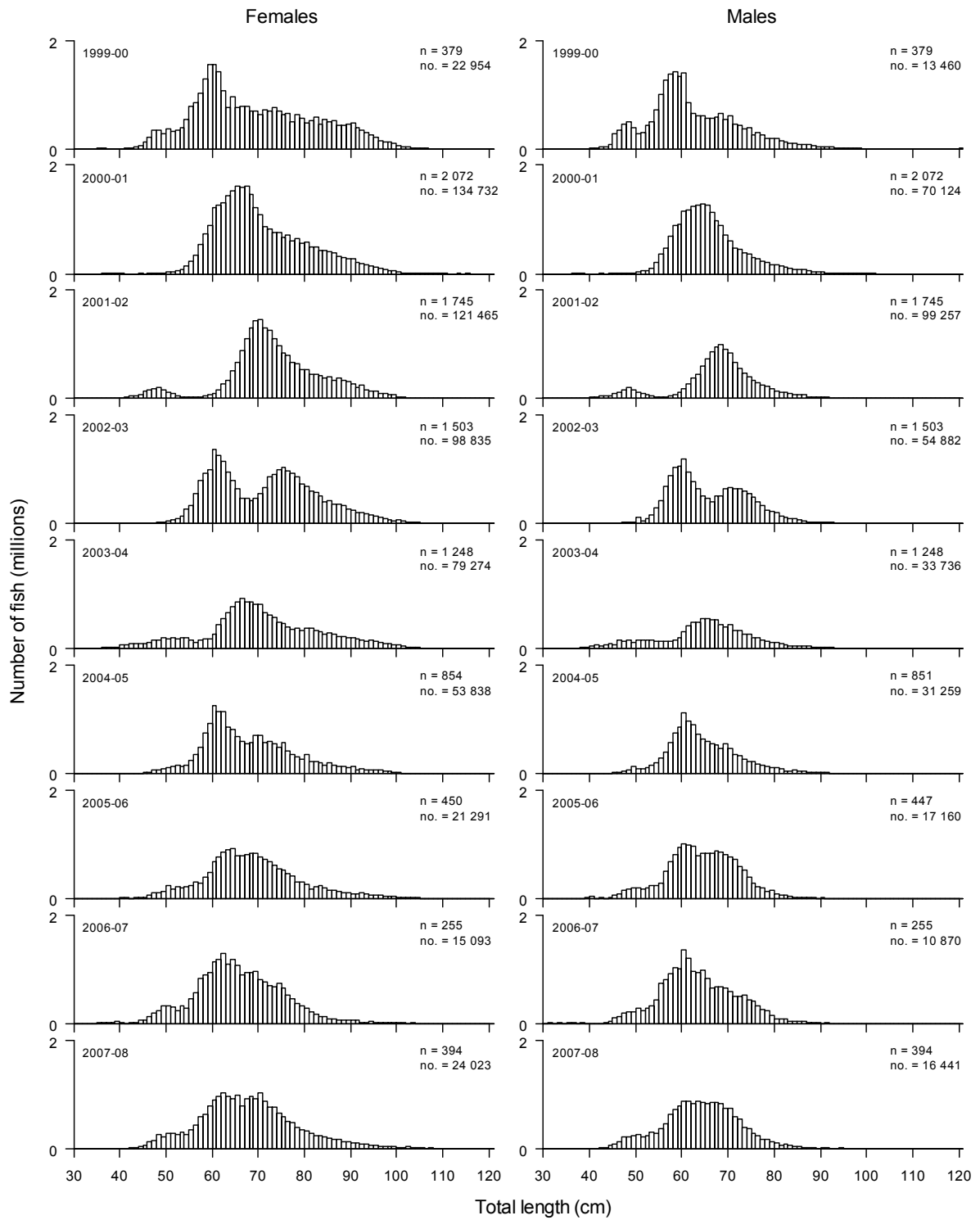


Figure 26 ctd.

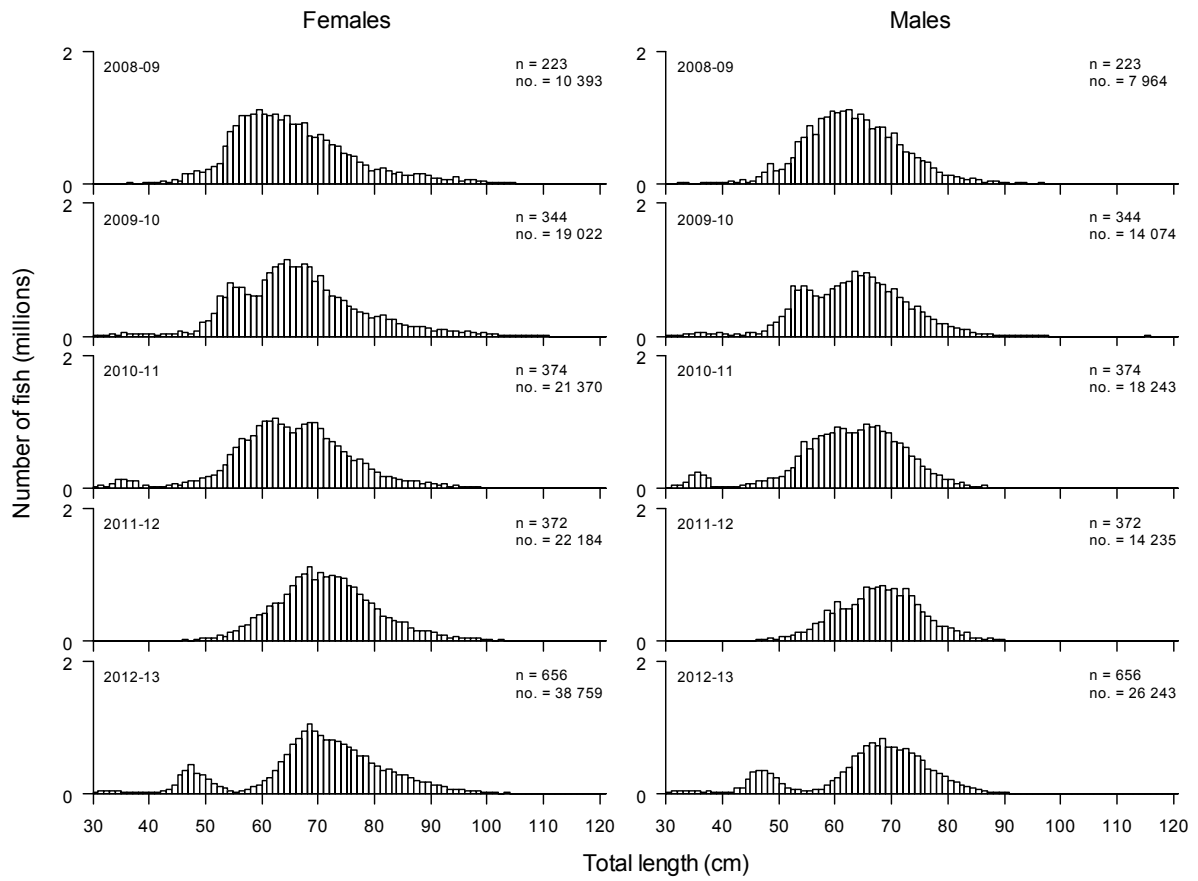


Figure 26 ctd.

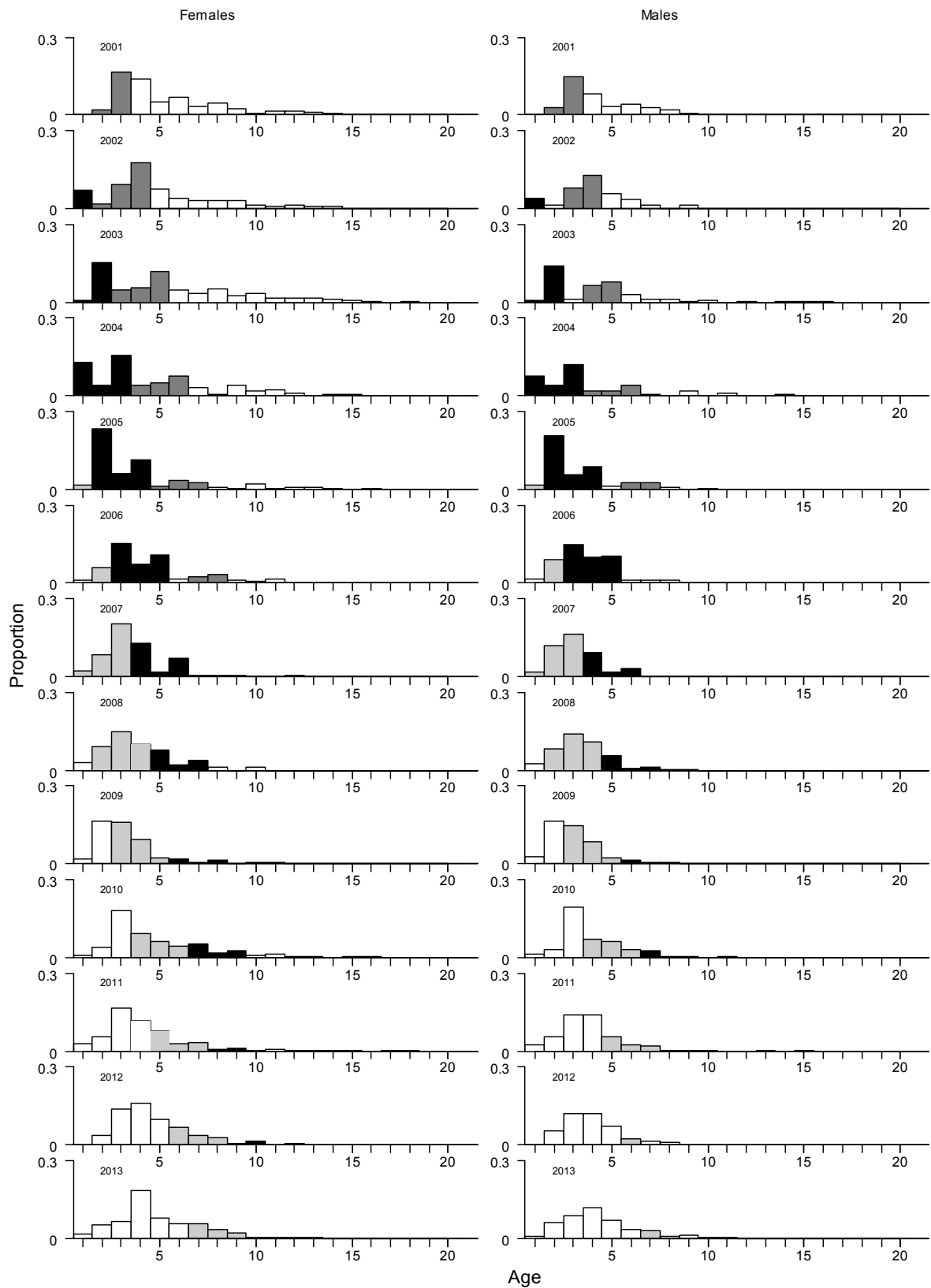


Figure 27: Proportions at age and sex in the catch from the Chatham Rise fishery as estimated by direct ageing of otoliths from 2000–01 to 2012–13. Dark grey bars show 1997–99 year-classes; black bars show 2000–02 year-classes; light grey bars show 2003–05 year-classes.

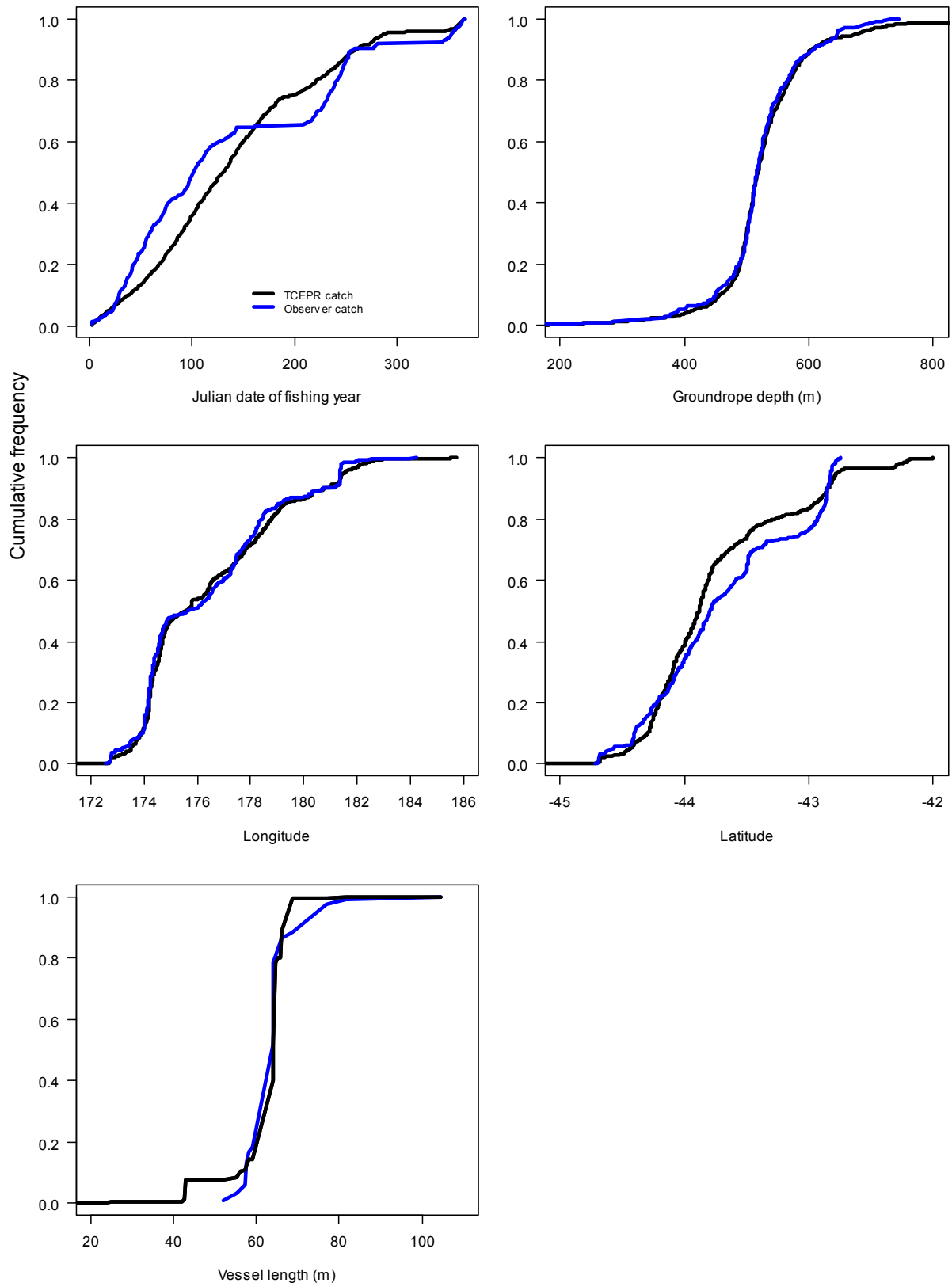


Figure 28: Comparison of Chatham Rise 2012–13 Observer Programme catch coverage with TCEPR catches by day of year, depth, latitude, longitude, and vessel length (m). If sampling is representative of the fishery, then blue lines (observed catches) should overlay black lines (TCEPR catch).

