Catches, size, and age structure of the 2007–08 hoki fishery, and a summary of input data used for the 2009 stock assessment

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New Zealand Fisheries Assessment Report 2010/18
July 2010

Published by Ministry of Fisheries
Wellington
2010

ISSN 1175-1584 (print)
ISSN 1179-5352 (online)

Ballara, S.L.; O'Driscoll, R.L.; Fu, D. (2010).
Catches, size, and age structure of the 2007–08 hoki fishery, and a summary of input data used for the 2009 stock assessment.
New Zealand Fisheries Assessment Report 2010/18.

This series continues the informal
New Zealand Fisheries Assessment Research Document series
which ceased at the end of 1999.

EXECUTIVE SUMMARY

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New Zealand Fisheries Assessment Report 2010/18.

This report summarises the catch by area and presents the length and age structure of hoki caught commercially during the 2007–08 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 2009.

The total reported hoki catch in 2007–08 was 89 328 t, 11 700 t less than in 2006–07, and the lowest total catch since 1985–86. Catches in 2007–08 decreased on the WCSI, Cook Strait, and Puysegur, were similar on the Chatham Rise, and increased on the ECSI and in the Sub-Antarctic. The Chatham Rise was the largest hoki fishery for the second consecutive year, with 37 909 t taken from this area. The catch on the WCSI declined by 12 000 t to 21 083 t, and was the lowest catch taken from this area since the late 1970s. The catch from Cook Strait continued to drop, to 18 243 t, the lowest level since 1989–90. The catch from the Sub-Antarctic increased slightly to 8747 t. As the hoki quota was fully caught before the end of the fishing year, catches in both Puysegur and ECSI were relatively low, with 2360 t taken from the ECSI and 324 t from Puysegur. About 30 000 t of the total catch was taken from western areas in 2007–08, which is higher than the agreed voluntary catch limit of 25,000 t.

Length frequencies and catch-at-age results from the commercial fishery show that most of the catch in 2007–08 was fish from the 2002–06 year-classes. Widespread occurrence of young fish may indicate relatively good recent recruitment, or may be because there are fewer older fish remaining in the population. The female bias in hoki catches observed in all areas from 2000–01 to 2003–04 has changed as the proportion of young fish has increased: there are now more males than females in the spawning areas. However, there is still some evidence that the proportion of males age 7 and older has declined in the WCSI fishery. The largest average size of fish in 2007–08 was from the Sub-Antarctic. Almost half of the hoki taken on the Chatham Rise were less than 65 cm.

The estimate of total hoki biomass from the Chatham Rise trawl survey in January 2009 was 144 088 t, an increase of 87% from 2008. The relative index for 2+ (2006 year-class) hoki was strong, while that for 1+ (2007 year-class) hoki was average. The December 2008 Sub-Antarctic trawl survey biomass estimate of 47 488 t was similar to that in 2007 and much higher than in 2006. The abundance of spawning hoki observed in the Cook Strait acoustic survey decreased by 23% from 2007, to 167 000 t in 2008.

1. INTRODUCTION

This report provides data relevant to the 2009 hoki stock assessment. Catch statistics and biological data from the commercial fishery during the 2007–08 fishing year are presented, and results from other research programmes since March 2008 are summarised. These include the results of trawl surveys of the Sub-Antarctic in November–December 2008 and Chatham Rise in January 2009, and the NIWA and industry acoustic surveys of Cook Strait and the east and west coasts of the South Island in winter 2008. Details of model structure, results, and yield estimates from the hoki stock assessment in 2009 will be published separately.

This report provides the final reporting requirements for Objective 2 of HOK2007/01B, Objective 2 and 3 of MID2007/01, and Objective 1 of MID2007/01B.

1.1 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 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 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 the east coast of the North Island, but these are small by comparison.

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. Although a greater proportion of the total catch is still taken during the spawning season, the hoki fishery now operates throughout the rest of the year, producing high quality fillets from both spawning and non-spawning fisheries. Since 1994–95, there has been an increase in the number of vessels under 43 m total length, and fishing inside the 25 n. mile line on the WCSI has increased. Twin-trawl rigs were introduced in about 2000 and their use is increasing in all hoki fisheries, except Cook Strait and inside the line on the WCSI. Spectra trawls were introduced to some vessels in 2007–08.

1.2 Catch history

The total annual catches of hoki within the EEZ from 1969 to 2007–08 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. Catches have since declined, and the TACC was reduced from 250 000 t to 200 000 t in the 2001–02 fishing year, to 180 000 t in 2003–04, and further to 100 000 t from 2004–05 to 2006–07, and 90 000 t in 2007–08. The current

TACC (2008–09) is 90 000 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. 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 over the last six years, to the current level of 21 100 t (Table 3). In Cook Strait, catches increased from 1988–89 to a peak of 67 000 t in 1995–96, declined to a low of 24 200 t in 2001–02, peaked again at 40 900 t in 2003–04, and dropped to 18 200 to 24 800 t in the last four years. Non-spawning catches on the Chatham Rise increased from 1993–94, peaked at about 75 000 t in 1997–98 and 1998–99, then decreased. The Chatham Rise catch of 37 900 t in 2006–07 and 2007–08 was up slightly on catches in the previous three years. Catches from the Sub-Antarctic peaked at over 30 000 t in 1999–00 to 2001–02, but declined to between 6200 and 8700 t from 2004–05 to 2007–08. Catches from other areas have remained at relatively low levels (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. This catch split was achieved in 2006–07. 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 2007–08, with 30 200 t taken from western areas.

1.3 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. Research results presented in the past year are summarised here.

A new stock assessment was carried out in 2008 (Francis 2009) using the Bayesian model developed in 2002 (Francis et al. 2003) and implemented in the general-purpose stock-assessment program CASAL (Bull et al. 2008). As in previous years, a number of initial exploratory runs were carried out to provide information about which assumptions should be carried forward and used in the final assessment. The Hoki Working Group then agreed on two final model runs, which were similar to the runs used in 2007 (Francis 2008). These two runs differed in the mechanism used to deal with the lack of old fish in the observations: either: a) allowing natural mortality to vary with age; or b) allowing a domed selectivity in spawning fisheries (Francis 2009). Both hoki stocks were estimated to be increasing after recently reaching their lowest levels since the fishery began. The western stock was estimated as being much more depleted (28–30% B_0) than the eastern stock (42–45% B_0). The western stock experienced an extended period of poor recruitment from 1995 to 2001, but there was some evidence of better (although still below average) recruitment in 2002–06. For the eastern stock, recent recruitment had been close to the long-term average. Projections suggested that continued fishing at current levels would likely increase the biomass of the western stock but maintain the present biomass of the eastern stock (Francis 2009).

Analyses carried out after the 2008 assessment illustrated improvements to model assumptions when natal fidelity is not assumed and provided improved estimates of proportion spawning (Francis 2009).

Observations from surveys and conclusions from modelling work indicate that a significant proportion of adult hoki do not mature and migrate to the spawning grounds each year (e.g., Livingston et al. 1997). Parker et al. (NIWA, unpublished results) described a classification tree

model to estimate the proportion of hoki that had spawned the previous winter based on macroscopic, histological, and physiological indicators from samples collected during summer (November–December) Sub-Antarctic trawl surveys. This analysis identified that a large proportion of histological samples could be determined to be from spawned fish based on the presence of residual eggs (63% of 4+ female hoki in 2003 and 2004 samples had one or more residual eggs). The classification method achieved a high degree of correct classification using only two or three histological factors, suggesting that separating spawned from not-spawned fish is feasible from summer samples. The new method gave very similar results (90% classification agreement) to a previous study by Grimes & O'Driscoll (2006), which was based on a more subjective approach. Both studies indicated that about 85% of the 4+ year old fish from 2003–2004 had spawned.

Bycatch and discards in the hoki, hake and ling fishery from 2000–01 to 2006–07 were described by Ballara et al. (2010). Total bycatch ranged from 36 000 to 58 000 t per year from a total landed trawl catch of 130 000 to 238 000 t. Bycatch ratios of commercial species were highest in Puysegur and lowest in Cook Strait. Bycatch ratios of non-commercial species were highest on the Chatham Rise and lowest for Cook Strait. Total annual discard estimates ranged from about 5500 to 29 000 t per year with the main species being discarded including spiny dogfish, rattails, javelinfish, hoki, and shovelnose dogfish. Discard ratios of commercial species were highest in Cook Strait and Sub-Antarctic and discard ratios of non-commercial species were lowest in Cook Strait. Spiny dogfish was the main QMS species discarded. Discarding of hoki, hake, and ling was 9.7% of total observed discards. Fish lost from the net during landing accounted for only a small fraction (0–14.5%) of the total fish discards each year in the hoki, hake, and ling fishery. Non-commercial bycatch such as javelinfish and rattails that were previously discarded are now mainly mealed.

Mormede et al. (2008) analysed factors affecting the probability of fur seal captures in the WCSI hoki fishery and concluded that the most important factor was region, with most captures of fur seals being in the Hokitika Canyon. Other explanatory variables were year, day/night, nation, vessel power and tow duration.

Preliminary results from the Chatham Rise trophic study indicate that hoki predominately eat lantern fishes, particularly *Lampanyctodes hectoris*, and other midwater fishes (Dunn et al. 2009). They also consume significant quantities of natant decapods, notably pasiphaeid and sergestid shrimps, and euphausids. The results so far corroborate the findings of Clark (1985a, 1985b) on the diet of hoki from the Campbell Plateau, New Zealand. The results also show that hoki are prey of stargazers, smooth skates, deepwater sharks (spiny dogfish, shovelnose dogfish, school sharks, and leafscale gulper sharks), ling, and hake. Ling appear to eat hoki that have been discarded by the fishery. A few other species ingest hoki opportunistically while in the trawl net. There was no evidence that hoki are cannibalistic.

Tuck et al. (2009) derived ecosystem indicators from the Sub-Antarctic trawl series data from 1991 to 2005 and the Chatham Rise trawl series from 1992 to 2007. Indicators were based on measures of diversity, fish size, and trophic level in an attempt to identify the effects of fishing on fish communities. This analysis included calculation of a species distribution index for hoki.

Work continues on the acoustic target strength (TS) of hoki. The current focus is attempting to resolve differences between estimates of TS of New Zealand hoki with Australian results which give TS values about 6 dB higher. Acoustic data were collected during winter 2008 in Cook Strait in conjunction with a video camera system (Dunford 2009). Although the system obtained several images from a school of hoki it was not possible to obtain simultaneous optical and acoustic measurements of hoki. Target strength measurements obtained from the hoki schools were also compromised by the presence of significant numbers of smaller mesopelagic fish. Australian measurements made with a towed optical-acoustic system off Tasmania during winter 2008 suggest that TS values for large (90 cm) hoki are higher than those estimated by the current New Zealand TS-length relationship of Macaulay (2006) (Tim Ryan, CSIRO, pers. comm.).