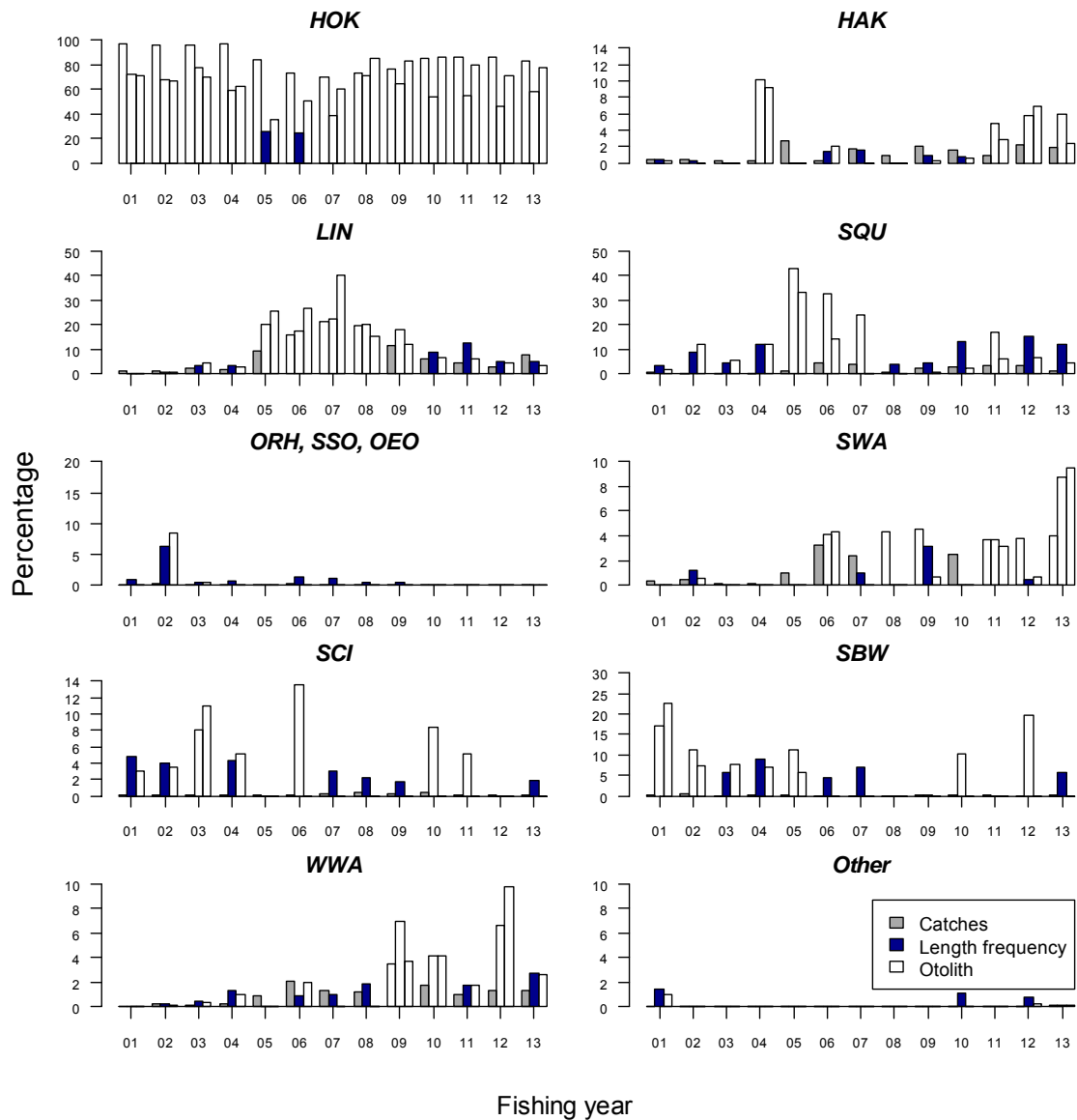


Figure 29: Percentages of hoki TCEPR, TCER and CELR catch, hoki length frequencies, and hoki otoliths collected by the Observer Programme, by target species for the Sub-Antarctic fishery from 2000–01 to 2012–13. Three-letter codes denote target species: HOK, hoki; HAK, hake; SQU, squid; ORH, orange roughy, SSO, smooth oreo; OEO, oreo; SWA, silver warehou; SBW, southern blue whiting; SCI, scampi; LIN, ling; WWA, white warehou; Other, other target species combined.

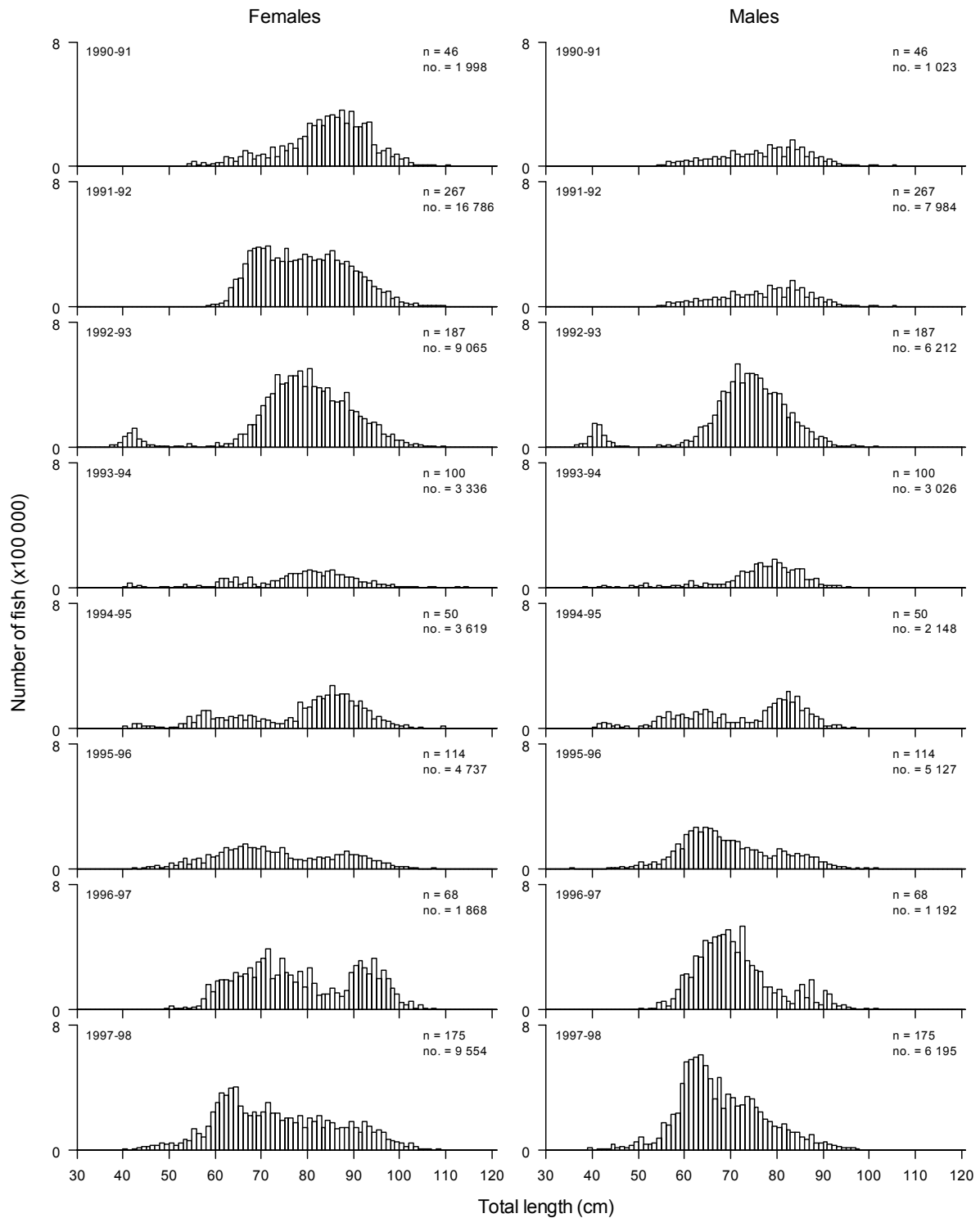


Figure 30: Length frequency of hoki taken in commercial catches from the Sub-Antarctic fishery from 1990-91 to 2012-13 sampled by the Observer Programme (and combined with Hoki Management Company data in 2000-01 to 2004-05). 2006-07 data includes target hoki and ling tows only. n, number of tows sampled; no., number of fish sampled.

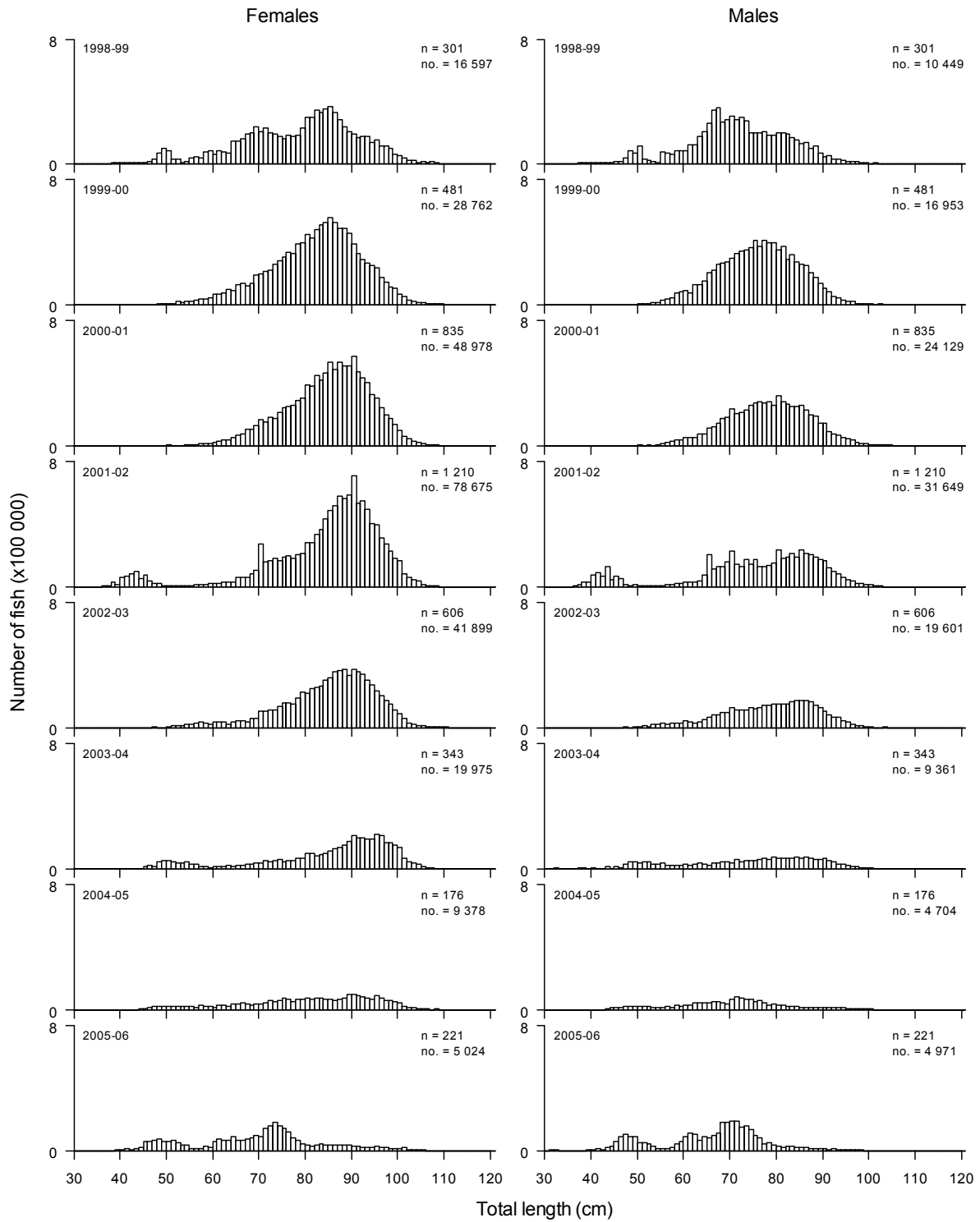


Figure 30 ctd.

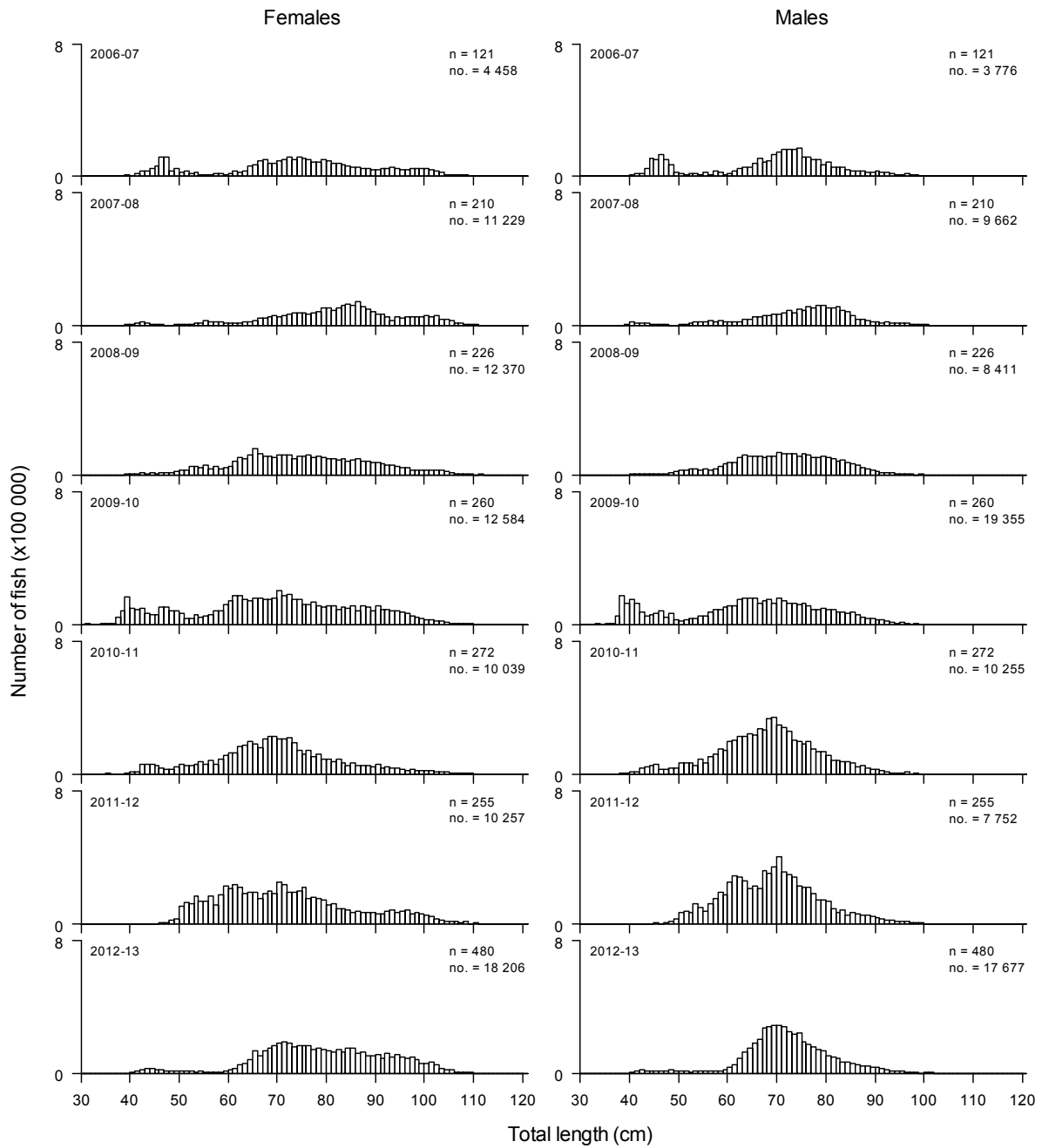


Figure 30 ctd.

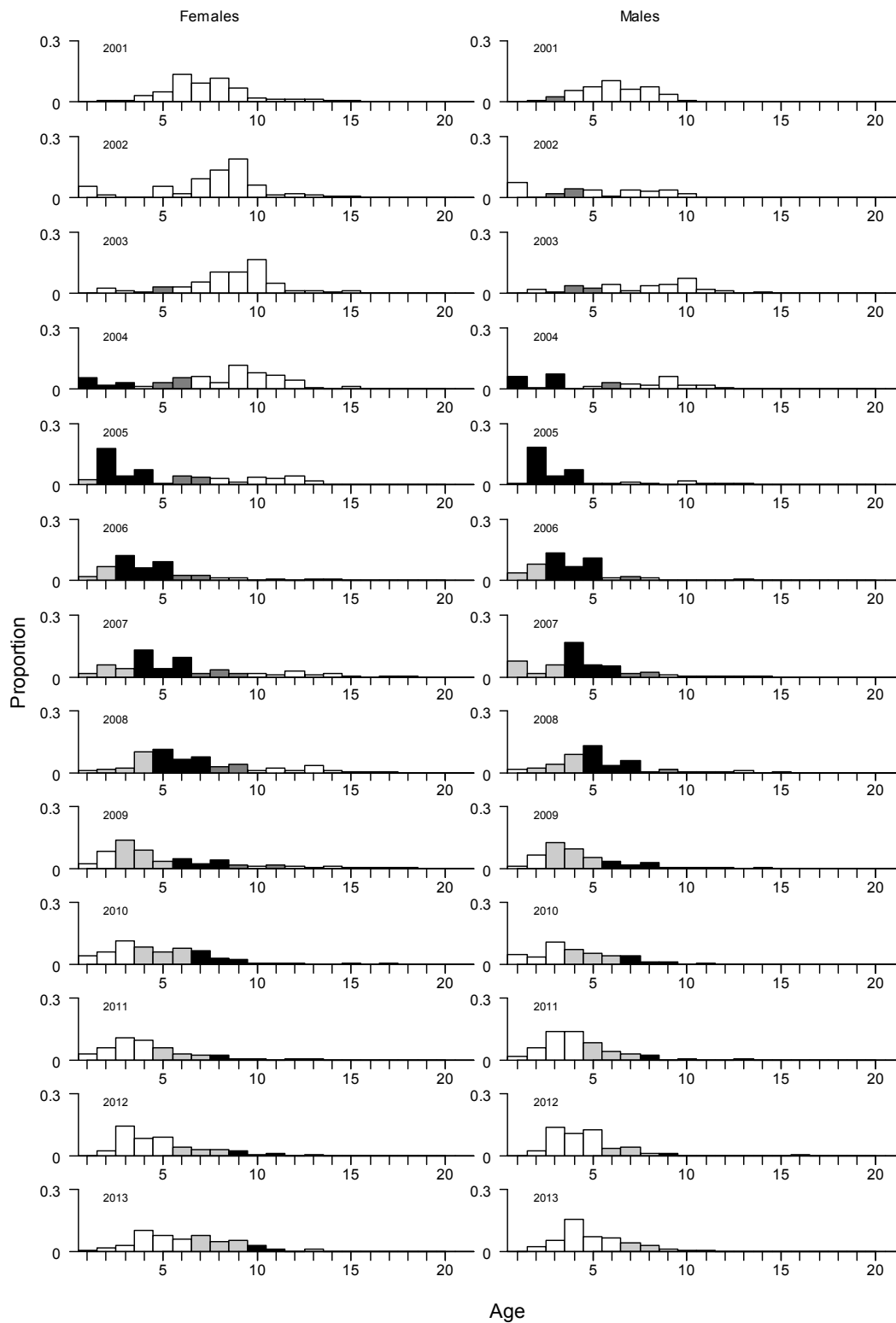


Figure 31: Proportions at age and sex in the catch from the Sub-Antarctic fishery as estimated by direct ageing of otoliths from 2000–01 to 2012–13. Dark grey bars show 1997–99 year-classes; black bars show 2000–02 year-classes; light grey bars show 2003–05 year-classes.

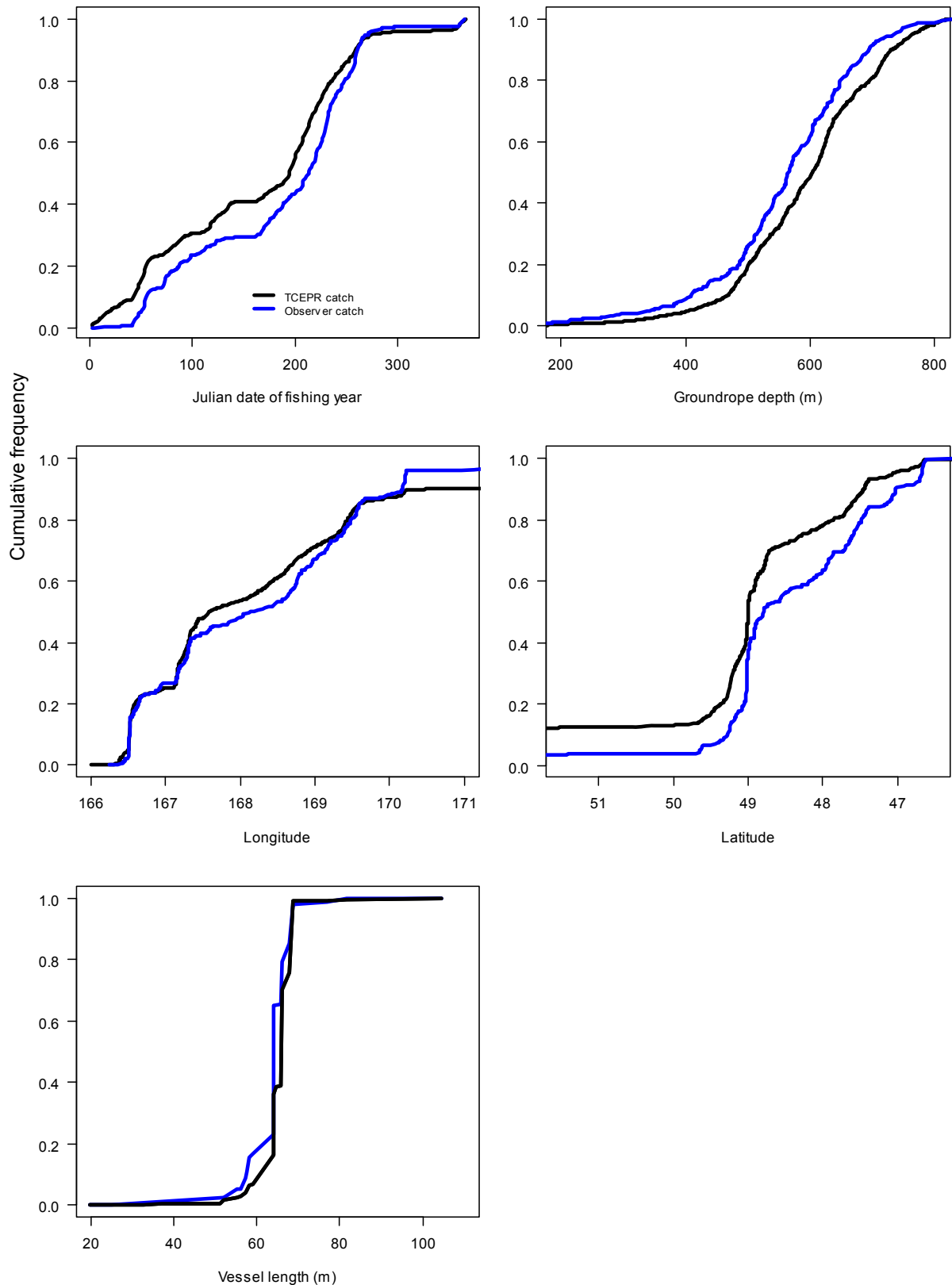


Figure 32: Comparison of Sub-Antarctic 2012–13 Observer Programme catch coverage with TCEPR catches by day of year, depth, latitude, longitude and vessel length (m). If sampling is representative of the fishery, then blue lines (observed catches) should overlay black lines (TCEPR catch).

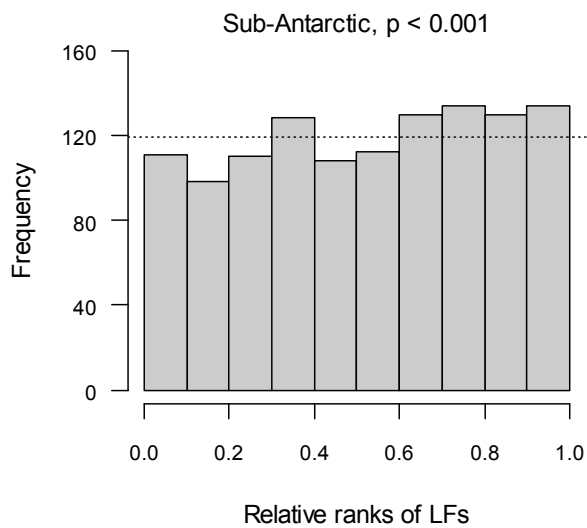
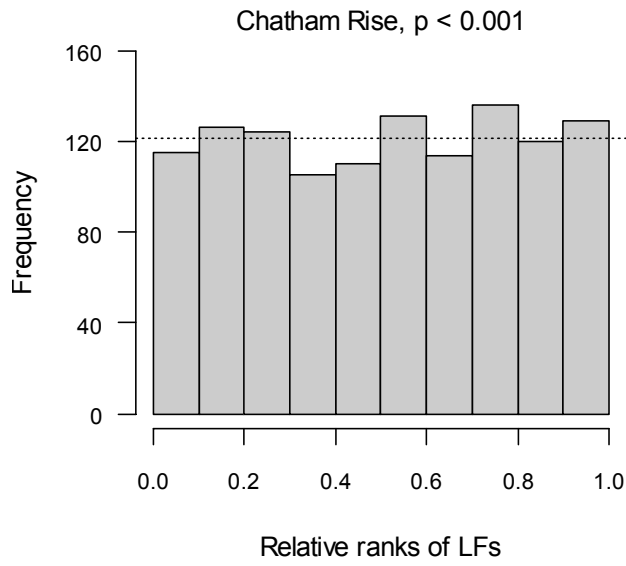


Figure 33: Histograms of ranks of the lengths that yielded 2012–13 Chatham Rise and Sub-Antarctic otoliths relative to the lengths of hoki measured for each tow. If sampling is random then the expected counts are given by the dotted line. The p-value is calculated using the rank-sum test.

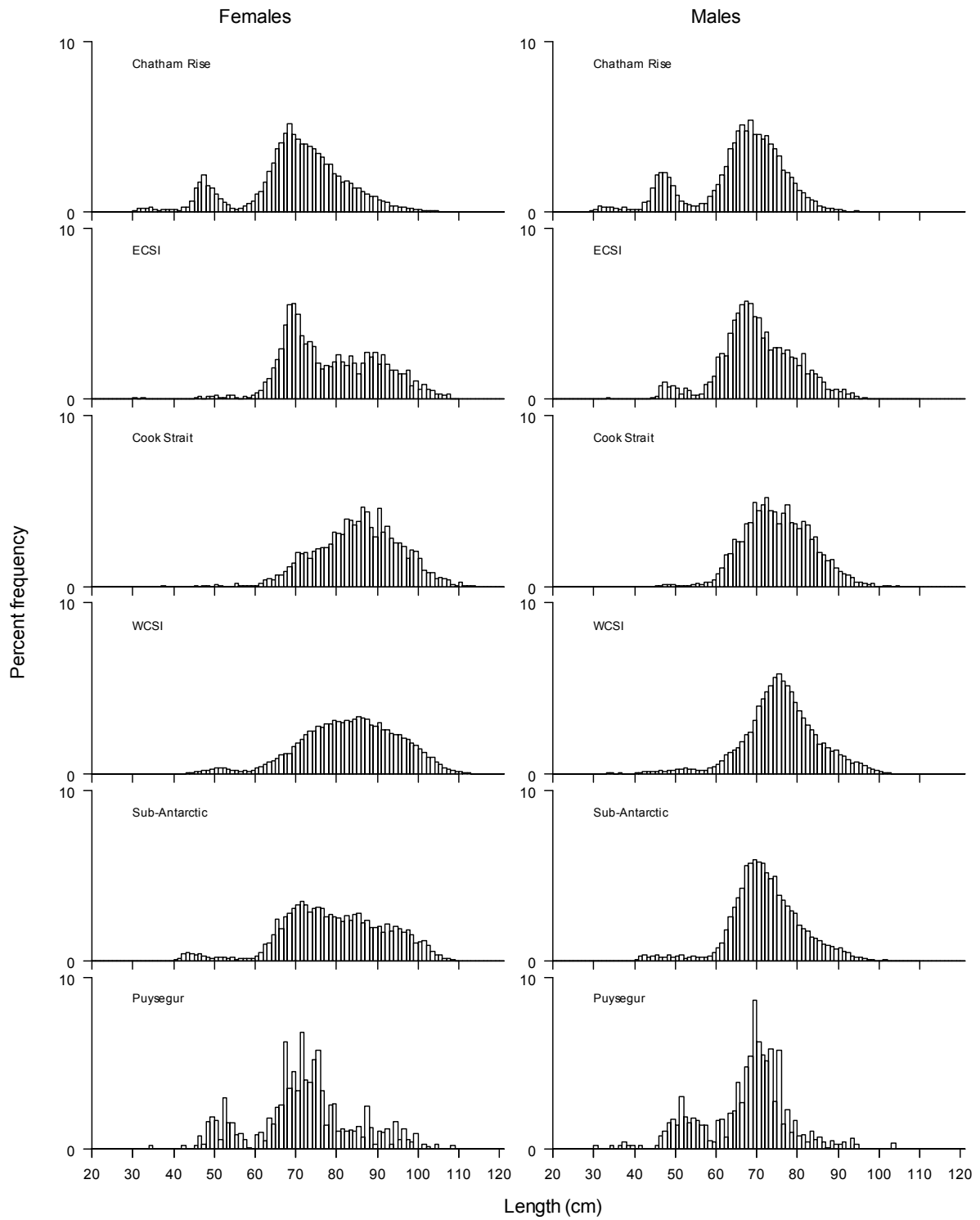


Figure 34: Length frequency of female and male hoki taken in commercial catches from different areas during the 2012–13 fishing year. All areas sampled by the Observer Programme.

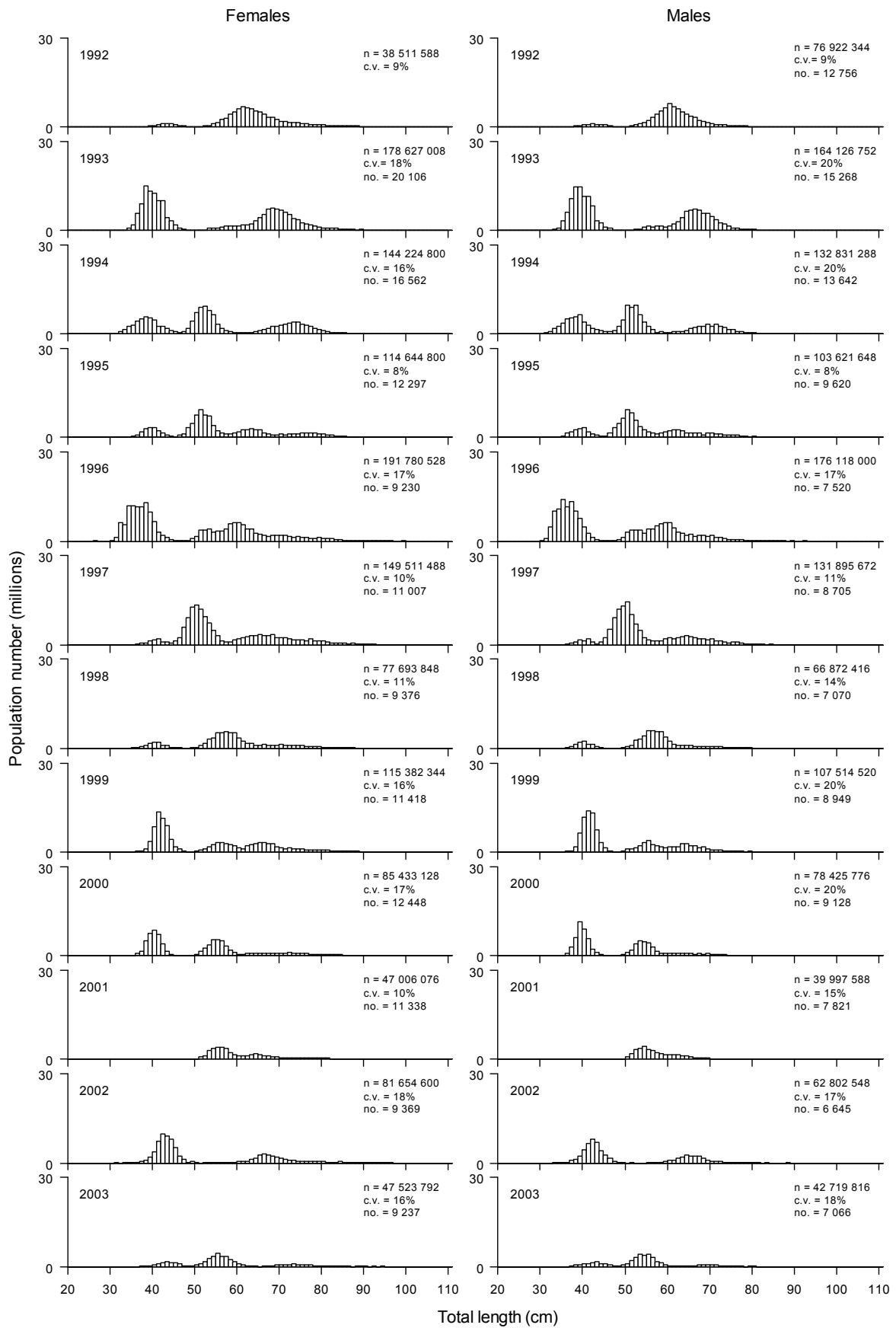


Figure 35: Scaled length frequency for hoki from Chatham Rise *Tangaroa* trawl surveys. n, population numbers of fish; CV, coefficients of variation; no., number of fish measured.