New fisheries-independent information available in 2009 included results from trawl surveys of the Sub-Antarctic in November–December 2008 and Chatham Rise in January 2009, and an acoustic survey of Cook Strait and the ECSI in July–August 2008 (O'Driscoll 2009). Results from these

surveys are summarised in Section 3.1. Additional acoustic surveys were carried out from industry vessels in Cook Strait, ECSI, and WCSI, but the results from these surveys were not included in the stock assessment.

2. HOKI FISHERY, 2007–08

2.1 Catch and effort information

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

In the 2007–08 fishing year the TACC for HOK1 was 90 000 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 of Fisheries that only 25 000 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.

The Hoki Fishery Management Company (now Deepwater Group Limited) introduced a Code of Practice for hoki target trawling in 2001 with the aim of protecting small fish (less than 60 cm). The main components of this Code of Practice are: 1) a restriction on fishing in waters shallower than 450 m; 2) a rule requiring vessels to 'move on' if there are more than 10% small hoki in the catch. More recently, the Code of Practice has been extended to include seasonal and area closures in spawning fisheries.

2.1.2 Catch

The overall catch of 89 328 t was 11 700 t lower than in 2006–07 and 670 t lower 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 87 690 t. As the data extraction was done in mid December 2008, 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 89 328 t.

Catches decreased in the WCSI, Cook Strait, and Puysegur spawning areas; remained similar on the Chatham Rise; and increased on the ECSI, and Sub-Antarctic (Figure 2, Table 3). For only the second time, the WCSI was not the largest New Zealand hoki fishery, with 37 909 t taken from the Chatham Rise and 21 083 t from the WCSI in 2007–08. The WCSI catch in 2007–08 was the lowest since 1979 and 12 000 t lower than the catch from 2006–07 (see Tables 2 and 3). Catches inside the 25 n. mile line on the WCSI dropped to 935 t or 4% of the WCSI catch (Table 4a), down from a peak of 42% of the catch in 2003–04. The catch from Cook Strait further decreased from 20 000–21 000 t in 2005–06 and 2006–07 to 18 243 t in 2007–08, the lowest since 1989–90. Catches from the Sub-Antarctic peaked at over 30 000 t in 1999–00 to 2001–02, but declined to between 6200 and 7700 t in 2004–05 to 2006–07, with 8747 t taken in 2007–08 (see Table 3). Catches from Puysegur decreased from 1500 t in 2005–06 to 440 t in 2006–07, and 324 t in 2007–08 due mainly to western quota limitations. Catches in the other eastern spawning fishery on the ECSI increased from 997 t in 2006–07 to 2360 t in 2007–08. Overall, about 30 000 t of the total catch in 2007–08 was taken from western areas (Figure 2).

Most of the hoki catch in 2007–08 was taken during the spawning season from June to September (Figure 3). As in previous years, peak catches on the WCSI and Cook Strait spawning grounds were in July and

August (Figure 4). Most of the WCSI catch was taken by the first week of August, while catches from Cook Strait continued through to mid September. In Cook Strait, about 2800 t was caught outside the spawning season. Fishing occurred mainly from July to September on the ECSI, when hoki are known to be spawning in this area. Very little fishing occurred at Puysegur during the spawning season due to quota constraints (see Figure 3). Outside the spawning season, most of the catch was taken from December 2007 to June 2008 on the Chatham Rise, and from October to December 2007 in the Sub-Antarctic, with small amounts of catch taken over the rest of the year in these areas (see Figures 3 and 4). Small catches were taken year-round from the ECNI (see Figure 3).

Changes have occurred in targeting in the hoki fishery. Up until 2003–04 most of the hoki catch was almost entirely from target hoki tows. Since then, hoki targeting has decreased, especially on the Sub-Antarctic, WCSI, and Chatham Rise. In 2007–08 a decrease in hoki catch by target hoki tows was seen in most areas, with catches from tows targeting hoki making up 85% of the hoki catch on the WCSI, 73% on the Sub-Antarctic, and 90% on the Chatham Rise. There have been increases in hoki catches from tows targeting ling in the Sub-Antarctic, from tows targeting ling and hake on the Chatham Rise, and from tows targeting hake on the WCSI. Cook Strait remains almost exclusively a hoki target fishery.

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 Tables 4 and 5. Catch rates for the WCSI are presented for both midwater and bottom trawls (Tables 5a and 5b). Table 5 does not include data from CELR forms, which account for up to a third of the catch in Cook Strait and some catch from the WCSI, or the new TCER forms as they have been used for only one year (see Table 4). It also does not include data from the LCER, LTCER, TLCER or NCELR forms. As the data for 2007–08 were extracted in December 2008, some data for this fishing year may not have been included.

Midwater trawl catches accounted for 60% of the total spawning season catch on the WCSI in 2007–08 (Table 4a). Unstandardised catch rates from all non-zero midwater tows in 2007–08 were the highest since 2001–02, with a median catch of 3.8 t per hour, and a median tow duration of 1.8 hours (Table 5a). Catch rates were slightly higher (4.8 t per hour) for target hoki tows than for all tows, with a lower median tow duration of 1.7 hours. Catch rates in bottom trawls on the WCSI were lower than in midwater trawls, with a median catch rate of 0.3 t per hour for all non-zero hoki catches and 1.7 t per hour for target hoki tows (Table 5b). Median tow duration of bottom trawls increased to 9.0 hours for all target species, and was 4.8 hours for target hoki only tows in 2007–08.

Midwater trawl catches accounted for 47% of the spawning season catch reported on TCEPR forms from Cook Strait in 2007–08 (Table 4b) Another 6671 tonnes of catch was reported on TCER (See Table 4b). Unstandardised catch rates continued to be high in Cook Strait, with a median catch rate of 31.4 t per hour in non-zero mid-water tows and a median tow duration of only 0.6 hours (equivalent to a median catch of 19.4 t per tow) (Table 5c).

Over 98% of the Chatham Rise catch in 2007–08 was taken in bottom trawls, with most of the catch reported on TCEPR forms (Table 4c). There has been a general increase in tow duration on the Chatham Rise since the 1990s, with a median tow duration of 4.8 h in 2007–08 (See Table 5d). The median unstandardised catch rate in bottom trawls on the Chatham Rise was 0.8 t per hour from 2005–06 to 2007–08, the highest since 1999–2000 (Table 5d). The catch rate in hoki target trawls has increased from 0.6 t per hour in 2003–04 to 1.4 t per hour in 2007–08 (Table 5d).

Spawning season catches from the ECSI were mainly reported on TCEPR (See Table 4d). Similar catch rates were recorded for midwater and bottom tows of 2.6 t per hour and 2.8 t per hour respectively (Table 5e).

Bottom trawl catches reported on TCEPR accounted for 65% of the catch take from the Sub-Antarctic in 2007–08 (See Table 4e). Median tow duration in 2007–08 was the same as in 2006–07 (5.5 hours), but unstandardised catch rates in bottom trawls increased from 0.1 t per hour to 0.2 t per hour (Table

5f). Catch rates for hoki target bottom trawls were much higher, at 0.9 t per hour in 2008–09 (Table 5f), but are still lower than target catch rates in the other hoki fisheries.

Too few tows were carried out at Puysegur in 2007–08 to estimate catch rates (Tables 4f, 5g).

Ballara et al. (2006) calculated standardised CPUE indices for the non-spawning Chatham Rise fishery to the end of the 2002–03 fishing year, using both lognormal and Tweedie mixed effects models. CPUE indices are not currently included in the hoki stock assessment and the work of Ballara et al. (2006) has not been updated.

2.1.4 Bycatch

Estimates of bycatch in the hoki fishery were determined from data collected by Ministry of Fisheries observers. For target hoki trawls, the observer data in 2007–08 represent about 38% of vessels, 9% of tows, and 14.7% of the total catch (Table 6). The bycatch rate (defined as the percentage of the hoki catch) was estimated for hake, ling, silver warehou, and spiny dogfish (Table 7). Other bycatch species are also taken, particularly in the non-spawning fisheries, but bycatch rates for these 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 in Table 7 should be treated with caution. Caution also needs to be made with interpretation of the definition of the hoki target fishery, due to changes in targeting. A more comprehensive analysis of catch and discards in the hoki, hake and ling fishery from 2000–01 to 2006–07 was described by Ballara et al. (2010).

Bycatch rates in 2007–08 were generally low (less than 5%) for all species in all areas except the Sub-Antarctic. Ling (43.3%) was the major bycatch species in the Sub-Antarctic. The observed bycatch in the WCSI fishery in 2007–08 was similar to 2006–07, with hake (0.6%) and ling (0.9%) the major contributors. As in the past, there was very little bycatch in Cook Strait, with spiny dogfish having the largest observed bycatch rate (1.8%). Ling (2.2%), silver warehou (2.7%), and hake (1.4%) were the major bycatch species on the Chatham Rise.

2.2 Size and age composition of commercial catches

The main hoki fisheries in 2007–08 were identified by extracting from the Ministry of Fisheries catch and effort database all tows that targeted and/or caught hoki. Data to estimate length frequencies in 2007–08 were available from the Ministry's Observer Programme (OP) and shed sampling of landed fish by NIWA. The observer programme formerly run by the Hoki Fishery Management Company (HMC) has been discontinued and no data have been available since 2004–05.

The positions of all tows by the commercial fleet for which hoki was the reported target species in 2007–08 are shown in Figure 5a, and the position of all tows sampled for hoki length frequency distributions by the OP are shown in Figure 5b. Hoki were measured by OP observers in 995 tows, of which 246 came from the WCSI, 100 from Cook Strait, 394 from the Chatham Rise, 210 from the Sub-Antarctic, 4 from the ECSI, 5 from Puysegur, 33 from ECNI, and 2 from west coast North Island (WCNI). Shed samples from 32 landings of hoki from Cook Strait and 7 landings from the WCSI inside the 25 n. mile line were collected by NIWA in 2007–08 under Ministry of Fisheries Project MID2007/01. Tables 8 and 9 describe observer trip and shed sampling timing in greater detail for the main areas sampled.

In winter 2006, during the shed sampling programme, NIWA was made aware that three larger vessels from one company were sorting fish (by size) at sea to decrease onshore processing time and improve product quality. In 2007 and 2008 vessels longer than 40 m were therefore no longer sampled by the NIWA shed sampling programme and the Ministry's Observer Programme undertook to sample these vessels at sea. Observer samples for vessels longer than 40 m were obtained in Cook Strait but not for WCSI in 2006–07 or 2007–08.

Length frequencies were estimated for each of the major fisheries as the weighted (by catch or landing 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. Data from outside the line were split into weekly time periods throughout the season, although adjacent weeks were combined if there were fewer than 10 OP length samples available. Observer data from inside the 25 n. mile line were stratified fortnightly where possible. Length frequencies from Cook Strait were stratified by month, island of landing, and vessel size. 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 MFish Observer Programme and from shed samples collected by NIWA. Subsamples of 748 otoliths from both Cook Strait and the WCSI were selected, prepared, and read using the validated technique of Horn & Sullivan (1996) as modified by Cordue et al. (2000). Each subsample was derived by randomly selecting a set number of otoliths from each of a series of 5 cm length bins covering the bulk of the catch and then systematically selecting additional otoliths to ensure the tails of the length distribution were represented. The chosen sample sizes approximated those necessary to produce mean weighted c.v.s 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 for each sex separately. A single age-length key was applied to the WCSI with no distinction made between fish sampled inside the 25 n. mile line by NIWA shed samples and outside the line by OP observers. A preliminary analysis of otolith data from 2001 to 2003 suggested that the mean length at age was greater for hoki taken inside the line, but the difference in the fitted growth curves was not statistically significant (O'Driscoll et al. 2004b). Likewise, a single age-length key was applied using Cook Strait otoliths with no distinction made between NIWA shed samples and OP samples. 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 distributions in both the Chatham Rise and Sub-Antarctic fisheries were 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 year. 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 c.v. of 0.20 in some years.

On the Chatham Rise in 2007–08, 1221 otoliths (504 males and 717 females) were selected as follows out of 3391 otoliths collected from 385 tows:
1. Reject all otoliths from tows catching less than 1 t of hoki.
2. For tows catching between 1 t and 5 t of hoki select at random 2 otoliths from each tow.
3. For tows catching between 5 t and 10 t of hoki select at random 5 otoliths from each tow.

4. For tows catching between 10 t and 15 t of hoki select at random 7 otoliths from each tow.
5. For tows catching more than 15 t of hoki select at random 9 otoliths from each tow.

On the Sub-Antarctic in 2007–08, 1222 otoliths (477 males and 745 females) were selected as follows out of 1783 otoliths collected from 173 tows:
1. Reject all otoliths from tows catching less than 1 t of hoki.
2. For tows catching between 1 t and 5 t of hoki select at random 7 otoliths from each tow.
3. For tows catching between 5 t and 10 t of hoki select at random 9 otoliths from each tow.
4. For tows catching between 10 t and 15 t of hoki select at random 9 otoliths from each tow.
6. For tows catching more than 15 t of hoki select at random 9 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 summed 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).

In 2007–08 most of the Chatham Rise otoliths came from the hoki target fishery with a very small number of otoliths (25) from hake, orange roughy, and ling target tows. Hoki target tows accounted for about 98% of the observed hoki catch on the Chatham Rise. About 85% of the aged Sub-Antarctic otoliths came from target hoki tows, with the rest coming from the ling target fisheries. Hoki and ling target tows accounted for about 97% of the observed hoki catch in the Sub-Antarctic.

An optimised length frequency (OLF) model is still used in the hoki stock assessment to provide estimates of catch-at-age before 1999–2000 in the Sub-Antarctic and up to 1997–98 on the Chatham Rise, and was described in detail by Hicks et al. (2002).

2.2.1 Size and age composition in spawning fisheries

West coast South Island

The 2008 catch from the WCSI fishery had one main length mode for the females and four for the males (Figure 6). Most of the catch was fish from the 2000–06 year classes (ages 2–8) (Figure 7). The main length mode for female hoki comprised the 2003 year-class (5 year olds) centred at 86 cm, with the 2004 and 2005 year-class fish on the left hand side of this mode centred at 76 and 63 cm respectively, and the right hand tail comprising fish from the 2002 year-class and older, up to lengths of 110 cm (ages 8–15) (Figure 6 and 7). For the males, the modes for different year-classes were more distinct: the 2003 year-class was centred at 82 cm, 2004 year-class at 73 cm, 2005 year-class at 63 cm and the 2006 year-class at 46 cm (Figures 6 and 7). A few small (28–35 cm) male hoki from the 2007 year class were also caught.

The percentage of young fish (those aged 3 or less) by number in the WCSI catch was 26% – higher than in 2006–07 (when 19% of the fish were 3 or younger). Small hoki were caught in all areas of the WCSI fishery, both inside and outside the 25 n. mile line. About 14% of the WCSI catch by number was less than 60 cm. Of the female fish less than 55 cm (i.e., mostly 2 year-olds from the 2006 year class), about 79% were in spawning condition, compared to 96% of all fish (Table 10). 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.

From 2000 to 2004, the sex ratio of the WCSI catch was highly skewed (Figure 8), with many more females caught than males. In 2005–08, as the catch of younger fish increased, the sex bias has reversed with more males than females caught (Figure 8). In 2008, 41% of fish in the catch by numbers were females. However, there is still female bias in the catch from the WCSI at older ages. The observed proportion of males for fish aged 7 and older declined from about 0.4 in the late 1980s to less than 0.2 in 2003–04 to 2005–06, and was 0.22 in 2007–08 (Figure 8).

There were differences in the length frequencies from shed samples of fish caught inside the 25 n. mile line and at-sea samples of fish outside this area in 2008, with a higher proportion of larger fish (greater than 70 cm) from samples taken inside the line (Figure 9). This pattern has also been reported in data from previous years (Figure 9).

From 2004–07, there were differences between length distributions of hoki inside the line estimated from shed sampling and from samples collected by the OP on vessels fishing inside the line, with fewer small fish in shed samples (Figure 9). One potential explanation for these differences in length

frequencies inside the line is high-grading (dumping of small fish on non-observed vessels at sea, so these are not present in shed samples), but there was no other evidence for this. There were no tows collected by the OP on vessels fishing inside the line in 2008, so there were no data to compare with the length distribution from shed sampling.

There was a decrease in mean length of hoki from the WCSI over the first half of the 2008 spawning season (Figure 10). This 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 2006–08 (Figure 10).

Cook Strait

The length distribution of female hoki from Cook Strait in 2008 mainly ranged from 55 to 110 cm, while males were 50–90 cm (Figure 11). The catch of males was dominated by fish from the 2003–05 year-classes (ages 3–5), but there was a broader age distribution of females from ages 3 to 15 (Figure 12). The modal age was 4 (2004 year-class) for males, and age 5 (2003 year-class) for females (Figure 12). Fewer fish from the 2006 year-class (age 2) were caught in Cook Strait than in the other fisheries, and only 6% of the catch was fish less than 60 cm in 2008 (reduced from 8% in 2007), although 22% of the catch was fish less than 65 cm. The sex ratio of the Cook Strait catch has been skewed with more females than males from 2001 to 2005. From 2006 to 2008 the number of males increased and there were more males caught than females (55–60% males in the catches in 2006–2008). The mean length of hoki from Cook Strait in 2007–08 (73 cm) was the lowest in the history of the fishery.

Because of the problem of three large vessels sorting fish at sea first encountered in 2006 (Ballara et al. unpublished results), the 2007 and 2008 length frequencies (see Figure 11) and catch-at-age (Figure 12) were based on market samples for vessels under 40 m and observer data for vessels over 40 m (Table 9). Comparison of length frequencies in 2008 suggested that the size distribution of the catch was similar across all vessel classes (Figure 13), except for the fish landed in Wellington, which had fewer large fish; however there was only one sample for this port of landing.

The mean length of hoki from market samples decreased in July and through early August (Figure 14), and appeared to increase slightly in early September.

Puysegur

In 2007–08, only five samples were collected from Puysegur, all in November 2007 and only small fish were caught (Figure 15). Little can be concluded from this as the sample size was too small, and there were no samples during the spawning season.

East coast South Island

Four OP samples were collected from the ECSI during the 2008 spawning season. Fish sizes (Figure 16) were similar to those observed in the non-spawning fishery on the Chatham Rise.

2.2.2 Size and age composition in non-spawning fisheries

Chatham Rise

The length distribution of hoki from the Chatham Rise in 2008 ranged from 45 to 90 cm and was dominated by small hoki from the 2003–06 year-classes (ages 2–5), with few larger, older fish caught (Figures 17–18). About 67% of the catch by number was fish less than 70 cm, with 48% of the catch by number less than 65 cm, and 26% less than 60 cm. The modal age of both males and females was 3 (2004 year-class). More females than males were caught in 2007–08, with females making up 57% of the catch.

The OP data used to estimate catch-at-age was reasonably representative of the overall spatial and temporal distribution of the catch in 2007–08 (Figure 19). About 87% of OP data came from the hoki target fishery; 97% of otoliths came from the hoki target fishery (Figure 20). The tree-based regression split the OP data from the Chatham Rise fishery into three strata based on depth and longitude (Table 11). Mean length of hoki on the Chatham Rise was smaller in shallower water and on the north Chatham Rise.

Sub-Antarctic

The Sub-Antarctic catch consisted mainly of 60–90 cm fish from the 2002–06 year classes, with a mode at age 5 for both males and females (Figures 21–22). However, there was a higher proportion of larger older fish in the Sub-Antarctic than in other areas. The proportion of hoki greater than 80 cm has increased substantially from 2005–06 and these larger fish now make up nearly 49% of the catch. Only 9% of the catch was fish less than 60 cm. In 2007–08 males made up 43% of the estimated Sub-Antarctic catch, a reduction from 49–51% male in 2005–06 and 2006–07.

The OP sampling was not very representative of the overall spatial distribution of the catch (Figure 23), with very little sampling from January to August (see Table 8). The tree-based regression split the OP data from the Sub-Antarctic fishery into three strata based on latitude and longitude (Table 12). Smaller fish were found in the west and on the Snares Shelf. The number of OP samples collected from hoki target tows has decreased from 2000–01 to 2007–08 as the Sub-Antarctic fishery has become more of a bycatch fishery (Figure 24). In 2007–08 85% of the available otoliths came from target hoki tows and the rest from ling target tows. Length frequencies by target species showed that small hoki were more likely to be caught in fisheries targeting hoki, squid and ling, while fisheries targeting white warehou, or oreos in the Sub-Antarctic caught larger hoki (Figure 25).

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

In addition to the problems associated with whether observer coverage is representative of the catch (see above, and Figures 19 and 23), 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 3 fish on the spawning fisheries). As in previous years (e.g., Ballara et al. unpublished results), a rank sums test showed that the observers tended to select larger fish for extraction of otoliths from the Chatham Rise and Sub-Antarctic in 2007–08 (Figure 26). This introduces a bias into the age estimates which is difficult to correct. Improved training of observers is required to ensure that otoliths are taken randomly.