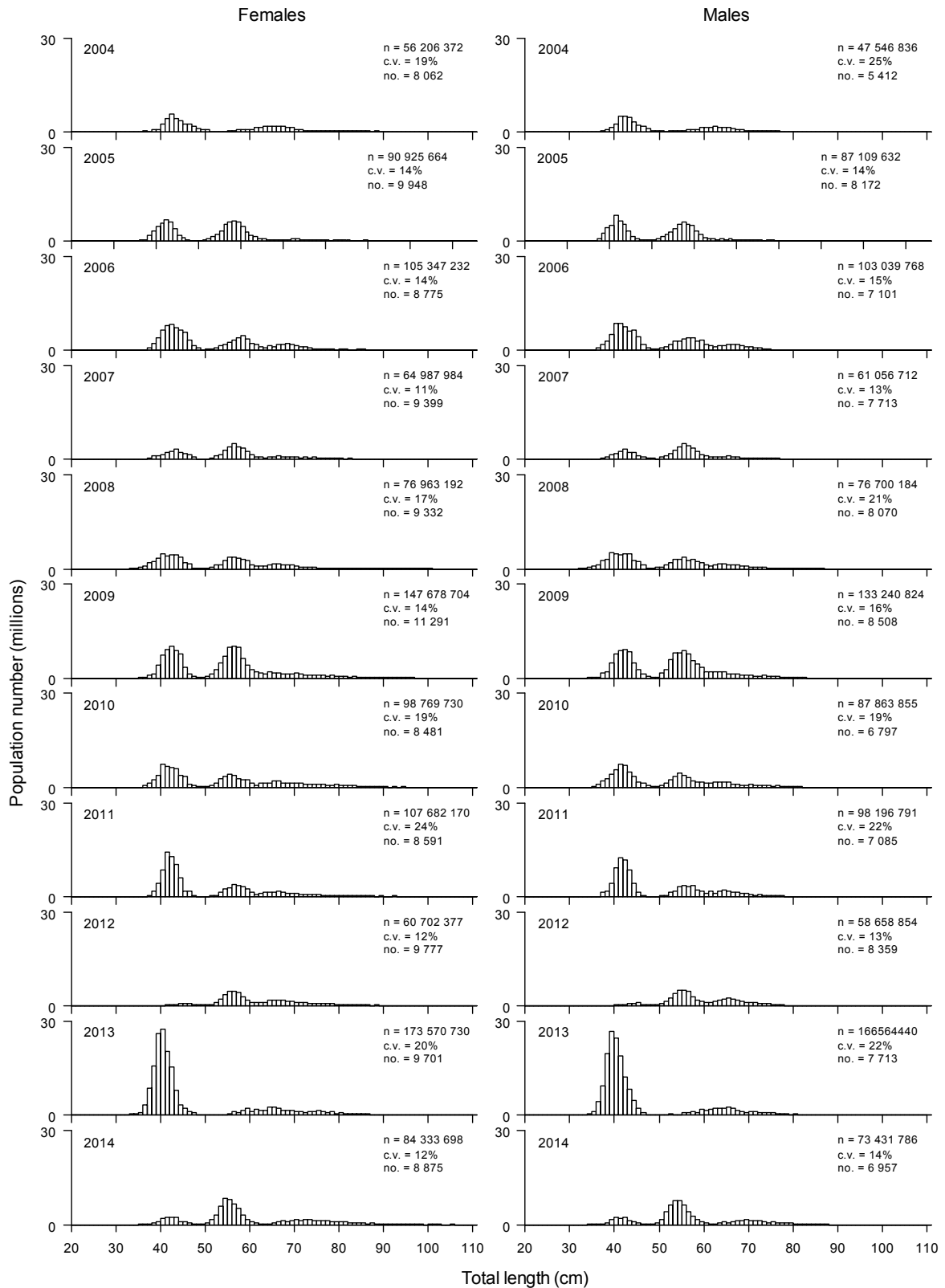


Figure 35 ctd.

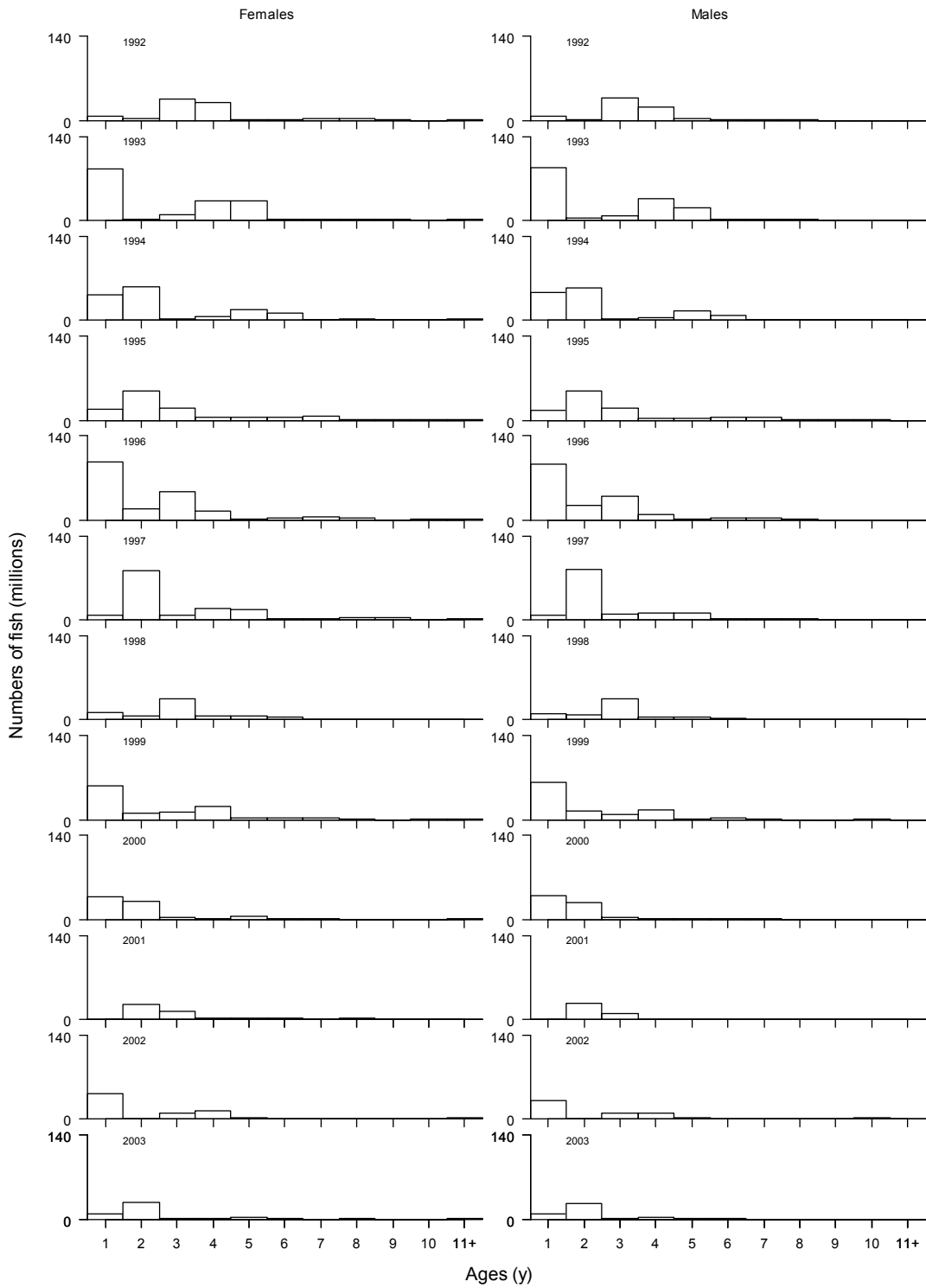


Figure 36: Scaled age frequency for hoki from Chatham Rise *Tangaroa* trawl surveys 1992–2014.

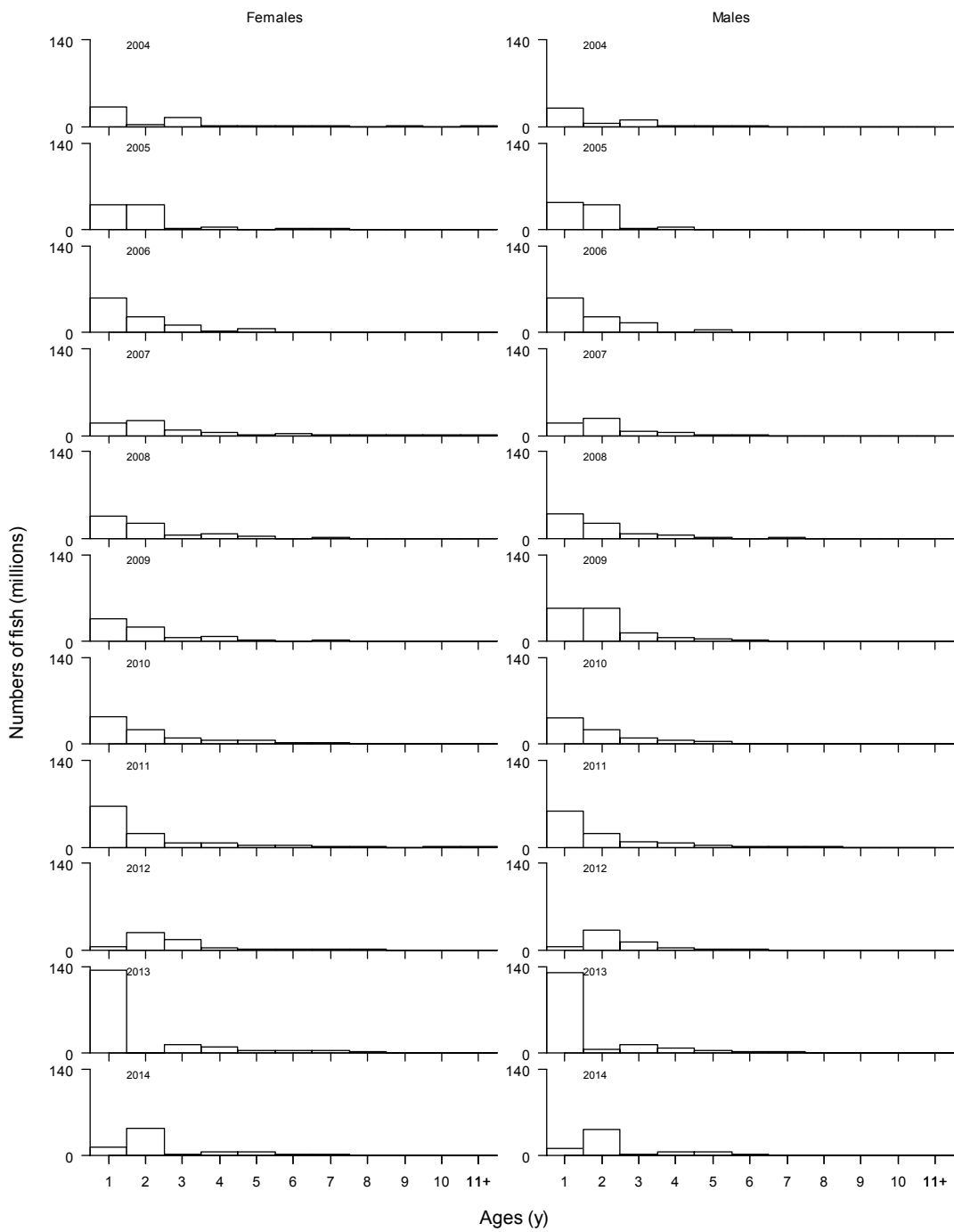


Figure 36 ctd.

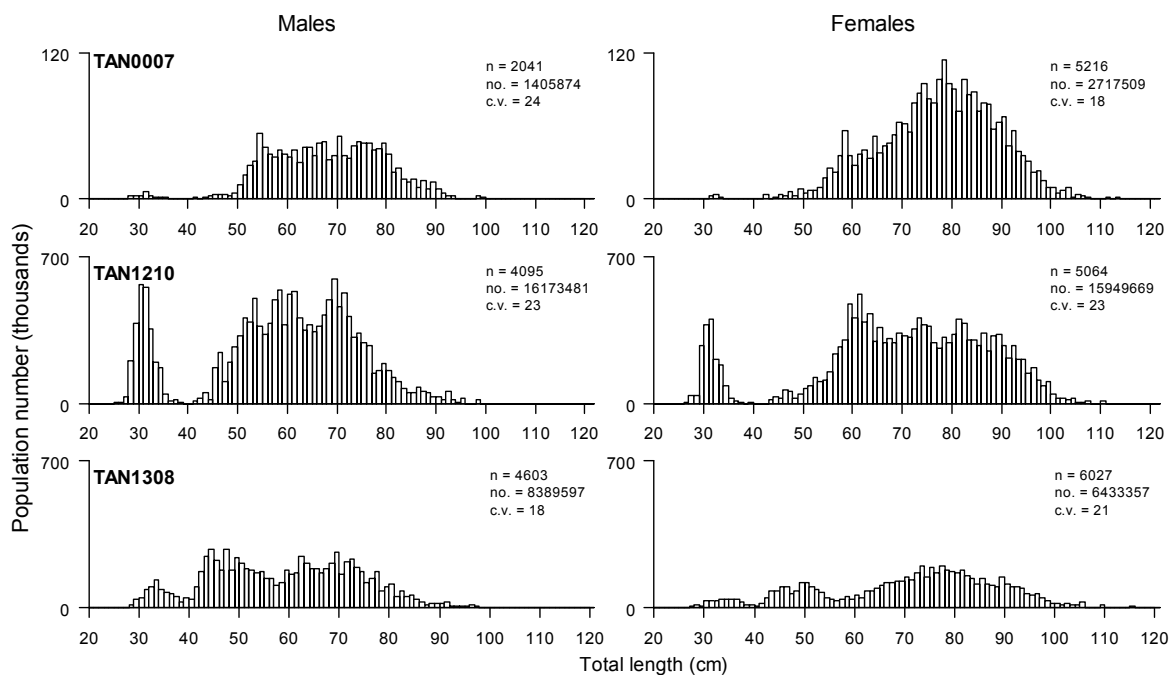


Figure 37: Scaled length frequency for male and female hoki in core strata from WCSI *Tangaroa* trawl surveys in 2000 (TAN0007), 2012 (TAN1210), and 2013 (TAN1308). n, number of fish measured; no., population numbers of fish; CV, coefficients of variation.

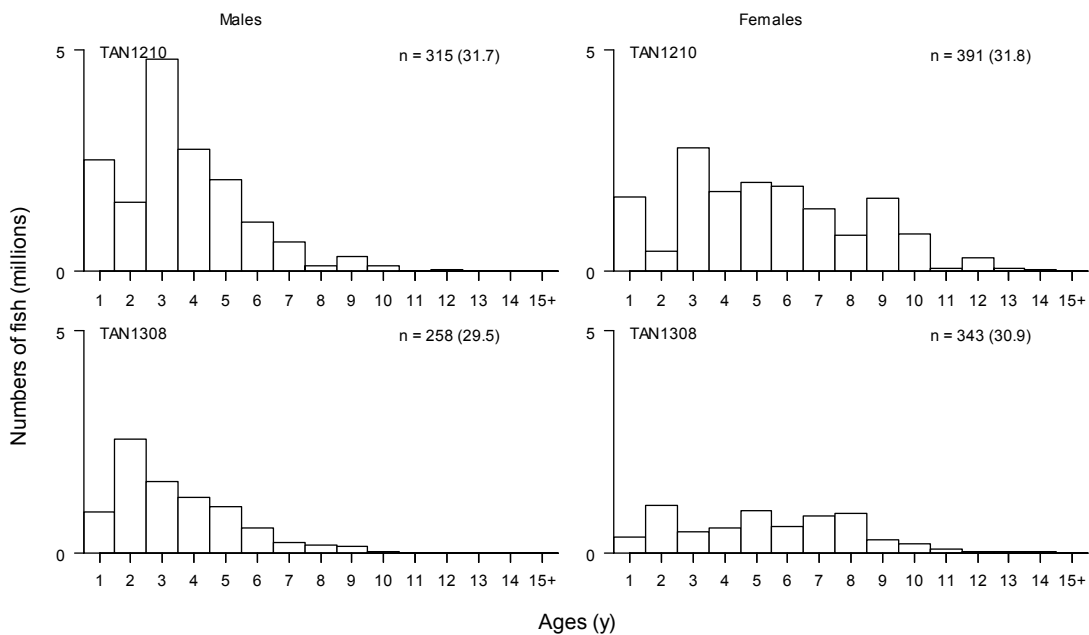


Figure 38: Scaled age frequency for hoki from core strata in the 2012 and 2013 WCSI *Tangaroa* trawl survey. Number of fish aged (n values) are given with CVs in parentheses. Hoki were not aged from the 2000 survey.

APPENDICES

Table A1a: Number of vessels, tows, and total catch inside and outside the 25 nautical mile line off WCSI, by year. Data source ungrouped non-zero TCEPR, TCER, and CELR data. Year defined as June to October. There were no October data available for 2013. It is assumed that CELR data all comes from inside the 25 nautical mile line, and includes mid-water and bottom trawl tows reported on the CELR form only.