2.2.3 Comparison of size and age composition between main areas

Length distributions from the main fisheries in 2007–08 are compared in Figure 27. The catch was dominated by fish from 40 to 90 cm (2002–05 year-classes). A length mode at about 40–55 cm corresponding to the 2006 year class (2 year olds) was also observed in most areas, but was less apparent in Cook Strait. Larger fish, especially females, were caught in the Sub-Antarctic and Cook Strait. The percentage of small fish in the catch in 2007–08 was lower than in 2006–07 for all areas except for WCSI (Figure 28), although almost half of hoki on the Chatham Rise were less than 65 cm.

3. HOKI RESEARCH

3.1 Resource surveys

3.1.1 Trawl surveys

Chatham Rise

The eighteenth annual trawl survey of the Chatham Rise was completed between 27 December 2008 and 23 January 2009, with 108 stations used for biomass estimation. The total biomass of all hoki in 2009 increased by 87% from 2008 and was at a similar level to that in 1994 (Table 13). This overall increase was driven by an increase in the biomass estimate for recruited hoki (3+ years and older) from 37 200 t in 2008 to 53 700 t in 2009, along with a strong 2+ biomass (2006 year-class) and an average 1+ biomass (2007 year-class) estimates (Table 13).

Hoki size and age frequencies from the 2009 Chatham Rise survey were dominated by the 1+ mode at 34–48 cm, the 2+ mode at 48–62 cm, and the 3+ mode at 62–74 cm, with only a few older fish (Figures 29 and 30). There has been an increasing trend in mean length of hoki at age over the 1982–1997 year-classes (Livingston & Stevens 2005), and fish from the 2006 and 2007 year-classes were again relatively large at ages 2+ and 1+ respectively in 2009 (see Figure 29).

Sub-Antarctic

The twelfth survey in the *Tangaroa* summer trawl time series was carried out from 24 November to 22 December 2008, with 95 successful stations. Previous surveys in the summer series were in November–December 1991–93, and 2000–07. An autumn series has also been carried out in the same area in March–June 1992, 1993, 1996, and 1998. The abundance estimate of hoki in core 300– 800 m strata from the 2008 survey was 47 488 t (Table 14), very similar to the 2007 survey, confirming the large increase seen in the 2007 survey. The estimated biomass in 2008 was back to the levels observed in the 2001–02 surveys, but only about half the biomass seen in the early 1990s.

Hoki length frequencies in 2008 show a broad size range (Figure 31), with the number of hoki similar to that in the 2007 survey. Modes at 33–47 cm and 48–60 cm correspond to hoki from the 2007 and 2006 year-classes (Figure 32) and these small fish were caught mainly at Puysegur and on the Stewart-Snares shelf. Biomass estimates for 1+ and 2+ hoki were 948 t and 1563 t respectively, both of which were slightly lower than in 2007, and there were fewer 1+ and 2+ fish than seen in the 2003 and 2004 surveys. Modes from 60 to 90 cm consisted of fish from the 2002–05 year classes at ages 3–6, with ageing indicating a mode at age 6 (2002 year-class) for both males and females (Figure 32). A lot of larger older hoki were also present between 90 and 110 cm for females and 90 to 100 cm for males (see Figure 31), with a moderate showing of the 2000 year class at age 8, and the 1994 year class at age 14 in the females (Figure 32).

3.1.2 Acoustic surveys

Cook Strait

The 2008 acoustic survey of spawning hoki abundance in Cook Strait was carried out by NIWA on *Kaharoa* from 15 July to 25 August (O'Driscoll 2009). Seven snapshots were completed (Table 15) and 13 trawls were done for mark identification. Six snapshots were also completed by the industry vessel *Thomas Harrison*, although a transducer fault meant that data from this survey should not be included in the abundance index.

The acoustic abundance index for Cook Strait in 2008 using the most recent TS-L relationship of Macaulay (2006) was 167 000 t (Table 15), which was higher than in 2005 and 2006, but lower than the 2007 industry survey (Table 16). As in recent surveys, most of the hoki were concentrated in Cook Strait Canyon, with few hoki in the Narrows Basin. However, research trawl catch rates in the Narrows Basin were higher than in 2005 and 2006.

ECSI

Two acoustic snapshots to estimate spawning hoki abundance in Pegasus Canyon and Conway Trough were carried out by NIWA from *Kaharoa* on 14–16 August 2008 (O'Driscoll 2009). These areas were surveyed previously from an industry vessel in 2002 and 2003 and from *Kaharoa* in 2006. Results showed that Pegasus Canyon is still an important eastern spawning area, but it is difficult to compare results between years due to differences in survey timing (O'Driscoll 2009). An aggregation-based survey from the industry vessel *Rehua* suggested that more fish were present in Pegasus Canyon during September 2008 than were detected by the *Kaharoa* in August.

WCSI

Acoustic surveys were carried out on the WCSI from 1988 to 2000 but the series was discontinued because of uncertainty with mark composition north of Hokitika Canyon (e.g., Cordue 2002). There have been no research surveys in this area since, except for an acoustic survey of Hokitika Canyon from an industry vessel in 2003 (O'Driscoll et al. 2004a).

The industry vessel *Rehua* carried out an aggregation-based survey in four small areas in the Hokitika Canyon and to the north from 17 to 22 August 2008. However, the results added little to our understanding of distribution and abundance of hoki on the WCSI. The survey did not cover the full extent of the aggregations and only a small fraction of the total WCSI spawning area. The composition of hoki 'fuzz' in the north is still an issue.

4. CONCLUSIONS

The total reported hoki catch in 2007–08 was 89 328 t, just below the TACC of 90 000 t, 11 700 t less than in 2007–08, and the lowest total catch since 1985–86. Catches in 2007–08 decreased on the WCSI, Cook Strait, and Puysegur, were similar on the Chatham Rise, and increased on the ECSI, and Sub-Antarctic. For only the second time the WCSI was not the largest hoki fishery, with 37 909 t taken from the Chatham Rise. About 30 000 t of the catch was taken from western fisheries.

Length frequencies and catch-at-age results from the commercial fishery show that most of the catch in 2007–08 was fish from the 2002–06 year-classes. Widespread occurrence of young fish may indicate relatively good recent recruitment, or may be because there are fewer older fish remaining in the population. The largest average size of fish in 2007–08 was from the Sub-Antarctic. Survey indices suggest stable or increasing populations. Relative indices from the Chatham Rise trawl survey suggested the 2007 year-class is average and the 2006 year-class is above average.

5. ACKNOWLEDGMENTS

This work was funded by Ministry of Fisheries Research Projects MID2007/01, MID2007/01B, and

HOK2007/01B. It also incorporates results from MFish Projects HOK2007/02B and MDT2007/01B and industry-funded project DWG09301. Thanks to the many scientific and industry staff who contributed to the collection and analysis of data used in this report. We especially thank NIWA staff for otolith preparation, and Peter Horn and Niki Davey for their ageing work.

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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.

				New Zealand		
Year	U.S.S.R.	Japan	South Korea	Domestic	Chartered	Total
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 MFish 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 QMS, estimated catch (t) data[1], and TACC (t) for HOK 1 from 1986–1987 to 2007–08. Reported 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). Estimated catches from 2000–01 have been recalculated to exclude HOKET (hoki caught outside the EEZ).

Year	Reported catch	Estimated catch (MHR)		TACC
		Exclude HOKET	Include HOKET	
1986–87	158 171		175 000	250 000
1987–88	216 206		255 000	250 000
1988–89	208 500		210 000	250 000
1989–90	210 000		210 000	251 884
1990–91	215 000		210 000	201 897
1991–92	215 000		215 000	201 897
1992–93	195 000		215 000	202 155
1993–94	191 000		195 000	202 155
1994–95	174 000		190 000	220 350
1995–96	210 000		168 000	240 000
1996–97	246 000		194 000	250 000
1997–98	269 000		230 000	250 000
1998–99	244 500		234 000	250 000
1999–00	242 000		237 000	250 000
2000–01	224 618	229 858	229 858	250 000
2001–02	195 524	195 501	195 506	200 000
2002–03	180 092	184 660	184 668	200 000
2003–04	133 184	135 784	135 786	180 000
2004–05	102 057	104 364	106 189	100 000
2005-06	100 608	104 385	105 965	100 000
2006–07	97 713	101 010	102 861	100 000
2007–08	87 690	89 328	91 055	90 000

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 of Fisheries 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.

Table 3: Estimated total catch (t) of hoki by area[1], 1988–89 to 2007–08. 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).

	Spawning fisheries				Non-spawning fisheries					
Fishing Year	WCSI	Puysegur	Cook Strait	ECSI	Sub-Antarctic	Chatham Rise and ECSI	ECNI	WCNI	Unrep.	Total catch
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	90 113	2 964	46 469	2 103	24 323	75 645	2 604	-	92	244 527
1999–00	101 127	2 947	43 165	2 419	34 172	56 500	1 444	-	516	242 420
2000–01	100 561	6 944	36 641	2 429	30 384	50 494	2 104	-	115	229 858
2001–02	91 223	5 447	24 201	2 890	30 453	39 628	1 177	-	-	195 501
2002–03	73 925	6 014	36 650	7 148	20 146	39 212	944	6	40	184 660
2003–04	45 171	1 156	40 901	2 145	11 661	33 646	900	5	-	135 784
2004–05	33 057	5 520	24 766	3 262	6 226	30 722	534	2	56	104 364
2005–06	38 920	1 500	21 748	677	6 726	34 061	733	8	-	104 385
2006–07	33 122	437	20 138	997	7 668	37 892	711	13	-	101 010
2007–08	21 099	324	18 235	2 360	8 747	37 909	655	8	-	89 328

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 4a: Number of vessels, tows, and total catch inside and outside the 25 nautical mile line of the WCSI by year. Data source ungroomed non-zero TCEPR, TCER, and CELR data. Year defined as June to October. No October data in 2008. CELR data are assumed to all come from inside the 25 nautical mile line.