Fishing year	Number of vessels					Number of tows				
	TCEPR Outside	TCER Outside	TCEPR Inside	TCER Inside	CELR	TCEPR Outside	TCER Outside	TCEPR Inside	TCER Inside	CELR
1990	79	-	37	-	13	7 989	-	83	-	196
1991	75	-	41	-	17	8 135	-	68	-	302
1992	71	-	25	-	17	6 171	-	47	-	358
1993	64	-	22	-	18	6 886	-	108	-	511
1994	69	-	30	-	18	8 463	-	137	-	423
1995	65	-	36	-	21	8 521	-	189	-	319
1996	59	-	27	-	23	6 631	-	157	-	581
1997	74	-	46	-	23	7 710	-	444	-	742
1998	67	-	35	-	23	7 609	-	365	-	447
1999	53	-	34	-	18	6 835	-	280	-	624
2000	47	-	28	-	15	6 624	-	725	-	855
2001	52	-	45	-	16	6 960	-	1 380	-	819
2002	47	-	37	-	13	6 401	-	1 253	-	563
2003	44	-	29	-	8	6 619	-	829	-	680
2004	42	-	31	-	10	5 133	-	1 271	-	748
2005	37	-	15	-	10	3 623	-	530	-	464
2006	35	-	20	-	5	3 993	-	210	-	348
2007	30	-	9	-	6	2 620	-	146	-	253
2008	24	5	8	9	-	2 335	18	45	155	-
2009	25	6	3	11	-	1 961	15	3	253	-
2010	28	5	8	12	-	2 318	13	56	313	-
2011	29	6	9	16	-	2 802	40	298	474	-
2012	29	9	12	14	-	2 848	54	379	488	-
2013	24	10	11	13	-	3 057	91	181	588	-

Fishing year	Catches (kg)								
	TCEPR Outside	TCER Outside	Total Outside	TCEPR Inside	TCER Inside	CELR	Total Inside	Total Overall	Percent Inside
1990	158 447	-	158 447	1 585	-	339	1 924	160 371	1
1991	128 259	-	128 259	1 015	-	222	1 237	129 496	1
1992	100 507	-	100 507	849	-	184	1 033	101 540	1
1993	95 402	-	95 402	737	-	522	1 259	96 661	1
1994	113 833	-	113 833	1 110	-	693	1 803	115 636	1
1995	79 083	-	79 083	1 851	-	747	2 598	81 681	3
1996	67 247	-	67 247	2 492	-	1 908	4 400	71 647	3
1997	83 269	-	83 269	5 698	-	2 360	8 058	91 327	6
1998	96 144	-	96 144	5 522	-	2 610	8 132	104 276	5
1999	85 486	-	85 486	4 295	-	3 846	8 141	93 627	5
2000	87 547	-	87 547	9 443	-	4 719	14 162	101 709	9
2001	80 508	-	80 508	16 627	-	4 979	21 606	102 114	16
2002	70 674	-	70 674	17 846	-	4 180	22 026	92 700	19
2003	57 211	-	57 211	11 583	-	4 944	16 527	73 738	16
2004	26 287	-	26 287	13 922	-	4 885	18 807	45 094	31
2005	24 820	-	24 820	5 574	-	2 223	7 797	32 617	17
2006	33 131	-	33 131	2 681	-	2 438	5 119	38 250	7
2007	30 192	-	30 192	1 128	-	1 962	3 090	33 282	3
2008	19 926	32	19 958	327	567	-	894	20 852	4
2009	19 285	23	19 308	36	1 102	-	1 138	20 446	6
2010	33 178	36	33 214	951	1 983	-	2 934	36 148	8
2011	40 653	168	40 821	4 047	3 441	-	7 488	48 309	16
2012	45 837	148	45 985	4 641	3 598	-	8 239	54 224	15
2013	49 039	97	49 136	2 596	3 589	-	6 185	55 321	11

Table A1b: Number of TCEPR, TCER and CELR Cook Strait tows, total catch, and number of vessels by year. Data source is un-groomed non-zero TCEPR, TCER, and CELR tows catching hoki. ‘CELR trawl’ includes mid-water and bottom trawl tows reported on the CELR form only. Year defined as June to October. There were no October data available for 2013.

Fishing year	Number of vessels				Number of tows			
	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	18	-	30	48	1 071	-	568	1 639
1991	22	-	41	63	2 097	-	1 510	3 607
1992	24	-	31	55	1 684	-	845	2 529
1993	20	-	30	50	1 532	-	934	2 466
1994	31	-	39	70	1 957	-	1 374	3 331
1995	26	-	33	59	2 291	-	1 263	3 554
1996	42	-	37	79	4 700	-	1 459	6 159
1997	40	-	28	68	4 921	-	1 059	5 980
1998	31	-	28	59	3 022	-	1 315	4 337
1999	21	-	28	49	2 656	-	942	3 598
2000	22	-	32	54	2 372	-	1 157	3 529
2001	25	-	23	48	2 042	-	981	3 023
2002	19	-	22	41	1 127	-	531	1 658
2003	21	-	25	46	1 933	-	998	2 931
2004	20	-	31	51	1 863	-	1 134	2 997
2005	15	-	15	30	1 454	-	476	1 930
2006	13	-	13	26	1 067	-	328	1 395
2007	8	-	14	22	980	-	491	1 471
2008	7	20	-	27	668	581	-	1 249
2009	10	21	1	32	878	551	1	1 430
2010	8	18	-	26	841	523	-	1 364
2011	7	20	-	27	519	571	-	1 090
2012	9	20	-	29	779	401	-	1 180
2013	10	20	-	30	971	359	-	1 330

Fishing year	Catches (kg)			
	TCEPR	TCER	CELR	Total
1990	12 109	-	2 596	14 705
1991	22 153	-	7 013	29 166
1992	19 583	-	4 973	24 556
1993	17 533	-	4 199	21 732
1994	26 785	-	9 071	35 856
1995	26 600	-	7 361	33 962
1996	50 986	-	8 018	59 005
1997	49 946	-	6 562	56 508
1998	36 308	-	9 408	45 716
1999	34 040	-	6 222	40 262
2000	30 603	-	8 986	39 588
2001	24 630	-	8 188	32 818
2002	17 628	-	4 104	21 732
2003	27 341	-	7 271	34 613
2004	28 509	-	10 520	39 030
2005	18 482	-	4 369	22 851
2006	16 670	-	3 035	19 704
2007	12 594	-	5 403	17 997
2008	9 215	6 661	-	15 876
2009	10 044	5 112	-	15 156
2010	10 916	4 875	-	15 791
2011	7 315	4 519	-	11 834
2012	9 998	3 154	-	13 152
2013	12 304	3 119	-	15 423

Table A1c: Number of Chatham Rise and ECSI vessels, tows and catch for all vessels by year for the non-spawning season. Data source is un-groomed non-zero TCEPR, TCER, and CELR tows catching hoki. ‘CELR’ includes all fishing methods reported on the CELR form, and ‘CELR trawl’ includes mid-water and bottom trawl tows only. Chatham Rise data includes data from October to September, and ECSI data includes data from October to May.

Fishing year	Number of vessels				Number of tows			
	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	47	-	23	70	3 325	-	529	3 854
1991	69	-	38	107	5 724	-	900	6 624
1992	76	-	30	106	8 601	-	539	9 140
1993	75	-	29	104	8 575	-	511	9 086
1994	78	-	26	104	6 447	-	525	6 972
1995	87	-	31	118	10 028	-	675	10 703
1996	102	-	26	128	11 651	-	399	12 050
1997	105	-	18	123	12 609	-	277	12 886
1998	97	-	18	115	16 176	-	210	16 386
1999	87	-	24	111	14 984	-	421	15 405
2000	70	-	16	86	13 432	-	330	13 762
2001	68	-	11	79	12 360	-	373	12 733
2002	60	-	14	74	10 343	-	280	10 623
2003	63	-	15	78	11 400	-	255	11 655
2004	59	-	11	70	9 511	-	211	9 722
2005	51	-	12	63	7 418	-	132	7 550
2006	52	-	14	66	7 314	-	134	7 448
2007	47	-	11	58	7 324	-	153	7 477
2008	42	11	-	53	7 012	65	-	7 077
2009	37	12	1	50	6 227	79	2	6 308
2010	39	16	-	55	6 003	278	-	6 281
2011	39	14	-	53	5 446	140	-	5 586
2012	37	13	-	50	5 647	190	-	5 837
2013	39	14	-	53	5 456	417	-	5 873

Fishing year	Catches (kg)			
	TCEPR	TCER	CELR	Total
1990	13 091	-	71	13 161
1991	29 965	-	162	30 126
1992	48 036	-	99	48 134
1993	44 169	-	63	44 231
1994	22 662	-	63	22 725
1995	38 991	-	182	39 173
1996	50 283	-	86	50 368
1997	55 726	-	93	55 819
1998	77 105	-	93	77 197
1999	72 656	-	929	73 585
2000	55 912	-	98	56 010
2001	49 307	-	532	49 840
2002	39 105	-	38	39 144
2003	39 071	-	17	39 088
2004	33 608	-	39	33 647
2005	30 423	-	8	30 432
2006	34 934	-	6	34 941
2007	37 797	-	10	37 806
2008	37 855	60	-	37 915
2009	38 997	8	-	39 005
2010	39 086	47	-	39 133
2011	38 402	40	-	38 442
2012	39 169	72	-	39 241
2013	36 441	89	-	36 531

Table A1d: Number of ECSI vessels, tows and catch for all vessels by year for the spawning season. Data source is un-groomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as June to October. ‘CELR trawl’ includes mid-water and bottom trawl tows reported on the CELR form only. There were no data available for October 2013.

Fishing year	Number of vessels				Number of tows			
	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	8	-	17	25	45	-	123	168
1991	12	-	20	32	134	-	234	368
1992	10	-	12	22	106	-	242	348
1993	9	-	13	22	32	-	274	306
1994	9	-	12	21	44	-	215	259
1995	12	-	10	22	48	-	72	120
1996	26	-	10	36	192	-	77	269
1997	21	-	6	27	194	-	153	347
1998	20	-	6	26	213	-	81	294
1999	19	-	9	28	141	-	151	292
2000	16	-	9	25	126	-	229	355
2001	16	-	8	24	197	-	251	448
2002	17	-	10	27	257	-	146	403
2003	21	-	11	32	555	-	219	774
2004	14	-	10	24	114	-	248	362
2005	12	-	3	15	284	-	69	353
2006	6	-	5	11	141	-	76	217
2007	12	-	4	16	108	-	27	135
2008	10	4	-	14	239	47	-	286
2009	11	3	-	14	103	37	-	140
2010	10	4	-	14	78	97	-	175
2011	8	5	-	13	129	74	-	203
2012	11	6	-	17	183	88	-	271
2013	12	6	-	18	245	55	-	300

Fishing year	Catches (kg)			
	TCEPR	TCER	CELR	Total
1990	51	-	229	280
1991	841	-	503	1 345
1992	547	-	396	943
1993	137	-	172	309
1994	164	-	353	517
1995	52	-	103	155
1996	1 199	-	103	1 301
1997	817	-	973	1 790
1998	1 300	-	371	1 671
1999	765	-	1 329	2 094
2000	599	-	1 822	2 421
2001	1 658	-	760	2 418
2002	2 806	-	225	3 031
2003	6 460	-	1 006	7 466
2004	1 370	-	927	2 297
2005	4 683	-	50	4 733
2006	1 137	-	57	1 194
2007	1 001	-	63	1 064
2008	2 302	40	-	2 342
2009	1 117	29	-	1 146
2010	600	138	-	738
2011	1 504	152	-	1 657
2012	2 355	175	-	2 530
2013	3 284	110	-	3 394

Table A1e: Number of Sub-Antarctic vessels, tows and catch for all vessels by fishing year. Data source is un-groomed non-zero TCEPR, TCER, and CELR tows catching hoki. ‘CELR trawl’ includes mid-water and bottom trawl tows reported on the CELR form only.

Fishing year	Number of vessels				Number of tows			
	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	64	-	-	64	2 787	-	-	2 787
1991	66	-	-	66	4 617	-	-	4 617
1992	76	-	-	76	7 025	-	-	7 025
1993	63	-	2	65	6 143	-	4	6 147
1994	65	-	-	65	3 718	-	-	3 718
1995	62	-	-	62	3 585	-	-	3 585
1996	68	-	1	69	4 170	-	2	4 172
1997	74	-	-	74	5 003	-	-	5 003
1998	68	-	1	69	5 419	-	4	5 423
1999	68	-	-	68	5 145	-	-	5 145
2000	56	-	1	57	7 677	-	3	7 680
2001	56	-	-	56	7 401	-	-	7 401
2002	55	-	1	56	8 443	-	25	8 468
2003	50	-	3	53	5 689	-	10	5 699
2004	46	-	-	46	3 850	-	-	3 850
2005	43	-	-	43	2 638	-	-	2 638
2006	41	-	-	41	2 507	-	-	2 507
2007	36	-	-	36	3 004	-	-	3 004
2008	35	-	-	35	2 731	-	-	2 731
2009	32	1	-	33	2 914	1	-	2 915
2010	34	2	-	36	3 171	2	-	3 173
2011	35	1	-	36	2 931	1	-	2 932
2012	34	3	-	37	2 731	3	-	2 734
2013	35	1	-	36	2 844	1	-	2 845

Fishing year	Catches (kg)			
	TCEPR	TCER	CELR	Total
1990	11 748	-	-	11 748
1991	16 669	-	-	16 669
1992	30 688	-	-	30 688
1993	24 836	-	-	24 836
1994	11 636	-	-	11 636
1995	13 128	-	-	13 128
1996	14 269	-	1	14 270
1997	21 771	-	-	21 771
1998	25 129	-	1	25 129
1999	23 753	-	-	23 753
2000	33 772	-	-	33 772
2001	30 076	-	-	30 076
2002	30 175	-	-	30 175
2003	20 194	-	5	20 199
2004	11 635	-	-	11 635
2005	6 337	-	-	6 337
2006	6 961	-	-	6 961
2007	7 661	-	-	7 661
2008	8 708	-	-	8 708
2009	9 807	-	-	9 807
2010	12 275	-	-	12 275
2011	12 655	-	-	12 655
2012	15 743	-	-	15 743
2013	14 098	-	-	14 098

Table A1f: Number of Puysegur vessels, tows and catch for all vessels by year for the spawning season. Data source is un-groomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as June to December. ‘CELR trawl’ includes mid-water and bottom trawl tows reported on the CELR form only. There were no October to December data available for 2013.

Fishing year	Number of vessels				Number of tows			
	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	44	-	-	44	992	-	-	992
1991	41	-	-	41	780	-	-	780
1992	40	-	-	40	918	-	-	918
1993	28	-	2	30	385	-	10	395
1994	38	-	2	40	407	-	16	423
1995	28	-	2	30	422	-	6	428
1996	29	-	-	29	609	-	-	609
1997	39	-	-	39	799	-	-	799
1998	32	-	-	32	539	-	-	539
1999	30	-	1	31	535	-	3	538
2000	25	-	1	26	584	-	29	613
2001	37	-	1	38	856	-	8	864
2002	27	-	2	29	555	-	16	571
2003	31	-	1	32	493	-	10	503
2004	16	-	1	17	213	-	20	233
2005	24	-	1	25	468	-	12	480
2006	21	-	1	22	361	-	23	384
2007	14	-	2	16	191	-	21	212
2008	16	-	-	16	212	-	-	212
2009	8	1	-	9	146	12	-	158
2010	12	1	-	13	108	1	-	109
2011	13	4	-	17	178	13	-	191
2012	15	3	-	18	215	22	-	237
2013	15	2	-	17	130	6	-	136

Fishing year	Catches (kg)			
	TCEPR	TCER	CELR	Total
1990	7 378	-	-	7 378
1991	4 870	-	-	4 870
1992	4 744	-	-	4 744
1993	2 039	-	-	2 039
1994	2 382	-	-	2 382
1995	1 413	-	-	1 413
1996	2 401	-	-	2 401
1997	5 847	-	-	5 847
1998	2 137	-	-	2 137
1999	2 867	-	4	2 871
2000	2 757	-	-	2 757
2001	6 586	-	1	6 587
2002	5 222	-	7	5 229
2003	5 821	-	16	5 837
2004	1 124	-	5	1 129
2005	5 480	-	-	5 481
2006	1 321	-	6	1 327
2007	376	-	9	385
2008	304	-	-	304
2009	198	4	-	203
2010	198	2	-	200
2011	1 155	2	-	1 157
2012	1 144	1	-	1 145
2013	647	-	-	648

Table A2a: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all WCSI vessels by year. Year defined as June to October. There were no October data available for 2013. Data are non-zero catches for TCEPR midwater tows.