	Number of Vessels					Number of Tows				
Year	TCEPR Outside	TCER Outside	TCEPR inside	TCER Inside	CELR	TCEPR outside	TCER outside	TCEPR inside	TCER inside	CELR
1990	80	-	34	-	20	8 268	-	78	-	240
1991	76	-	37	-	22	8 497	-	62	-	314
1992	71	-	27	-	17	6 526	-	45	-	345
1993	64	-	20	-	19	7 307	-	104	-	544
1994	71	-	23	-	25	9 224	-	120	-	436
1995	65	-	37	-	25	8 541	-	182	-	386
1996	75	-	27	-	29	7 098	-	159	-	566
1997	90	-	45	-	22	8 255	-	469	-	700
1998	77	-	37	-	21	7 853	-	372	-	403
1999	63	-	35	-	17	6 931	-	271	-	668
2000	56	-	33	-	18	6 709	-	739	-	791
2001	61	-	47	-	16	7 018	-	1401	-	826
2002	50	-	38	-	14	6 542	-	1264	-	561
2003	47	-	34	-	6	6 693	-	845	-	677
2004	43	-	33	-	10	5 175	-	1296	-	747
2005	39	-	15	-	10	3 622	-	540	-	469
2006	35	-	20	-	6	3 949	-	209	-	352
2007	32	-	8	-	7	2 617	-	145	-	252
2008	25	5	12	9	-	2 320	18	44	131	-

								Catch (t)	Percent
Year	TCEPR Outside	TCER Outside	Total Outside	TCEPR Inside	TCER Inside	CELR	Total Inside	Total	inside
1990	144 350	-	144 350	1 222	-	448	1 670	146 020	1
1991	117 789	-	117 789	803	-	265	1 068	118 857	1
1992	93 831	-	93 831	664	-	197	861	94 692	1
1993	91 221	-	91 221	689	-	548	1 237	92 458	1
1994	107 519	-	107 519	1 023	-	753	1 776	109 295	2
1995	69 653	-	69 653	1 877	-	841	2 718	72 371	4
1996	60 963	-	60 963	2 509	-	2 060	4 569	65 532	7
1997	78 390	-	78 390	5 715	-	2 439	8 154	86 544	9
1998	91 724	-	91 724	5 422	-	2 712	8 134	99 858	8
1999	82 079	-	82 079	3 966	-	3 969	7 935	90 014	9
2000	86 603	-	86 603	9 667	-	4 775	14 442	101 045	14
2001	78 663	-	78 663	6 742	-	5 043	21 785	100 448	22
2002	69 486	-	69 486	7 936	-	4 224	22 160	91 646	24
2003	57 287	-	57 287	1 598	-	4 953	16 551	73 838	22
2004	26 343	-	26 343	3 927	-	4 885	18 812	45 155	42
2005	25 160	-	25 160	5 669	-	2 255	7 924	33 084	24
2006	33 639	-	33 639	2 741	-	2 485	5 226	38 865	13
2007	29 997	-	29 997	1 122	-	1 964	3 086	33 083	9
2008	19 962	32	19 994	368	567	-	935	20 929	4

Table 4b: Number of TCEPR, TCER and CELR Cook Strait tows, total catch, and number of vessels by year. Data source is ungroomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as June to October. No October data in 2008.

	Number of Vessels				Number of tows			
Year	TCEPR	TCER	CELR	Total	TCEPR	TCER	CELR	Total
1990	18	-	34	52	1 077	-	611	1 688
1991	22	-	42	64	2 095	-	1 511	3 606
1992	24	-	31	55	1 682	-	826	2 508
1993	20	-	31	51	1 552	-	961	2 513
1994	31	-	38	69	2 002	-	1 434	3 436
1995	30	-	31	61	2 531	-	1 231	3 762
1996	74	-	36	110	4 626	-	1 389	6 015
1997	73	-	30	103	4 895	-	1 023	5 918
1998	53	-	29	82	3 048	-	1 274	4 322
1999	42	-	28	70	2 641	-	894	3 535
2000	39	-	32	71	2 329	-	1 104	3 433
2001	36	-	27	63	1 958	-	971	2 929
2002	25	-	21	46	1 196	-	519	1 715
2003	30	-	25	55	1 904	-	988	2 892
2004	23	-	31	54	1 871	-	1 132	3 003
2005	21	-	16	37	1 423	-	475	1 898
2006	15	-	14	29	1 066	-	327	1 393
2007	14	3	16	33	1 002	6	494	1 502
2008	9	19	-	28	591	575	-	1 166

	Catch (t)			
Year	TCEPR	TCER	CELR	Total
1990	15 701	-	3 360	19 061
1991	25 082	-	7 938	33 020
1992	20 860	-	5 304	26 164
1993	18 401	-	4 388	22 789
1994	29 507	-	9 775	39 282
1995	30 745	-	8 327	39 072
1996	54 280	-	8 793	63 073
1997	51 630	-	6 777	58 407
1998	37 670	-	9 657	47 327
1999	34 611	-	6 387	40 998
2000	30 954	-	8 618	39 572
2001	24 631	-	8 180	32 811
2002	17 908	-	4 151	22 059
2003	27 231	-	7 242	34 473
2004	28 334	-	10 520	38 854
2005	18 758	-	4 431	23 189
2006	16 894	-	3 094	19 988
2007	12 693	-	5 407	18 100
2008	8 822	6 671	-	15 493

Table 4c: Number of Chatham Rise and ECSI vessels, tows and catch for all vessels by year for the non-spawning season. Data source is ungroomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as October to June. 'CELR' includes all fishing methods reported on the CELR form, and 'CELR trawl' includes midwater and bottom trawl tows only.

Fishing	Number of Vessels					Number of tows			
year	TCEPR	TCER	CELR trawl	CELR	Total	TCEPR	TCER	CELR trawl	Total
1989–90	45	-	23	35	80	2 839	-	527	3 366
1990–91	65	-	36	50	115	5 198	-	891	6 089
1991–92	72	-	27	41	113	7 894	-	540	8 434
1992–93	73	-	31	41	114	8 102	-	482	8 584
1993–94	71	-	26	39	110	6 079	-	522	6 601
1994–95	82	-	29	44	126	8 321	-	683	9 004
1995–96	108	-	26	39	147	9 954	-	395	10 349
1996–97	109	-	18	28	137	11 420	-	270	11 690
1997–98	111	-	18	28	139	14 719	-	193	14 912
1998–99	99	-	20	27	126	14 249	-	333	14 582
1999–00	72	-	16	27	99	12 559	-	278	12 837
2000–01	72	-	11	19	91	11 507	-	366	11 873
2001–02	65	-	13	19	84	9 582	-	285	9 867
2002–03	62	-	16	23	85	10 485	-	265	10 750
2003–04	58	-	12	21	79	8 126	-	222	8 348
2004–05	51	-	12	22	73	6 699	-	136	6 835
2005–06	53	-	14	23	76	6 523	-	142	6 665
2006–07	48	-	11	22	70	6 531	-	158	6 689
2007–08	45	11	-	13	69	6 259	63	-	6 322

Fishing	Catch (t)				
year	TCEPR	TCER	CELR trawl	CELR	Total
1989–90	15 690	-	91	101	15 791
1990–91	31 644	-	182	189	31 833
1991–92	47 992	-	100	104	48 096
1992–93	43 763	-	64	73	43 836
1993–94	22 779	-	68	80	22 859
1994–95	36 577	-	194	207	36 784
1995–96	46 271	-	66	84	46 355
1996–97	52 075	-	85	101	52 176
1997–98	73 084	-	34	58	73 142
1998–99	72 781	-	64	74	72 855
1999–00	53 455	-	86	90	53 545
2000–01	46 066	-	101	109	46 175
2001–02	35 835	-	18	27	35 862
2002–03	35 269	-	20	24	35 293
2003–04	25 569	-	14	17	25 586
2004–05	27 863	-	9	12	27 875
2005–06	31 652	-	7	11	31 663
2006–07	33 839	-	10	17	33 856
2007–08	33 534	5	-	6	33 545

Table 4d: Number of ECSI vessels, tows and catch for all vessels by year for the non-spawning season. Data source is ungroomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as June to October. 'CELR' includes all fishing methods reported on the CELR form, and 'CELR trawl' includes midwater and bottom trawl tows only. No data for October 2008.

Fishing	Number of Vessels					Number of tows			
year	TCEPR	TCER	CELR trawl	CELR	Total	TCEPR	TCER	CELR trawl	Total
1990	9	-	18	27	36	38	-	190	228
1991	11	-	15	28	39	149	-	185	334
1992	10	-	11	19	29	89	-	237	326
1993	10	-	12	21	31	44	-	315	359
1994	8	-	11	20	28	35	-	161	196
1995	17	-	10	24	41	64	-	98	162
1996	23	-	11	19	42	194	-	58	252
1997	22	-	6	14	36	177	-	140	317
1998	22	-	11	17	39	226	-	106	332
1999	21	-	9	15	36	142	-	146	288
1900	14	-	9	12	26	96	-	233	329
2001	19	-	9	15	34	209	-	268	477
2002	19	-	9	12	31	270	-	125	395
2003	25	-	10	13	38	558	-	217	775
2004	11	-	10	17	28	129	-	243	372
2005	11	-	3	9	20	237	-	69	306
2006	10	-	5	13	23	73	-	77	150
2007	10	-	4	11	21	107	-	26	133
2008	8	4	-	8	20	225	47	-	272

Fishing	Catch (t)				
year	TCEPR	TCER	CELR trawl	CELR	Total
1990	64	-	303	312	376
1991	972	-	563	567	1 539
1992	565	-	428	431	996
1993	167	-	181	184	351
1994	178	-	382	384	562
1995	256	-	122	125	381
1996	1 109	-	108	111	1 220
1997	815	-	1 003	1 007	1 822
1998	1 354	-	433	437	1 791
1999	736	-	1 440	1 444	2 180
1900	551	-	1 885	1 888	2 439
2001	1 714	-	771	779	2 493
2002	2 749	-	226	228	2 977
2003	6 295	-	1 007	1 009	7 304
2004	1 700	-	927	929	2 629
2005	3 502	-	51	54	3 556
2006	672	-	60	67	739
2007	963	-	62	65	1 028
2008	2 314	40	-	5	2 359

Table 4e: Number of Sub-Antarctic vessels, tows and catch for all vessels by year for the non-spawning season. Data source is ungroomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as October to June. 'CELR' includes all fishing methods reported on the CELR form, and 'CELR trawl' includes midwater and bottom trawl tows only.