All target species MW tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	69	149 295	6 780	4.2	10.3	2.6
1991	66	118 323	6 744	4.0	10.2	2.6
1992	61	92 024	5 193	3.6	12.4	3.5
1993	57	82 529	5 263	3.2	10.3	3.7
1994	63	105 195	7 139	3.0	8.9	3.2
1995	59	75 148	7 408	3.5	4.9	1.4
1996	59	64 802	5 171	3.5	6.8	1.9
1997	77	83 828	6 728	3.8	7.4	2.0
1998	66	95 864	6 695	3.5	10.4	2.8
1999	56	76 767	5 256	3.1	10.3	3.3
2000	52	79 535	5 316	2.8	12.0	4.3
2001	62	78 853	5 879	2.6	9.0	3.4
2002	56	61 528	4 654	2.3	9.8	4.1
2003	51	51 751	4 312	3.0	8.1	2.4
2004	51	32 049	4 230	2.4	4.6	1.5
2005	37	19 682	2 365	2.5	5.1	1.8
2006	36	21 067	2 015	3.0	6.7	2.5
2007	31	21 093	1 432	3.5	9.3	3.5
2008	15	12 047	886	1.8	6.4	3.8
2009	23	12 590	887	3.2	8.9	3.1
2010	26	23 033	1 216	2.6	15.3	5.2
2011	24	29 603	1 514	2.0	17.2	8.2
2012	27	30 122	1 567	2.1	16.3	7.9
2013	24	33 858	1 811	2.6	15.4	6.1
All years	239	1 450 589	100 461	3.2	9.1	2.8

Target hoki MW tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	69	149 263	6 736	4.2	10.3	2.6
1991	66	118 202	6 727	4.0	10.2	2.6
1992	60	91 904	5 141	3.6	12.4	3.6
1993	56	82 133	5 030	3.1	10.5	4.1
1994	62	105 007	6 978	3.0	9.5	3.3
1995	59	74 715	7 145	3.5	4.9	1.5
1996	59	64 735	5 115	3.5	6.8	1.9
1997	77	83 408	6 620	3.8	7.9	2.1
1998	66	95 670	6 630	3.5	10.4	2.8
1999	56	76 532	5 142	3.1	10.3	3.4
2000	51	79 269	5 194	2.7	12.0	4.5
2001	62	78 512	5 726	2.6	9.3	3.6
2002	56	61 336	4 579	2.3	9.8	4.3
2003	51	51 466	4 208	3.0	8.1	2.5
2004	51	31 874	4 152	2.3	4.9	1.6
2005	37	19 620	2 266	2.4	5.7	2.0
2006	34	20 729	1 734	2.6	8.5	3.2
2007	31	20 786	1 136	2.8	15.0	5.5
2008	13	11 841	806	1.7	7.3	4.7
2009	15	12 367	685	2.7	14.2	5.0
2010	23	22 884	1 172	2.5	17.1	5.5
2011	24	29 468	1 495	2.0	17.4	8.4
2012	27	30 071	1 559	2.1	16.3	7.9
2013	24	33 704	1 793	2.6	15.4	6.2
All years	239	1 445 498	97 769	3.2	9.5	2.9

Table A2b: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all WCSI vessels by year. Year defined as June to October. There were no October data available for 2013. Data are non-zero catches for TCEPR bottom tows.

All target species BT tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	41	10 737	1 292	4.0	3.2	0.8
1991	36	10 951	1 458	4.0	3.6	0.9
1992	38	9 334	1 036	4.1	4.1	1.0
1993	33	13 656	1 727	3.8	5.2	1.4
1994	32	9 703	1 468	4.2	3.7	0.8
1995	27	5 809	1 331	4.5	2.5	0.5
1996	38	4 914	1 586	4.7	2.1	0.4
1997	47	5 145	1 442	5.0	2.2	0.5
1998	40	5 925	1 308	5.2	2.9	0.5
1999	39	12 894	1 835	4.7	4.1	0.8
2000	34	17 487	2 064	4.5	6.0	1.2
2001	40	18 238	2 399	4.5	5.0	0.9
2002	35	26 993	3 005	5.0	5.2	1.0
2003	39	17 057	3 197	5.3	2.3	0.4
2004	35	8 174	2 154	6.0	1.5	0.3
2005	30	10 708	1 801	6.6	2.5	0.4
2006	26	14 723	2 145	8.3	2.8	0.4
2007	22	10 252	1 344	7.1	3.1	0.4
2008	17	8 179	1 472	9.0	2.4	0.3
2009	18	6 735	1 083	9.2	3.0	0.3
2010	21	11 116	1 171	7.2	4.9	0.8
2011	21	15 075	1 565	6.1	6.2	1.0
2012	23	20 353	1 656	5.2	9.9	1.9
2013	18	17 777	1 427	5.1	10.8	2.3
All years	144	291 933	40 966	5.0	3.5	0.6

Target hoki BT tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	34	10 597	1 129	4.2	4.1	1.1
1991	31	10 877	1 321	4.0	4.1	1.1
1992	28	9 152	791	4.0	7.0	1.7
1993	29	13 611	1 588	3.8	5.9	1.6
1994	29	9 679	1 369	4.3	4.2	0.9
1995	24	5 794	1 290	4.5	2.5	0.5
1996	37	4 885	1 544	4.7	2.1	0.4
1997	42	5 115	1 354	5.0	2.5	0.5
1998	34	5 888	1 217	5.3	3.1	0.5
1999	35	12 856	1 689	4.7	5.1	1.0
2000	32	17 417	1 903	4.4	6.3	1.4
2001	37	18 216	2 314	4.6	5.0	1.0
2002	34	26 724	2 839	5.0	5.9	1.1
2003	39	16 793	2 791	5.1	3.0	0.6
2004	34	7 911	1 799	5.7	2.0	0.4
2005	27	9 732	1 240	5.6	4.5	0.8
2006	24	13 087	1 405	7.0	5.0	0.8
2007	20	8 874	731	4.8	9.3	1.7
2008	13	5 246	480	5.0	8.6	1.7
2009	13	4 460	350	4.5	11.2	2.6
2010	19	9 214	611	3.2	13.5	4.7
2011	17	11 707	908	4.1	11.4	2.9
2012	20	18 853	1 184	3.8	15.0	4.1
2013	16	16 063	996	3.5	15.6	4.8
All years	130	272 752	32 843	4.6	4.7	1.0

Table A2c: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all Cook Strait vessels by year. Year defined as June to October. There were no October data available for 2013. Data are non-zero catches for TCEPR midwater tows.

All target species tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	17	11 894	1 048	1.2	9.1	7.4
1991	22	22 033	2 073	1.5	8.2	5.0
1992	22	19 372	1 644	1.2	8.3	6.5
1993	20	17 372	1 517	1.0	8.3	7.0
1994	28	25 313	1 821	1.0	11.8	11.8
1995	24	24 538	2 171	1.0	8.4	9.9
1996	36	42 407	3 113	0.8	11.2	17.1
1997	34	42 705	3 493	1.0	10.6	11.8
1998	29	31 035	2 404	1.0	11.4	11.9
1999	21	28 452	2 072	1.0	12.4	14.8
2000	21	27 950	1 990	0.7	12.0	19.9
2001	25	23 581	1 842	0.8	11.0	13.8
2002	15	17 147	1 068	1.0	14.9	17.6
2003	20	26 979	1 816	1.0	12.6	16.2
2004	19	27 712	1 793	1.0	12.2	13.9
2005	13	18 166	1 344	1.0	13.0	16.7
2006	11	16 330	1 015	0.8	15.1	21.1
2007	7	12 444	952	1.0	11.0	13.4
2008	6	7 558	404	0.9	18.4	21.8
2009	8	9 095	740	0.7	10.1	17.7
2010	8	10 839	820	0.8	11.2	14.6
2011	6	7 346	527	0.8	11.3	16.7
2012	9	9 812	768	1.0	10.3	13.3
2013	9	11 597	849	0.7	12.0	17.5
All years	71	491 678	37 284	1.0	10.7	12.5

Target hoki tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	17	11 894	1 048	1.2	9.1	7.4
1991	22	22 033	2 073	1.5	8.2	5.0
1992	22	19 372	1 644	1.2	8.3	6.5
1993	18	17 352	1 511	1.0	8.5	7.1
1994	28	25 272	1 815	1.0	11.8	11.9
1995	24	24 482	2 167	1.0	8.4	9.9
1996	36	42 330	3 102	0.8	11.3	17.3
1997	34	42 637	3 487	1.0	10.6	11.8
1998	29	30 998	2 402	1.0	11.4	11.9
1999	21	28 449	2 071	1.0	12.4	14.9
2000	21	27 950	1 990	0.7	12.0	19.9
2001	25	23 553	1 839	0.8	11.0	13.8
2002	15	17 147	1 068	1.0	14.9	17.6
2003	20	26 979	1 814	1.0	12.6	16.2
2004	19	27 712	1 791	1.0	12.2	14.0
2005	13	18 162	1 343	1.0	13.0	16.8
2006	11	16 330	1 014	0.8	15.1	21.1
2007	7	12 396	949	1.0	10.9	13.4
2008	5	7 555	397	0.9	18.8	22.6
2009	8	9 083	739	0.7	10.1	17.6
2010	8	10 783	818	0.8	11.2	14.5
2011	6	7 346	527	0.8	11.3	16.7
2012	9	9 812	768	1.0	10.3	13.3
2013	9	11 597	849	0.7	12.0	17.5
All years	71	491 224	37 226	1.0	10.7	12.5

A2d: Number of Chatham Rise and ECSI non-zero hoki bottom tows and vessels, total catches, median tow duration, median catch per tow, and median catch per hour by fishing year. Data source is un-groomed bottom non-zero TCEPR tows catching hoki. Chatham Rise data includes data from October to September, and ECSI data includes data from October to May.

All bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	47	13 001	3 297	4.0	1.5	0.5
1991	59	18 080	4 787	4.0	2.0	0.5
1992	72	43 456	8 169	4.0	3.1	0.8
1993	61	39 238	7 523	3.9	3.4	1.0
1994	64	18 125	5 305	3.5	2.1	0.7
1995	70	30 585	7 914	3.8	3.0	0.9
1996	84	37 620	9 294	3.6	2.9	0.9
1997	96	42 898	10 330	3.7	3.2	0.9
1998	82	55 824	12 479	4.0	3.3	0.9
1999	77	61 528	12 620	4.0	4.1	1.0
2000	60	44 753	10 746	4.1	3.0	0.8
2001	60	46 150	11 429	4.5	3.0	0.7
2002	55	36 271	9 491	4.5	2.9	0.7
2003	62	37 415	10 912	4.7	2.5	0.5
2004	58	31 656	9 131	5.0	2.3	0.5
2005	50	28 914	7 048	5.0	2.8	0.6
2006	50	34 077	7 145	4.8	3.5	0.8
2007	46	37 640	7 267	4.6	3.5	0.8
2008	38	37 375	6 890	4.8	3.6	0.8
2009	37	38 956	6 186	4.3	4.6	1.1
2010	38	38 454	5 833	4.5	5.3	1.2
2011	38	38 136	5 286	4.7	5.9	1.2
2012	35	38 818	5 428	4.8	5.7	1.3
2013	35	35 093	5 181	4.8	5.6	1.2
All years	199	884 063	189 691	4.2	3.1	0.8

Target hoki bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	31	11 788	1 902	4.0	3.8	1.0
1991	41	16 761	3 285	4.0	3.5	0.9
1992	47	42 305	5 408	3.8	5.7	1.6
1993	40	38 354	5 169	3.5	5.7	1.6
1994	36	17 525	3 372	3.2	4.2	1.3
1995	42	30 097	6 485	3.5	3.9	1.1
1996	58	37 177	7 969	3.5	3.2	1.0
1997	73	42 380	8 988	3.5	3.7	1.1
1998	63	55 315	11 159	4.0	4.2	1.0
1999	46	60 838	11 244	4.0	4.4	1.1
2000	34	44 113	9 413	4.1	3.7	0.9
2001	40	44 928	9 762	4.5	3.5	0.8
2002	31	35 087	7 773	4.4	3.4	0.8
2003	32	36 051	9 196	4.8	3.0	0.6
2004	28	30 207	7 142	4.9	3.0	0.6
2005	21	27 472	4 973	5.0	4.1	0.8
2006	20	32 329	4 997	4.8	5.0	1.0
2007	21	34 746	4 733	4.5	5.8	1.2
2008	22	33 527	4 187	4.8	6.6	1.4
2009	21	33 645	3 896	4.2	7.3	1.7
2010	21	35 151	4 349	4.6	6.9	1.5
2011	23	34 811	4 056	4.8	7.2	1.5
2012	24	37 639	4 380	4.8	7.2	1.6
2013	22	33 926	4 160	4.8	6.7	1.4
All years	163	846 172	147 998	4.1	4.2	1.0

Table A2e: Number of ECSI non-zero hoki midwater or bottom tows and vessels, total catches, median tow duration, median catch per tow, and median catch per hour by year. Data source is un-groomed midwater or bottom non-zero TCEPR tows catching hoki. Year defined as June to October. There were no October data available for 2013. Data are not shown for MW vessels in 2009 or 2010 as there was only one vessel.

All target species mid-water tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
2000	7	289	24	2.7	7.5	2.4
2001	15	1 264	123	2.4	6.0	2.2
2002	10	2 003	145	2.2	10.9	4.2
2003	18	4 453	301	2.1	13.1	5.2
2004	5	1 438	85	2.2	10.4	6.0
2005	6	4 037	221	2.0	15.0	8.4
2006	4	485	41	1.5	10.0	5.7
2007	4	299	26	1.1	8.7	8.8
2008	3	263	28	3.0	8.1	2.7
2009	1	-	-	-	-	-
2010	1	-	-	-	-	-
2011	4	879	57	1.0	14.7	10.8
2012	8	1 686	117	1.6	10.3	5.2
2013	10	2 932	189	2.0	14.6	6.6
All years	34	20 520	1 391	2.0	12.1	5.4

Target hoki mid-water tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
2000	7	289	24	2.7	7.5	2.4
2001	15	1 264	123	2.4	6.0	2.2
2002	10	2 003	145	2.2	10.9	4.2
2003	18	4 453	301	2.1	13.1	5.2
2004	5	1 438	85	2.2	10.4	6.0
2005	6	4 037	221	2.0	15.0	8.4
2006	4	485	41	1.5	10.0	5.7
2007	4	299	26	1.1	8.7	8.8
2008	3	263	28	3.0	8.1	2.7
2009	1	-	-	-	-	-
2010	1	-	-	-	-	-
2011	4	879	57	1.0	14.7	10.8
2012	8	1 686	117	1.6	10.3	5.2
2013	10	2 932	189	2.0	14.6	6.6
All years	34	20 242	1 373	2.0	12.1	5.4

Table A2e ECSI ctd.

All target species bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
2000	7	289	24	2.7	7.5	2.4
2001	15	1 264	123	2.4	6.0	2.2
2002	10	2 003	145	2.2	10.9	4.2
2003	18	4 453	301	2.1	13.1	5.2
2004	5	1 438	85	2.2	10.4	6.0
2005	6	4 037	221	2.0	15.0	8.4
2006	4	485	41	1.5	10.0	5.7
2007	4	299	26	1.1	8.7	8.8
2008	3	263	28	3.0	8.1	2.7
2009	1	462	24	0.8	15.2	21.2
2010	1	28	7	1.9	3.1	1.4
2011	4	879	57	1.0	14.7	10.8
2012	8	1 686	117	1.6	10.3	5.2
2013	10	2 932	189	2.0	14.6	6.6
All years	34	20 520	1 391	2.0	12.1	5.4

Target hoki bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
2000	7	289	24	2.7	7.5	2.4
2001	15	1 264	123	2.4	6.0	2.2
2002	10	2 003	145	2.2	10.9	4.2
2003	18	4 453	301	2.1	13.1	5.2
2004	5	1 438	85	2.2	10.4	6.0
2005	6	4 037	221	2.0	15.0	8.4
2006	4	485	41	1.5	10.0	5.7
2007	4	299	26	1.1	8.7	8.8
2008	3	263	28	3.0	8.1	2.7
2009	1	462	24	0.8	15.2	21.2
2010	1	28	7	1.9	3.1	1.4
2011	4	879	57	1.0	14.7	10.8
2012	8	1 686	117	1.6	10.3	5.2
2013	10	2 932	189	2.0	14.6	6.6
All years	28	9 906	1 247	2.8	5.5	2.0

Table A2f: Number of Sub-Antarctic non-zero hoki bottom tows and vessels, total catches, median tow duration, median catch per tow, and median catch per hour for all vessels by fishing year. Data source is un-groomed non-zero TCEPR bottom tows catching hoki.