Fishing	Number of Vessels					Number of tows			
year	TCEPR	TCER	CELR trawl	CELR	Total	TCEPR	TCER	CELR trawl	Total
1989–90	51	-	1	2	53	1 981	-	4	1 985
1990–91	48	-	2	2	50	3 618	-	4	3 622
1991–92	57	-	4	5	62	6 199	-	39	6 238
1992–93	54	-	1	2	56	5 552	-	1	5 553
1993–94	50	-	0	2	52	3 122	-	0	3 122
1994–95	57	-	0	2	59	3 328	-	0	3 328
1995–96	85	-	1	3	88	3 388	-	2	3 390
1996–97	85	-	0	3	88	4 258	-	0	4 258
1997–98	81	-	1	3	84	4 987	-	3	4 990
1998–99	66	-	0	0	66	4 565	-	0	4 565
1999–00	65	-	1	2	67	7 371	-	4	7 375
2000–01	63	-	0	2	65	6 744	-	0	6 744
2001–02	60	-	2	3	63	7 870	-	28	7 898
2002–03	51	-	2	3	54	5 519	-	8	5 527
2003–04	47	-	1	1	48	3 657	-	2	3 659
2004–05	43	-	0	1	44	2 383	-	0	2 383
2005–06	43	-	0	0	43	2 093	-	0	2 093
2006–07	37	-	0	3	40	2 347	-	0	2 347
2007–08	39	-	-	4	43	2 457	-	-	2 457

Fishing	Catch (t)				
year	TCEPR	TCER	CELR trawl	CELR	Total
1989–90	12 760	-	0	0	12 760
1990–91	16 080	-	0	0	16 080
1991–92	30 419	-	2	2	30 421
1992–93	24 055	-	0	0	24 055
1993–94	9 988	-	0	0	9 988
1994–95	13 846	-	0	0	13 846
1995–96	12 064	-	1	1	12 065
1996–97	18 926	-	0	0	18 926
1997–98	23 947	-	1	1	23 948
1998–99	22 327	-	0	0	22 327
1999–00	33 152	-	0	1	33 153
2000–01	27 734	-	0	0	27 734
2001–02	28 126	-	0	0	28 126
2002–03	19 430	-	1	1	19 431
2003–04	10 458	-	0	0	10 458
2004–05	5 713	-	0	0	5 713
2005–06	5 840	-	0	0	5 840
2006–07	5 562	-	0	0	5 562
2007–08	7 926	-	-	0	7 926

Table 4f: Number of Puysegur vessels, tows and catch for all vessels by year for the non-spawning season. Data source is ungroomed non-zero TCEPR, TCER, and CELR tows catching hoki. Year defined as June to December. 'CELR' includes all fishing methods reported on the CELR form, and 'CELR trawl' includes midwater and bottom trawl tows only. No October to December data in 2008.

Fishing	Number of Vessels					Number of tows			
year	TCEPR	TCER	CELR trawl	CELR	Total	TCEPR	TCER	CELR trawl	Total
1990	47	-	0	0	47	1 035	-	0	1 035
1991	41	-	0	0	41	800	-	0	800
1992	44	-	0	1	45	936	-	0	936
1993	27	-	2	2	29	393	-	10	403
1994	39	-	2	3	42	425	-	16	441
1995	29	-	2	2	31	337	-	6	343
1996	34	-	0	0	34	566	-	0	566
1997	48	-	0	0	48	812	-	0	812
1998	36	-	0	0	36	544	-	0	544
1999	32	-	1	1	33	538	-	3	541
1900	28	-	2	2	30	595	-	32	627
2001	40	-	1	1	41	877	-	8	885
2002	30	-	2	2	32	572	-	16	588
2003	37	-	1	1	38	510	-	10	520
2004	19	-	1	1	20	220	-	20	240
2005	25	-	1	1	26	443	-	12	455
2006	22	-	1	1	23	333	-	23	356
2007	15	-	2	3	18	197	-	21	218
2008	16	-	-	1	17	218	-	-	218

Fishing	Catch (t)				
year	TCEPR	TCER	CELR trawl	CELR	Total
1990	9 697	-	0	0	9 697
1991	5 518	-	0	0	5 518
1992	5 062	-	0	0	5 062
1993	2 139	-	0	0	2 139
1994	2 319	-	0	0	2 319
1995	1 228	-	0	0	1 228
1996	2 617	-	0	0	2 617
1997	5 931	-	0	0	5 931
1998	2 218	-	0	0	2 218
1999	2 938	-	4	4	2 942
1900	2 812	-	0	0	2 812
2001	6 709	-	1	1	6 710
2002	5 321	-	7	7	5 328
2003	5 886	-	16	16	5 902
2004	1 121	-	5	5	1 126
2005	5 498	-	0	0	5 498
2006	1 352	-	6	6	1 358
2007	398	-	9	9	407
2008	314	-	-	0	314

Table 5a: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all west coast South Island vessels by year. Year defined as June to October. No October data in 2008. Data are non-zero catches for TCEPR midwater tows.

All target species:

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	70	133 412	6 779	4.2	13.2	3.0
1991	67	107 027	6 741	4.0	11.4	2.7
1992	61	84 543	5 192	3.6	12.1	3.5
1993	57	78 232	5 262	3.2	10.8	3.8
1994	65	98 005	7 142	3.0	9.7	3.3
1995	59	64 994	6 678	3.5	5.6	1.6
1996	69	58 084	5 175	3.5	7.3	2.0
1997	84	78 611	6 732	3.8	7.7	2.1
1998	75	90 150	6 693	3.5	10.8	2.8
1999	61	72 299	5 252	3.1	10.6	3.3
2000	57	78 105	5 315	2.7	12.1	4.4
2001	65	76 965	5 878	2.6	9.1	3.4
2002	56	60 170	4 650	2.3	9.9	4.2
2003	54	51 813	4 315	3.0	8.1	2.4
2004	52	32 123	4 224	2.4	4.7	1.5
2005	38	20 043	2 364	2.5	5.3	1.9
2006	36	21 528	2 014	3.0	6.9	2.5
2007	31	20 940	1 427	3.5	9.3	3.5
2008	16	12 133	880	1.8	6.5	3.8
All years	251	1 239 176	92 713	3.3	9.2	2.7

Target hoki tows:

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	70	133 370	6 735	4.2	13.3	3.0
1991	67	106 890	6 724	4.0	11.4	2.7
1992	60	84 416	5 140	3.6	12.5	3.6
1993	56	77 818	5 029	3.1	10.8	4.1
1994	64	97 800	6 981	3.0	10.3	3.5
1995	59	64 531	6 420	3.5	5.6	1.7
1996	69	58 011	5 120	3.5	7.3	2.0
1997	84	78 176	6 624	3.8	8.2	2.1
1998	75	89 949	6 631	3.5	10.8	2.8
1999	61	72 057	5 138	3.0	10.6	3.4
2000	56	77 836	5 194	2.7	12.1	4.6
2001	65	76 619	5 724	2.6	9.5	3.6
2002	56	59 976	4 575	2.3	9.9	4.3
2003	54	51 528	4 212	3.0	8.1	2.5
2004	52	31 948	4 146	2.3	4.9	1.6
2005	38	19 980	2 265	2.3	5.9	2.0
2006	34	21 182	1 734	2.6	8.7	3.3
2007	31	20 633	1 131	2.7	15.0	5.6
2008	14	11 929	803	1.7	7.5	4.8
All years	251	1 234 649	90 326	3.2	9.7	2.9

Table 5b: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all west coast South Island vessels by year. Year defined as June to October. No October data in 2008. Data are non-zero catches for TCEPR bottom tows.

All target species tows:

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	42	12 161	1 284	4.0	4.1	1.1
1991	36	11 565	1 456	4.0	4.1	1.0
1992	38	9 954	1 037	4.1	4.4	1.0
1993	33	13 731	1 724	3.7	5.4	1.4
1994	32	10 541	1 467	4.3	4.1	0.9
1995	26	6 557	1 325	4.5	2.8	0.6
1996	41	5 357	1 594	4.7	2.2	0.4
1997	57	5 391	1 434	4.9	2.4	0.5
1998	43	6 169	1 257	5.2	3.2	0.5
1999	41	13 360	1 748	4.7	4.9	0.9
2000	37	17 712	2 057	4.5	6.0	1.2
2001	43	18 438	2 393	4.6	5.0	1.0
2002	35	27 254	3 000	5.0	5.3	1.0
2003	40	17 098	3 189	5.3	2.3	0.4
2004	36	8 176	2 150	6.0	1.5	0.3
2005	33	10 812	1 793	6.6	2.5	0.4
2006	26	14 872	2 129	8.4	2.9	0.4
2007	24	10 255	1 348	7.0	3.1	0.4
2008	18	8 197	1 469	9.0	2.5	0.3
All years	154	227 601	33 854	5.0	3.3	0.6

Target hoki tows:

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	11 979	1 127	4.2	5.3	1.4
1991	31	11 482	1 320	4.0	4.6	1.2
1992	28	9 759	791	4.0	7.5	1.8
1993	29	13 685	1 588	3.7	6.2	1.6
1994	29	10 516	1 370	4.3	4.6	1.0
1995	24	6 541	1 289	4.5	2.8	0.6
1996	41	5 327	1 552	4.7	2.2	0.5
1997	51	5 360	1 370	5.0	2.6	0.5
1998	39	6 129	1 221	5.3	3.2	0.6
1999	38	13 323	1 685	4.7	5.3	1.0
2000	34	17 641	1 907	4.4	6.3	1.4
2001	37	18 417	2 312	4.5	5.0	1.0
2002	34	26 986	2 840	5.0	5.9	1.1
2003	40	16 831	2 790	5.1	3.0	0.6
2004	35	7 914	1 801	5.7	2.0	0.4
2005	28	9 826	1 238	5.6	4.6	0.8
2006	24	13 215	1 404	7.0	5.1	0.8
2007	21	8 879	735	4.8	9.0	1.7
2008	13	5 266	482	4.8	8.7	1.7
All years	139	219 075	28 822	4.7	4.2	0.9

Table 5c: 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. No October data in 2008. Data are non-zero catches for TCEPR midwater tows.