All target species bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	36	11 542	2 589	4.0	2.6	0.6
1991	43	16 177	4 420	4.3	2.6	0.6
1992	58	29 688	6 877	4.2	3.1	0.8
1993	39	22 304	5 647	4.0	3.1	0.8
1994	45	9 051	3 163	4.2	1.6	0.4
1995	42	11 716	3 223	4.3	2.2	0.6
1996	46	10 889	3 483	4.2	1.9	0.5
1997	58	19 288	4 522	4.5	3.2	0.7
1998	49	24 217	5 192	4.3	3.3	0.8
1999	49	20 966	4 673	4.5	2.9	0.7
2000	43	31 576	7 155	4.2	3.0	0.8
2001	46	26 222	6 669	4.5	2.7	0.6
2002	47	29 568	8 093	4.4	2.1	0.6
2003	44	19 870	5 556	4.9	2.4	0.5
2004	41	11 168	3 728	5.0	2.0	0.4
2005	40	6 148	2 542	5.3	1.0	0.2
2006	34	6 491	2 360	5.3	0.7	0.1
2007	31	7 420	2 878	5.2	0.8	0.2
2008	29	8 015	2 625	5.5	1.0	0.2
2009	25	9 195	2 807	5.0	1.0	0.2
2010	29	11 551	3 023	5.4	1.0	0.2
2011	28	10 973	2 689	5.0	1.5	0.3
2012	28	13 665	2 580	5.0	2.2	0.5
2013	29	14 053	2 773	4.8	2.6	0.5
All years	165	381 752	99 267	4.5	2.2	0.5

Hoki target bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	20	10 922	2 048	4.0	3.6	0.9
1991	30	15 229	3 862	4.4	2.8	0.6
1992	33	28 278	5 314	4.1	4.1	1.0
1993	24	21 359	4 817	3.8	3.6	0.9
1994	22	8 748	1 977	4.0	3.2	0.9
1995	25	11 453	2 297	4.0	3.9	1.0
1996	25	10 628	2 437	4.0	3.1	0.9
1997	42	18 919	3 293	4.2	4.6	1.1
1998	34	23 669	4 267	4.2	4.2	1.0
1999	33	20 391	3 563	4.2	4.1	1.1
2000	30	30 884	5 806	4.0	3.9	1.0
2001	31	25 397	5 324	4.2	3.5	0.8
2002	33	28 612	6 253	4.2	2.9	0.8
2003	33	19 101	4 322	4.8	3.0	0.7
2004	26	10 815	2 864	4.9	3.0	0.6
2005	25	5 151	1 351	5.1	2.5	0.5
2006	16	4 636	720	5.0	4.0	0.8
2007	20	5 143	1 136	4.5	2.2	0.5
2008	13	5 828	909	4.8	4.5	0.9
2009	12	6 883	918	4.4	5.1	1.2
2010	12	9 687	1 231	4.5	6.1	1.3
2011	15	9 210	1 237	4.5	5.5	1.2
2012	17	11 538	1 193	4.6	7.6	1.6
2013	16	11 705	1 363	4.3	6.2	1.5
All years	109	354 186	68 502	4.2	3.7	0.9

Table A2g: Number of Puysegur non-zero hoki bottom and midwater median tow duration, median catch per tow, and median catch per hour for all vessels by year. Data source is un-groomed midwater or bottom non-zero TCEPR tows catching hoki. Year defined as June to December. There were no October to December data available for 2013. Data have been removed where there is one vessel only.

All target species midwater tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	25	7 154	759	2.5	7.9	3.2
1991	16	3 188	269	2.4	10.2	4.1
1992	13	1 058	141	3.0	5.2	2.0
1993	8	660	71	2.0	6.2	2.8
1994	17	2 209	266	3.0	3.9	1.1
1995	15	1 015	163	2.3	3.0	1.4
1996	12	1 447	155	2.7	7.1	2.9
1997	20	4 742	410	3.5	8.5	2.5
1998	7	884	95	3.0	8.2	2.4
1999	16	1 416	141	3.4	4.8	1.3
2000	13	2 054	161	4.2	8.0	2.0
2001	22	5 212	372	4.3	10.0	2.2
2002	19	3 128	260	3.6	6.8	1.6
2003	20	5 137	309	3.0	12.1	3.6
2004	4	574	33	3.7	12.2	3.0
2005	9	4 953	220	2.1	22.0	9.6
2006	4	236	16	2.8	14.8	5.0
2007	1	-	-	-	-	-
2008	1	-	-	-	-	-
2009	1	-	-	-	-	-
2010	1	-	-	-	-	-
2011	2	1 047	75	3.2	12.9	3.2
2012	2	818	87	3.1	4.6	1.5
2013	2	183	14	4.0	10.8	2.5
All years	104	47 279	4 024	3.0	8.0	2.6

Hoki target mid-water tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	25	7 149	758	2.5	7.9	3.2
1991	16	3 173	268	2.4	10.2	4.1
1992	12	1 027	129	3.0	5.2	2.0
1993	8	660	71	2.0	6.2	2.8
1994	17	2 189	264	3.0	3.9	1.1
1995	15	1 015	163	2.3	3.0	1.4
1996	12	1 447	155	2.7	7.1	2.9
1997	20	4 742	410	3.5	8.5	2.5
1998	7	884	95	3.0	8.2	2.4
1999	16	1 416	141	3.4	4.8	1.3
2000	13	2 054	161	4.2	8.0	2.0
2001	22	5 206	371	4.3	10.0	2.2
2002	19	3 128	260	3.6	6.8	1.6
2003	20	5 137	309	3.0	12.1	3.6
2004	3	571	29	3.5	13.2	5.1
2005	8	4 942	216	2.1	22.0	10.0
2006	4	236	16	2.8	14.8	5.0
2007	1	-	-	-	-	-
2008	1	-	-	-	-	-
2009	1	-	-	-	-	-
2010	1	-	-	-	-	-
2011	2	1 047	75	3.2	12.9	3.2
2012	2	818	87	3.1	4.6	1.5
2013	2	183	14	4.0	10.8	2.5
All years	102	47 187	3 999	3.0	8.0	2.6

Table A2g ctd.: Puysegur.

All target species bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	15	104	207	3.3	0.2	0.1
1991	24	1 663	372	4.3	3.1	0.8
1992	30	4 012	842	4.3	3.0	0.6
1993	12	1 044	220	4.2	3.4	0.8
1994	20	394	175	4.2	1.1	0.3
1995	12	252	200	5.8	0.5	0.1
1996	16	955	354	4.3	1.0	0.2
1997	25	1 162	336	5.5	0.8	0.2
1998	19	1 295	252	4.8	2.8	0.6
1999	22	966	265	5.2	1.1	0.2
2000	20	849	273	5.4	1.0	0.2
2001	24	919	221	4.2	2.0	0.5
2002	18	1 852	193	3.8	6.5	1.5
2003	20	796	181	4.5	1.8	0.4
2004	14	198	81	4.8	0.6	0.1
2005	21	582	291	5.8	0.9	0.1
2006	16	1 002	256	4.0	1.0	0.3
2007	13	253	118	5.0	0.7	0.1
2008	6	134	56	4.8	1.4	0.3
2009	7	126	57	3.1	1.0	0.3
2010	7	121	110	4.8	0.5	0.1
2011	11	208	108	4.5	1.0	0.2
2012	7	163	59	3.7	1.0	0.4
2013	7	277	42	3.6	3.6	1.0
All years	95	19 327	5 269	4.5	1.4	0.3

Hoki target bottom tows:

Fishing year	Number of vessels	Total catch (t)	Number of tows	Median tow duration (h)	Median catch per tow (t)	Median catch per hour (t/h)
1990	8	22	20	3.5	0.7	0.2
1991	20	1 541	310	4.1	4.1	0.9
1992	26	3 778	701	4.2	3.1	0.8
1993	11	1 019	201	4.0	4.0	0.9
1994	16	356	138	4.4	1.1	0.3
1995	9	217	144	5.8	0.6	0.1
1996	16	892	272	4.1	1.5	0.3
1997	22	983	295	5.3	0.9	0.2
1998	18	1 262	237	4.8	3.0	0.7
1999	21	931	238	5.1	1.2	0.2
2000	18	817	224	5.0	1.6	0.3
2001	22	910	198	4.2	2.5	0.6
2002	16	1 836	184	3.8	7.0	1.7
2003	14	774	135	4.5	3.0	0.7
2004	5	152	24	3.3	4.2	1.2
2005	8	240	51	3.2	2.2	0.9
2006	6	707	79	3.5	6.0	2.1
2007	2	57	14	3.8	2.1	0.5
2008	1	-	-	-	-	-
2009	1	-	-	-	-	-
2010	1	-	-	-	-	-
2011	1	-	-	-	-	-
2012	1	-	-	-	-	-
2013	4	217	20	3.8	11.8	3.0
All years	77	16 809	3 498	4.3	2.5	0.6

Table A3: CPUE datasets for all vessels and for core (TCEPR) or final (observer) vessels for each year (1990–2013) for main hoki areas. Prop. zeros: proportion of zeros.

WCSI: TCEPR MW and BT tow-by-tow, target hoki

Fishing year	All vessels					Core vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1990	76	114 870.7	7 426	0.04	15.47	20	45 233.5	2 293	0.02	19.73
1991	73	104 351.8	7 714	0.04	13.53	28	56 607.3	2 815	0.02	20.11
1992	66	88 420.7	5 784	0.06	15.29	29	45 726.3	2 492	0.02	18.35
1993	60	86 397.3	6 440	0.06	13.42	35	54 397.4	3 791	0.05	14.35
1994	66	99 019.7	8 154	0.08	12.14	41	72 157.3	5 432	0.07	13.28
1995	62	67 688.7	8 229	0.10	8.23	43	51 360.0	6 010	0.09	8.55
1996	60	59 348.0	6 520	0.07	9.10	42	52 386.9	5 190	0.07	10.09
1997	75	76 493.8	7 455	0.07	10.26	50	64 129.9	5 849	0.07	10.96
1998	68	90 872.9	7 611	0.04	11.94	53	83 030.5	6 860	0.03	12.10
1999	59	78 734.5	6 454	0.03	12.20	49	76 298.2	6 313	0.03	12.09
2000	51	93 664.8	6 993	0.02	13.39	44	90 837.4	6 711	0.02	13.54
2001	63	90 558.7	7 698	0.02	11.76	47	83 685.0	6 861	0.02	12.20
2002	56	83 411.6	7 074	0.02	11.79	46	78 213.6	6 574	0.02	11.90
2003	51	68 053.1	6 950	0.02	9.79	44	63 746.9	6 537	0.02	9.75
2004	51	39 662.4	5 915	0.02	6.71	41	35 073.4	5 367	0.02	6.54
2005	37	28 856.1	3 456	0.02	8.35	35	26 888.6	3 275	0.02	8.21
2006	36	32 628.9	3 038	0.01	10.74	30	31 685.4	2 888	0.01	10.97
2007	32	29 157.3	1 813	0.01	16.08	28	28 157.2	1 757	0.01	16.03
2008	22	16 959.1	1 277	0.01	13.28	15	16 122.6	1 212	0.01	13.30
2009	20	16 775.3	1 029	0.01	16.30	13	15 774.6	965	0.01	16.35
2010	27	31 982.6	1 774	0.01	18.03	24	31 674.0	1 760	0.01	18
2011	27	40 966.0	2 389	0.01	17.15	24	40 537.0	2 356	0.01	17.21
2012	30	48 759.8	2 731	0.01	17.85	27	46 696.5	2 593	0.01	18.01
2013	26	49 557.0	2 774	0.01	17.86	22	47 553.9	2 637	0.01	18.03

WCSI: Observer MW and BT tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1990	14	47 607.1	1 512	0.02	31.49	5	9 290.8	482	0.02	19.28
1991	14	28 132.4	1 228	0.02	22.91	5	11 583.2	493	0.02	23.50
1992	10	18 562.5	754	0.03	24.62	5	6 115.7	225	-	27.18
1993	15	17 298.0	1 020	0.02	16.96	12	8 401.6	694	0.01	12.11
1994	15	32 398.4	1 549	0.02	20.92	10	16 556.2	981	0.01	16.88
1995	9	25 689.7	797	0.01	32.23	6	6 411.4	401	0.01	15.99
1996	15	17 676.5	1 030	0.03	17.16	10	9 999.4	768	0.02	13.02
1997	12	14 180.4	674	0.02	21.04	11	9 651.2	601	0.02	16.06
1998	16	18 622.0	896	0.01	20.78	14	13 560.6	803	0.01	16.89
1999	14	17 313.0	1 073	0.02	16.14	14	14 234.6	1 050	0.02	13.56
2000	17	18 525.3	1 154	0.00	16.05	16	17 662.3	1 141	0.00	15.48
2001	21	15 344.9	1 007	0.01	15.24	20	14 643.7	993	0.01	14.75
2002	16	16 461.8	1 303	0.01	12.63	15	16 090.9	1 275	0.01	12.62
2003	13	10 106.2	912	0.01	11.08	13	10 094.2	909	0.01	11.10
2004	16	8 397.7	1 299	0.01	6.46	14	7 564.0	1 186	0.01	6.38
2005	13	7 178.2	974	0.00	7.37	12	7 125.9	961	0.00	7.42
2006	13	9 522.3	780	0.00	12.21	13	9 519.6	778	0.00	12.24
2007	16	9 782.3	514	0.00	19.03	16	9 284.9	461	0.00	20.14
2008	11	7 054.5	426	0.00	16.56	11	7 020.8	422	0.00	16.64
2009	12	7 335.3	367	0.00	19.99	11	7 131.0	346	0.00	20.61
2010	14	9 163.6	543	0.02	16.88	13	8 102.0	468	0.02	17.31
2011	11	9 122.6	536	0.01	17.02	11	8 637.5	492	0.01	17.56
2012	15	16 707.3	881	0.01	18.96	13	14 579.3	757	0.01	19.26
2013	18	30 077.1	1 669	0.00	18.02	17	29 294.8	1 612	-	18.17

Table A3 ctd.

Cook Strait: TCEPR MW tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1990	17	11 745.5	1 039	0.03	11.30	10	7 583.8	680	0.02	11.15
1991	22	21 584.2	2 029	0.02	10.64	17	18 473.7	1 732	0.02	10.67
1992	22	17 812.0	1 563	0.03	11.40	16	14 936.2	1 295	0.03	11.53
1993	18	15 383.4	1 291	0.05	11.92	13	14 452.7	1 180	0.05	12.25
1994	28	23 715.1	1 715	0.04	13.83	15	19 029.3	1 305	0.03	14.58
1995	24	21 237.0	1 846	0.02	11.50	17	17 895.3	1 333	0.02	13.42
1996	36	33 975.6	2 514	0.03	13.51	22	22 084.8	1 612	0.03	13.70
1997	34	36 431.5	2 960	0.04	12.31	22	26 899.6	2 161	0.03	12.45
1998	29	25 536.3	1 967	0.02	12.98	18	20 841.5	1 624	0.02	12.83
1999	20	25 363.4	1 787	0.02	14.19	17	23 342.4	1 666	0.02	14.01
2000	21	21 423.6	1 541	0.02	13.90	19	20 156.5	1 435	0.02	14.05
2001	25	20 223.6	1 560	0.02	12.96	19	17 596.9	1 359	0.02	12.95
2002	15	14 340.7	864	0.01	16.60	7	11 961.6	707	0.01	16.92
2003	19	23 505.8	1 522	0.03	15.44	9	19 201.5	1 155	0.03	16.62
2004	19	24 394.4	1 568	0.01	15.56	13	21 252.4	1 382	0.01	15.38
2005	12	15 616.9	1 124	0.01	13.89	10	15 441.4	1 115	0.01	13.85
2006	11	13 334.7	852	0.01	15.65	9	12 809.5	808	0.01	15.85
2007	7	11 542.1	868	0.01	13.30	5	10 957.8	821	0.01	13.35
2008	5	6 226.5	327	0.01	19.04	3	6 072.8	311	0.01	19.53
2009	8	6 966.4	597	0.01	11.67	5	6 325.8	533	0.01	11.87
2010	8	9 383.2	720	0.01	13.03	5	9 241.9	706	0.01	13.09
2011	6	5 917.2	439	0.01	13.48	5	5 886.6	435	0.01	13.53
2012	9	8 944.9	709	0.01	12.62	5	8 325.6	640	0.01	13.01
2013	9	9 441.6	721	0.00	13.10	4	8 767.3	633	0.00	13.85

Cook Strait: Observer MW tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1998	11	3 355.4	197	0.05	17.03	9	2 429.5	141	0.03	17.23
1999	10	3 458.1	212	0.01	16.31	8	2 518.0	152	0.01	16.57
2000	7	3 016.9	151	0.01	19.98	7	2 236.5	111	0.00	20.15
2001	9	4 020.5	228	0.01	17.63	6	2 350.2	143	0.00	16.43
2002	9	1 989.8	135	0.04	14.74	5	1 052.5	75	0.00	14.03
2003	5	2 415.9	131	0.02	18.44	4	1 368.4	81	0.00	16.89
2004	7	2 482.5	126	0.03	19.70	6	1 726.0	90	0.02	19.18
2005	9	2 151.2	122	0.00	17.63	4	1 384.3	65	0.00	21.30
2006	5	1 079.8	65	0.00	16.61	4	831.3	47	0.00	17.69
2007	7	2 013.0	164	0.02	12.27	7	1 553.3	133	0.01	11.68
2008	6	3 409.2	198	0.02	17.22	5	2 611.1	145	0.01	18.01
2009	4	1 956.4	149	0.03	13.13	4	1 409.5	108	0.00	13.05
2010	9	3 181.6	229	0.01	13.89	7	2 378.2	183	0.01	13
2011	5	1 588.3	86	0.00	18.47	5	1 281.8	70	0.00	18.31
2012	7	1 516.1	141	0.03	10.75	7	1 298.1	122	0.04	10.64
2013	4	955.6	85	0.00	11.24	4	827.3	74	0.00	11.18

Table A3 ctd.

Chatham Rise: TCEPR BT tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1992	38	31 844.4	4 399	0.02	7.24	4	6 544.3	1 028	0.01	6.37
1993	37	27 900.9	4 053	0.01	6.88	3	9 829.4	1 842	0.01	5.34
1994	29	13 960.6	2 857	0.01	4.89	4	8 987.2	1 868	0.01	4.81
1995	35	20 237.8	4 395	0.03	4.60	8	15 151.2	3 268	0.02	4.64
1996	44	28 420.7	6 076	0.03	4.68	9	23 441.9	4 074	0.02	5.75
1997	66	34 575.5	7 218	0.03	4.79	10	27 599.2	4 766	0.02	5.79
1998	61	43 142.2	8 697	0.02	4.96	16	40 515.0	7 598	0.02	5.33
1999	44	53 376.4	9 439	0.01	5.65	15	52 117.9	8 923	0.01	5.84
2000	33	37 962.8	8 108	0.01	4.68	15	37 528.2	7 855	0.01	4.78
2001	39	37 552.3	8 352	0.01	4.50	15	35 719.5	7 840	0.01	4.56
2002	29	28 730.6	6 576	0.01	4.37	14	27 397.7	6 128	0.00	4.47
2003	29	28 680.0	7 623	0.01	3.76	15	26 612.4	7 005	0.01	3.80
2004	27	19 345.0	5 275	0.01	3.67	12	18 149.4	4 882	0.01	3.72
2005	23	21 152.6	3 973	0.01	5.32	10	20 017.6	3 612	0.01	5.54
2006	18	26 809.5	4 214	0.00	6.36	11	25 200.2	3 902	0.00	6.46
2007	17	27 487.8	3 800	0.01	7.23	9	25 705.6	3 503	0.01	7.34
2008	22	25 858.2	3 252	0.00	7.95	8	23 423.5	2 866	0.00	8.17
2009	19	27 240.3	3 192	0.00	8.53	7	23 625.0	2 711	0.00	8.71
2010	20	29 660.2	3 715	0.00	7.98	8	27 717.5	3 425	0.00	8.09
2011	21	30 514.7	3 615	0.00	8.44	8	27 227.2	3 204	0.00	8.50
2012	24	31 552.3	3 696	0.00	8.54	8	28 672.1	3 236	0.00	8.86
2013	20	28 393.6	3 617	0.00	7.85	7	25 918.8	3 237	0.00	8.01

Chatham Rise: Observer BT tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1994	5	2 915.8	568	0.01	5.13	2	1 246.8	252	0.00	4.95
1995	3	1 098.9	268	0.01	4.10	2	1 095.9	264	0.01	4.15
1996	4	1 560.7	274	0.01	5.70	2	1 376.0	225	0.00	6.12
1997	6	756.3	186	0.01	4.07	2	278.3	78	0.03	3.57
1998	13	4 334.7	864	0.01	5.02	12	4 248.8	837	0.01	5.08
1999	12	7 291.4	1 125	0.01	6.48	12	7 258.6	1 118	0.01	6.49
2000	8	2 948.8	536	0.02	5.50	6	2 934.6	522	0.02	5.62
2001	13	3 135.0	765	0.09	4.10	11	3 104.7	752	0.09	4.13
2002	10	4 224.9	921	0.00	4.59	9	4 224.0	919	0.00	4.60
2003	9	1 677.1	615	0.00	2.73	8	1 676.6	613	0.00	2.74
2004	6	1 306.8	298	0.07	4.39	4	1 298.7	289	0.01	4.49
2005	7	3 902.6	629	0.00	6.20	5	3 839.8	614	0.00	6.25
2006	8	3 393.3	461	0.00	7.36	7	3 381.9	452	0.00	7.48
2007	8	5 121.8	736	0.00	6.96	6	5 081.9	730	0.00	6.96
2008	7	4 832.6	642	0.00	7.53	7	4 662.4	600	0.00	7.77
2009	10	3 548.5	449	0.02	7.90	7	3 230.3	382	0.02	8.46
2010	9	5 379.0	577	0.00	9.32	8	2 655.4	325	0.01	8.17
2011	10	5 497.9	668	0.01	8.23	8	4 275.6	514	0.00	8.32
2012	8	6 622.9	791	0.01	8.37	6	5 234.2	649	0.01	8.07
2013	15	8 889.0	1 295	0.01	6.86	9	6 694.2	993	0.01	6.74

Table A3 ctd.

Sub-Antarctic: TCEPR BT tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1992										
1993	25	21 875.3	4 089	0.02	5.35	4	7 437.3	1 358	0.01	5.48
1994	23	18 737.4	4 188	0.02	4.47	4	8 125.6	1 740	0.01	4.67
1995	15	6 974.4	1 481	0.02	4.71	3	4 288.2	925	0.01	4.64
1996	24	10 310.9	2 012	0.03	5.12	6	6 408.9	1 391	0.03	4.61
1997	22	9 119.6	2 033	0.06	4.49	6	5 971.4	1 301	0.02	4.59
1998	37	12 282.3	2 162	0.03	5.68	13	11 338.5	1 819	0.03	6.23
1999	35	18 571.8	3 388	0.02	5.48	14	17 786.8	3 124	0.02	5.69
2000	30	15 962.3	2 772	0.02	5.76	12	13 577.5	2 266	0.02	5.99
2001	26	23 437.6	4 816	0.02	4.87	16	22 681.5	4 477	0.02	5.07
2002	31	17 452.6	4 028	0.02	4.33	15	16 586.8	3 713	0.02	4.47
2003	32	20 898.2	5 019	0.03	4.16	16	20 007.0	4 633	0.02	4.32
2004	29	15 922.1	3 723	0.02	4.28	15	15 305.0	3 471	0.01	4.41
2005	23	8 297.7	2 391	0.06	3.47	10	7 942.3	2 228	0.05	3.56
2006	25	4 524.9	1 216	0.06	3.72	7	4 150.1	1 026	0.04	4.04
2007	15	3 336.7	525	0.03	6.36	6	3 062.3	450	0.02	6.81
2008	20	3 422.9	800	0.05	4.28	9	3 078.8	721	0.03	4.27
2009	13	4 725.3	750	0.01	6.30	5	4 658.0	719	0.01	6.48
2010	12	5 696.0	743	0.01	7.67	4	5 616.0	723	0.01	7.77
2011	12	7 912.1	961	0.02	8.23	5	7 562.7	911	0.01	8.30
2012	15	8 030.2	1 111	0.01	7.23	5	7 326.9	1 020	0.01	7.18
2013	17	10 275.7	1 032	0.00	9.96	7	9 306.7	954	0.00	9.76
	16	9 798.2	1 134	0.01	8.64	6	9 505.0	1 082	0.01	8.78

Sub-Antarctic: Observer BT tow-by-tow, target hoki

Fishing year	All vessels					Final vessels				
	No. vessels	Catch	Effort	Prop. zeros	CPUE	No. vessels	Catch	Effort	Prop. zeros	CPUE
1998	6	1 304.4	219	0.00	5.96	4	1 246.6	201	0.00	6.20
1999	9	4 546.2	686	0.02	6.63	7	4 436.0	658	0.01	6.74
2000	8	3 374.0	809	0.01	4.17	7	3 370.9	803	0.01	4.20
2001	13	1 546.4	355	0.01	4.36	5	1 402.5	298	0.00	4.71
2002	7	3 035.5	628	0.00	4.83	5	2 998.5	616	0.00	4.87
2003	9	1 311.6	349	0.01	3.76	6	1 307.0	344	0.01	3.80
2004	7	443.4	156	0.17	2.84	3	413.7	144	0.15	2.87
2005	3	354.0	88	0.03	4.02	3	354.0	88	0.03	4.02
2006	4	797.2	92	0.00	8.67	3	762.1	80	0.00	9.53
2007	6	875.2	154	0.00	5.68	4	849.6	152	0.00	5.59
2008	5	1 898.6	317	0.01	5.99	3	1 612.9	213	0.00	7.57
2009	4	2 644.1	364	0.01	7.26	3	2 621.6	360	0.01	7.28
2010	6	2 311.8	280	0.07	8.26	4	2 023.8	238	0.03	8.50
2011	8	2 006.8	274	0.02	7.32	3	1 466.5	197	0.02	7.44
2012	5	1 631.3	192	0.00	8.50	3	1 154.5	136	0.00	8.49
2013	15	4 264.5	587	0.01	7.26	7	3 813.4	517	0.00	7.38

Table A4: Lognormal CPUE standardised indices, and binomial, and combined CPUE indices (with 95% confidence intervals).

WCSI: TCEPR tow-by-tow, target hoki			WCSI: Observer catch, target hoki		
Year	Index	CI	Year	Index	CI
1990	1.12	1.06–1.17	1990	1.06	0.92–1.22
1991	1.21	1.16–1.26	1991	1.10	0.98–1.23
1992	1.21	1.16–1.26	1992	1.23	1.04–1.45
1993	1.04	1.01–1.08	1993	0.98	0.88–1.09
1994	0.99	0.96–1.02	1994	1.00	0.92–1.09
1995	0.64	0.63–0.66	1995	0.74	0.65–0.83
1996	0.75	0.73–0.77	1996	0.77	0.70–0.84
1997	0.77	0.75–0.79	1997	0.87	0.79–0.96
1998	0.95	0.93–0.97	1998	0.97	0.90–1.05
1999	0.99	0.96–1.01	1999	0.86	0.80–0.94
2000	1.13	1.10–1.16	2000	1.13	1.05–1.21
2001	0.82	0.80–0.84	2001	0.74	0.69–0.80
2002	0.80	0.78–0.82	2002	0.86	0.80–0.92
2003	0.62	0.60–0.63	2003	0.51	0.47–0.56
2004	0.40	0.39–0.41	2004	0.32	0.30–0.34
2005	0.48	0.47–0.50	2005	0.47	0.44–0.51
2006	0.77	0.74–0.80	2006	0.83	0.76–0.89
2007	1.23	1.17–1.29	2007	1.43	1.30–1.57
2008	1.22	1.15–1.29	2008	1.17	1.06–1.29
2009	1.66	1.56–1.77	2009	1.74	1.56–1.94
2010	1.61	1.54–1.69	2010	1.51	1.36–1.66
2011	1.59	1.52–1.65	2011	1.90	1.72–2.09
2012	1.86	1.78–1.93	2012	2.05	1.89–2.23
2013	2.12	2.04–2.21	2013	2.23	2.09–2.37

Cook Strait: TCEPR MW tow-by-tow, target hoki			Cook Strait: Observer catch, target hoki		
Year	Index	CI	Year	Index	CI
1990	1.27	1.17–1.38	1998	0.97	0.80–1.18
1991	1.01	0.95–1.06	1999	0.98	0.80–1.19
1992	1.15	1.08–1.22	2000	1.01	0.81–1.25
1993	1.03	0.97–1.10	2001	0.74	0.59–0.91
1994	1.27	1.19–1.35	2002	0.82	0.64–1.06
1995	1.25	1.18–1.33	2003	0.66	0.50–0.87
1996	1.06	1.00–1.12	2004	1.33	1.06–1.67
1997	0.96	0.92–1.01	2005	1.46	1.11–1.92
1998	0.98	0.93–1.03	2006	1.23	0.92–1.66
1999	0.96	0.91–1.01	2007	0.66	0.55–0.80
2000	0.97	0.92–1.03	2008	1.22	1.01–1.47
2001	0.79	0.75–0.84	2009	0.73	0.58–0.91
2002	1.20	1.11–1.29	2010	1.05	0.87–1.27
2003	1.04	0.98–1.10	2011	1.46	1.14–1.87
2004	0.88	0.84–0.94	2012	1.05	0.84–1.31
2005	0.84	0.80–0.90	2013	1.16	0.89–1.50
2006	0.99	0.93–1.07			
2007	0.77	0.72–0.83			
2008	1.16	1.04–1.30			
2009	0.79	0.72–0.86			
2010	0.98	0.90–1.06			
2011	1.16	1.05–1.28			
2012	0.88	0.81–0.95			
2013	0.88	0.81–0.96			

Table A4: ctd.**Chatham Rise: TCEPR tow-by-tow, target hoki**

Year	Index	CI
1992	1.12	1.05–1.19
1993	1.05	1.00–1.10
1994	1.02	0.97–1.07
1995	0.88	0.85–0.92
1996	1.06	1.03–1.10
1997	0.98	0.95–1.01
1998	0.90	0.88–0.92
1999	1.03	1.01–1.05
2000	0.82	0.80–0.84
2001	0.77	0.75–0.79
2002	0.77	0.75–0.79
2003	0.59	0.57–0.60
2004	0.56	0.54–0.57
2005	0.79	0.77–0.82
2006	1.04	1.01–1.08
2007	1.08	1.04–1.12
2008	1.33	1.28–1.38
2009	1.48	1.42–1.54
2010	1.29	1.24–1.33
2011	1.37	1.32–1.41
2012	1.49	1.43–1.54
2013	1.35	1.30–1.40

Chatham Rise: Observer catch, target hoki

Year	Index	CI
1994	1.32	1.14–1.52
1995	0.82	0.70–0.95
1996	1.05	0.90–1.22
1997	0.48	0.37–0.62
1998	0.79	0.73–0.86
1999	0.99	0.92–1.07
2000	0.94	0.84–1.04
2001	0.64	0.59–0.70
2002	0.78	0.73–0.85
2003	0.53	0.48–0.58
2004	0.82	0.68–0.98
2005	0.92	0.83–1.01
2006	1.25	1.11–1.40
2007	1.19	1.09–1.29
2008	1.41	1.28–1.54
2009	1.51	1.35–1.70
2010	1.61	1.42–1.82
2011	1.31	1.19–1.45
2012	1.44	1.31–1.59
2013	1.33	1.22–1.44

Sub-Antarctic: TCEPR tow-by-tow, target hoki

Year	Index	CI
1992	1.02	0.96–1.09
1993	0.95	0.90–1.01
1994	1.12	1.04–1.21
1995	0.93	0.87–0.98
1996	0.98	0.92–1.04
1997	1.26	1.19–1.33
1998	1.09	1.05–1.13
1999	0.99	0.94–1.03
2000	0.92	0.88–0.95
2001	0.82	0.79–0.85
2002	0.80	0.77–0.83
2003	0.78	0.75–0.81
2004	0.56	0.53–0.58
2005	0.59	0.56–0.63
2006	0.82	0.75–0.90
2007	0.66	0.61–0.72
2008	1.17	1.08–1.26
2009	1.42	1.31–1.53
2010	1.47	1.38–1.58
2011	1.37	1.28–1.46
2012	1.75	1.63–1.87
2013	1.54	1.45–1.64

Sub-Antarctic: Observer catch, target hoki

Year	Index	CI
1998	1.21	0.98–1.50
1999	1.08	0.95–1.21
2000	0.72	0.64–0.81
2001	1.14	0.96–1.34
2002	0.67	0.59–0.77
2003	0.59	0.50–0.68
2004	0.92	0.75–1.12
2005	0.62	0.49–0.78
2006	1.15	0.88–1.50
2007	1.03	0.82–1.29
2008	1.52	1.30–1.77
2009	1.10	0.94–1.29
2010	1.28	1.08–1.51
2011	1.43	1.19–1.72
2012	0.99	0.81–1.22
2013	1.17	1.03–1.32