All target species tows:

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	15 414	1 052	1.2	11.9	10.7
1991	22	24 953	2 076	1.5	9.3	5.8
1992	22	20 635	1 645	1.2	8.8	7.3
1993	20	18 150	1 518	1.0	8.7	7.9
1994	28	27 569	1 827	1.0	12.8	13.9
1995	27	27 696	2 162	0.8	9.5	14.5
1996	53	45 461	3 110	0.5	12.0	21.4
1997	50	43 957	3 478	0.7	11.0	14.9
1998	47	32 307	2 413	0.8	11.9	13.0
1999	34	29 237	2 065	0.7	12.7	16.1
2000	27	28 177	1 984	0.5	12.1	21.7
2001	31	23 811	1 836	0.6	11.1	16.2
2002	17	17 255	1 065	0.6	15.1	24.6
2003	22	26 911	1 809	0.5	12.6	21.7
2004	22	27 598	1 790	0.7	12.2	17.4
2005	13	18 324	1 338	0.6	13.1	22.0
2006	13	16 575	1 013	0.5	15.4	26.3
2007	9	12 428	949	0.6	11.0	17.4
2008	7	7 246	372	0.6	19.2	31.4
All years	120	463 702	33 502	0.8	11.4	14.5

Target hoki tows:

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	15 414	1 052	1.2	tow	10.7
1991	22	24 953	2 076	1.5	11.9	5.8
1992	22	20 635	1 645	1.2	9.3	7.3
1993	18	18 128	1 512	1.0	8.8	8.0
1994	28	27 524	1 821	1.0	8.9	14.1
1995	27	27 633	2 158	0.8	12.8	14.5
1996	52	45 379	3 098	0.5	9.5	21.6
1997	49	43 928	3 473	0.7	12.2	14.9
1998	45	32 267	2 409	0.8	11.0	13.0
1999	34	29 234	2 064	0.7	11.9	16.1
2000	26	28 176	1 983	0.5	12.7	21.8
2001	31	23 783	1 833	0.6	12.1	16.2
2002	17	17 255	1 065	0.6	11.1	24.6
2003	22	26 910	1 807	0.5	15.1	21.7
2004	22	27 598	1 788	0.7	12.6	17.4
2005	13	18 320	1 337	0.6	12.2	22.0
2006	13	16 575	1 012	0.5	13.2	26.4
2007	9	12 380	946	0.6	15.4	17.4
2008	6	7 243	365	0.5	11.0	32.9
All years	117	463 335	33 444	0.8	11.4	14.5

Table 5d: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for all Chatham Rise and ECSI vessels by year. Year defined as October to June. Data are non-zero catches for TCEPR bottom tows.

All target species tows:

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	44	15 589	2 801	4.0	2.7	0.7
1991	56	18 708	4 288	4.0	2.6	0.7
1992	68	43 629	7 481	4.0	3.3	1.0
1993	59	38 873	7 107	3.8	3.8	1.1
1994	61	18 469	5 025	3.5	2.3	0.8
1995	65	28 014	6 464	3.6	3.3	1.0
1996	85	35 174	8 002	3.5	3.4	1.0
1997	102	39 695	9 298	3.6	3.3	1.0
1998	96	51 887	11 180	4.0	3.5	0.9
1999	89	61 532	11 944	4.0	4.2	1.1
2000	62	42 542	9 949	4.1	3.1	0.8
2001	64	43 022	10 592	4.5	3.0	0.7
2002	60	33 054	8 729	4.4	3.0	0.7
2003	62	33 785	10 022	4.7	2.4	0.5
2004	58	24 213	7 817	4.8	2.0	0.5
2005	50	26 387	6 342	5.0	2.8	0.6
2006	51	31 024	6 379	4.7	3.6	0.8
2007	47	33 663	6 473	4.4	3.6	0.8
2008	41	33 035	6 139	4.8	3.6	0.8
All years	217	652 294	146 032	4.0	3.1	0.8

Target hoki tows:

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	26	14 437	1 709	4.0	5.3	1.4
1991	38	17 603	3 091	4.0	3.9	1.1
1992	44	42 617	5 072	3.7	6.2	1.7
1993	38	38 112	4 957	3.5	5.9	1.7
1994	32	17 876	3 196	3.1	4.6	1.5
1995	35	27 554	5 160	3.4	4.5	1.3
1996	55	34 780	6 788	3.3	3.9	1.2
1997	77	39 220	8 057	3.5	3.9	1.1
1998	69	51 494	9 999	4.0	4.3	1.1
1999	51	61 055	10 769	4.0	4.8	1.2
2000	36	42 078	8 784	4.0	4.0	1.0
2001	42	41 930	9 022	4.4	3.7	0.8
2002	33	32 012	7 169	4.4	3.5	0.8
2003	31	32 662	8 409	4.7	2.9	0.6
2004	27	22 927	5 922	4.8	2.8	0.6
2005	21	25 263	4 595	5.0	4.1	0.8
2006	19	29 491	4 532	4.8	5.1	1.0
2007	20	31 194	4 296	4.3	5.7	1.2
2008	22	29 600	3 708	4.7	6.5	1.4
All years	172	631 906	115 235	4.0	4.1	1.0

Table 5e: 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. No October data in 2008.

All target species midwater tows:

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	15	317	104	2.3	2.0	0.9
2001	15	399	77	2.6	3.5	1.2
2002	16	852	125	2.6	4.0	1.8
2003	15	1 879	243	2.8	5.1	1.9
2004	10	318	57	3.3	3.5	1.0
2005	10	607	79	2.5	3.3	1.4
2006	4	221	42	2.7	3.4	1.6
2007	11	675	81	2.2	6.2	2.8
2008	11	2 071	211	2.7	7.5	2.6

Target hoki midwater tows:

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	10	316	95	2.4	2.2	1.0
2001	13	398	75	2.5	3.5	1.2
2002	11	844	119	2.6	4.2	1.9
2003	13	1 821	234	2.8	5.2	1.9
2004	5	317	52	3.5	3.8	1.1
2005	7	604	75	2.5	4.1	1.5
2006	4	183	39	2.7	3.1	1.6
2007	6	650	67	2.3	8.3	3.3
2008	9	1 887	178	2.9	9.2	2.9

All target species bottom tows:

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	9	292	25	2.7	6.0	2.3
2001	15	1 273	123	2.4	6.1	2.2
2002	12	1 873	131	2.3	11.9	5.8
2003	20	4 346	314	2.0	11.7	4.8
2004	5	1 054	57	2.1	12.2	6.6
2005	7	3 086	161	1.8	15.2	10.9
2006	6	685	62	1.9	8.0	3.1
2007	3	317	26	1.2	10.3	8.1
2008	4	275	33	2.9	7.1	2.8

Target hoki bottom tows:

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	9	292	25	2.7	6.0	2.3
2001	15	1 273	123	2.4	6.1	2.2
2002	11	1 873	130	2.4	11.9	5.8
2003	19	4 313	311	2.0	12.1	4.8
2004	5	1 054	57	2.1	12.2	6.6
2005	7	3 086	161	1.8	15.2	10.9
2006	6	677	61	1.8	7.9	3.1
2007	3	317	26	1.2	10.3	8.1
2008	4	226	27	3.7	7.6	2.7

Table 5f: Number of tows, vessels, median tow duration, catch per tow, and catch per hour for Sub-Antarctic vessels by year. Year defined as October to June. Data are non-zero TCEPR catches for bottom 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)
1989–90	31	12 597	1 818	3.7	4.0	1.1
1990–91	34	15 780	3 476	4.0	3.2	0.7
1991–92	49	29 385	6 111	4.2	3.3	0.9
1992–93	33	21 416	5 087	3.9	3.2	0.9
1993–94	40	8 478	2 754	4.2	1.6	0.4
1994–95	39	12 970	3 074	4.4	2.8	0.7
1995–96	61	10 331	2 962	4.1	2.2	0.5
1996–97	72	17 644	3 954	4.5	3.3	0.7
1997–98	61	22 916	4 780	4.3	3.3	0.9
1998–99	49	19 516	4 064	4.5	3.2	0.8
1999–00	52	30 871	6 854	4.2	3.0	0.8
2000–01	54	24 007	6 115	4.5	2.7	0.7
2001–02	52	27 513	7 561	4.5	2.2	0.6
2002–03	48	19 127	5 420	4.9	2.4	0.5
2003–04	42	10 245	3 558	5.0	2.0	0.4
2004–05	38	5 533	2 294	5.3	1.0	0.2
2005–06	37	5 615	2 025	5.3	0.6	0.1
2006–07	30	5 380	2 276	5.5	0.6	0.1
2007–08	33	7 232	2 352	5.5	1.0	0.2
All years	187	306 557	76 535	4.4	2.5	0.6

Hoki target 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)
1989–90	17	12 049	1 429	3.7	6.4	1.7
1990–91	24	15 452	3 139	4.1	3.5	0.8
1991–92	27	28 303	4 853	4.1	4.4	1.1
1992–93	23	20 698	4 394	3.8	3.8	1.0
1993–94	18	8 208	1 615	3.8	3.5	1.1
1994–95	23	12 676	2 175	4.0	4.5	1.1
1995–96	32	10 093	2 062	3.9	3.4	1.0
1996–97	51	17 315	2 805	4.2	5.1	1.2
1997–98	41	22 492	3 898	4.2	4.3	1.1
1998–99	34	19 040	3 174	4.2	4.2	1.1
1999–00	34	30 245	5 635	4.0	4.0	1.0
2000–01	34	23 178	4 872	4.3	3.5	0.9
2001–02	37	26 614	5 821	4.3	3.0	0.8
2002–03	34	18 358	4 196	4.8	3.0	0.7
2003–04	26	9 896	2 710	4.9	2.8	0.6
2004–05	25	4 915	1 289	5.1	2.5	0.5
2005–06	16	4 162	615	4.8	4.1	0.8
2006–07	20	3 678	843	4.7	2.2	0.5
2007–08	14	5 147	788	4.8	4.5	0.9
All years	125	292 518	56 313	4.2	3.8	0.9

Table 5g 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 ungroomed midwater or bottom non-zero TCEPR tows catching hoki. Year defined as June to December. No October to December data in 2008.

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	26	9 377	765	2.5	10.3	4.1
1991	16	3 608	269	2.4	11.6	4.6
1992	14	1 122	142	3.0	5.5	2.1
1993	8	691	71	1.7	6.5	3.4
1994	17	2 139	268	3.0	4.1	1.2
1995	15	867	116	2.5	3.4	1.7
1996	14	1 546	155	2.7	7.7	3.4
1997	23	4 763	411	3.5	8.8	2.5
1998	8	939	97	2.9	8.5	2.5
1999	17	1 435	141	3.4	4.9	1.1
1900	14	2 088	161	4.3	8.1	2.1
2001	24	5 278	373	4.3	10.1	2.2
2002	20	3 178	262	3.6	6.8	1.8
2003	22	5 167	309	2.7	12.2	3.7
2004	4	574	33	3.7	12.2	2.9
2005	10	4 989	217	2.1	22.3	10.1
2006	4	240	16	2.8	15.1	5.0
2007	1	43	1	-	-	-
2008	1	61	2	-	-	-
All years	112	48 105	3 809	2.9	8.6	2.9

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	26	9 371	764	2.5	10.4	4.1
1991	16	3 592	268	2.4	11.6	4.6
1992	13	1 089	130	3.0	5.5	2.1
1993	8	691	71	1.7	6.5	3.4
1994	17	2 116	266	3.0	4.1	1.2
1995	15	867	116	2.5	3.4	1.7
1996	14	1 546	155	2.7	7.7	3.4
1997	23	4 763	411	3.5	8.8	2.5
1998	8	939	97	2.9	8.5	2.5
1999	17	1 435	141	3.4	4.9	1.1
1900	14	2 088	161	4.3	8.1	2.1
2001	24	5 271	372	4.3	10.1	2.2
2002	20	3 178	262	3.6	6.8	1.8
2003	22	5 167	309	2.7	12.2	3.7
2004	3	572	29	3.5	13.2	5.1
2005	9	4 984	215	2.1	22.3	10.4
2006	4	240	16	2.8	15.1	5.0
2007	1	43	1	-	-	-
2008	1	61	2	-	-	-
All years	110	48 011	3 786	2.9	8.7	3.0

Table 6: Percentage observer coverage 2007–08 for hoki target tows by area, BT, BPT, MW, MPT trawl methods only.

2007–08 target hoki tows

Number of vessels

Area	TCEPR	TCER	Total	Observed	Percent observed
Chatham Rise	25	6	31	10	32.3
Cook Strait	5	14	19	6	31.6
ECNI	8	8	15	0	0.0
ECSI	9	5	14	3	21.4
Null	0	2	2	0	0.0
Puysegur	2	0	2	0	0.0
Subantarctic	17	0	17	5	29.4
WCNI	0	2	2	0	0.0
WCSI	23	8	31	10	32.3
Total	39	22	60	23	38.3

Number of tows

Area	TCEPR	TCER	Total	Observed	Percent observed
Chatham Rise	4 142	9	4 151	336	8.1
Cook Strait	1 199	538	1 737	100	5.8
ECNI	143	41	184	0	0.0
ECSI	325	11	336	12	3.6
Null	0	2	2	0	0.0
Puysegur	11	0	11	0	0.0
Subantarctic	964	0	964	153	15.9
WCNI	0	2	2	0	0.0
WCSI	1 307	85	1 392	210	15.1
Total	8 091	688	8 779	811	9.2

Catch (tonnes)

Area	TCEPR	TCER	Total	Observed	Percent observed
Chatham Rise	33 483	64	33 547	3 022	9.0
Cook Strait	11 655	6 470	18 126	2 100	11.6
ECNI	330	26	356	0	0.0
ECSI	2 533	58	2 591	57	2.2
Null	0	51	51	0	0.0
Puysegur	83	0	83	0	0.0
Subantarctic	6 393	0	6 393	1 315	20.6
WCNI	0	26	26	0	0.0
WCSI	17 186	644	17 829	5 098	28.6
Total	71 663	7 340	79 003	11 593	14.7

Table 7: Bycatch rates on vessels with Observer Programme observers in the hoki fishery (tows targeting hoki) from 1993–94 to 2007–08. The WCSI, Cook Strait, and ECSI data cover the spawning season (June–September) only.

		Catch in t (% of hoki catch)									
		Hoki		Hake		Ling		Silver warehou		Spiny dogfish	
WCSI	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	17 703	1 407	(7.9)	278	(1.6)	472	(2.7)	315	(1.8)	
	1996–97	14 192	647	(4.6)	129	(0.9)	421	(3.0)	59	(0.4)	
	1997–98	18 655	1 077	(5.8)	327	(1.8)	445	(2.4)	245	(1.3)	
	1998–99	17 412	1 026	(5.9)	290	(1.7)	220	(1.3)	218	(1.3)	
	1999–00	18 570	1 081	(5.8)	290	(1.6)	375	(2.0)	110	(0.6)	
	2000–01	16 285	514	(3.2)	259	(1.6)	273	(1.7)	82	(0.5)	
	2001–02	16 657	1 460	(8.8)	512	(3.1)	114	(0.7)	119	(0.7)	
	2002–03	10 188	529	(5.2)	190	(1.9)	96	(0.9)	41	(0.4)	
	2003–04	8 416	816	(9.7)	506	(6.0)	269	(3.2)	51	(0.6)	
	2004–05	7 178	334	(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	9 740	112	(1.2)	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)	
Cook Strait	1993–94	495	-		6	(1.3)	-		1	(0.2)	
	1994–95	-	-		-		-		-		
	1995–96	734	-		2	(0.3)	-		13	(1.8)	
	1996–97	-	-		-		-		-		
	1997–98	3 461	-		7	(0.2)	-		55	(1.6)	
	1998–99	4 881	-		19	(0.4)	-		97	(2.0)	
	1999–00	3 243	-		10	(0.3)	-		106	(3.3)	
	2000–01	4 361	-		16	(0.4)	-		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	(1.5)	
	2004–05	2 207	-		5	(0.2)	-		38	(1.7)	
	2005–06	1 080	-		2	(0.2)	-		15	(1.4)	
	2006–07	2 298	-		12	(0.5)	-		85	(3.7)	
	2007–08	3 438	-		8	(0.2)	-		63	(1.8)	
Puysegur	1993–94	946	-		8	(0.8)	7	(0.8)	6	(0.6)	
	1994–95	226	-		8	(3.7)	-		-		
	1995–96	719	2	(0.2)	33	(4.6)	3	(0.5)	2	(0.3)	
	1996–97	545	-		8	(1.5)	4	(0.8)	3	(0.6)	
	1997–98	-	-		-		-		-		
	1998–99	226	4	(1.9)	25	(10.9)	6	(2.4)	9	(4.0)	
	1999–00	562	-		26	(4.7)	26	(4.6)	7	(1.3)	
	2000–01	997	6	(0.6)	35	(3.5)	249	(25.0)	16	(1.6)	
	2001–02	572	-		20	(3.6)	44	(7.7)	1	(0.2)	
	2002–03	684	2	(0.3)	54	(7.9)	26	(3.8)	2	(0.3)	
	2003–04	562	-		33	(5.8)	14	(2.5)	2	(0.3)	
	2004–05	1 237	1	(0.1)	20	(1.6)	1	(0.1)	11	(0.9)	
	2005–06	478	3	(0.5)	105	(22.0)	26	(5.5)	1	(0.2)	
	2006–07	10	0	(0.2)	4	(38.5)	0	(0.6)	0	(0.5)	

-, less than 0.1 t (except for Cook Strait 1994–95 and 1996–97, Puysegur 1997–98 and 2007–08, and ECSI 1994–95 and 1996–97 for which there are no observer data)

Table 7: continued.

		Catch in t (% of hoki catch)				
		Hoki	Hake	Ling	Silver warehou	Spiny dogfish
Sub-Antarctic	1993–94	1 941	226 (11.6)	171 (8.8)	11 (0.6)	15 (0.8)
	1994–95	882	24 (2.7)	64 (7.2)	-	15 (1.7)
	1995–96	1 080	32 (3.0)	146 (13.5)	8 (0.8)	6 (0.6)
	1996–97	717	10 (1.4)	25 (3.4)	1 (0.1)	-
	1997–98	1 893	127 (6.7)	190 (10.0)	3 (0.2)	20 (1.1)
	1998–99	4 784	134 (2.8)	257 (5.4)	26 (0.6)	20 (0.4)
	1999–00	5 470	213 (3.9)	340 (6.2)	62 (3.0)	47 (0.9)
	2000–01	4 302	99 (2.3)	439 (10.2)	38 (5.5)	58 (1.4)
	2001–02	3 908	154 (3.9)	194 (5.0)	35 (0.9)	97 (2.5)
	2002–03	2 032	83 (4.1)	373 (18.4)	22 (1.1)	81 (4.0)
	2003–04	781	37 (4.7)	326 (41.8)	54 (6.9)	171 (22.0)
	2004–05	391	24 (6.1)	189 (48.3)	5 (1.2)	6 (1.5)
	2005–06	1 172	14 (1.2)	118 (10.1)	68 (5.8)	63 (5.4)
	2006–07	1 225	16 (1.3)	225 (18.4)	82 (6.7)	85 (6.9)
	2007–08	3 105	101 (3.2)	1 004 (32.3)	13 (0.4)	30 (1.0)
Chatham Rise*	1993–94	4 868	162 (3.3)	125 (2.6)	16 (0.3)	18 (0.4)
	1994–95	2 156	36 (1.6)	75 (3.5)	22 (1.0)	14 (0.7)
	1995–96	5 331	136 (2.5)	146 (2.7)	128 (2.4)	49 (0.9)
	1996–97	1 774	112 (6.3)	75 (4.2)	116 (6.6)	10 (0.6)
	1997–98	8 997	212 (2.4)	24 (2.7)	92 (1.0)	73 (0.8)
	1998–99	8 043	100 (1.2)	281 (3.5)	93 (1.2)	132 (1.6)
	1999–00	3 882	64 (1.7)	116 (3.0)	129 (3.3)	137 (3.5)
	2000–01	5 493	144 (2.6)	263 (4.8)	221 (4.0)	97 (1.8)
	2001–02	4 644	95 (2.0)	223 (4.8)	50 (1.1)	121 (2.6)
	2002–03	2 381	69 (2.9)	211 (8.9)	140 (5.9)	48 (2.0)
	2003–04	2 461	52 (2.1)	157 (6.4)	245 (10.0)	58 (2.3)
	2004–05	4 996	53 (1.1)	180 (3.6)	133 (2.7)	106 (2.1)
	2005–06	5 182	49 (0.9)	132 (2.5)	260 (5.0)	93 (1.8)
	2006–07	5 535	80 (1.5)	155 (2.8)	195 (3.5)	39 (0.7)
	2007–08	5 532	77 (1.4)	120 (2.2)	149 (2.7)	74 (1.3)
ECSI						
	2000–01†	5	- (0.5)	- (0.1)	-	-
	2001–02†	134	1 (0.8)	3 (2.4)	3 (2.2)	1 (0.7)
	2002–03	939	22 (2.4)	9 (0.9)	21 (2.2)	6 (0.6)
	2003–04	940	2 (0.3)	4 (0.5)	4 (0.4)	1 (0.1)
	2004–05	458	1 (0.2)	2 (0.5)	1 (0.2)	1 (0.2)
	2005–06	567	6 (1.0)	2 (0.3)	36 (6.3)	1 (0.2)
	2007–08	2903	3 (0.9)	6 (1.9)	6 0.2)	1 (0.3)

-, less than 0.1 t (except for Cook Strait 1994–95 and 1996–97, Puysegur 1997–98 and 2007–08, and ECSI 1994–95, 1996–97 and 2006–07 for which there are no observer data)
* Chatham Rise excludes the ECSI during the spawning season (June-September)
† Bycatch rates not calculated where observed hoki catch less than 100 t

Table 8: Number of 2007–08 hoki length frequencies and otoliths by observer trips, target species, and monthly timing.

(a) WCSI observer samples

Trip	Month	Target species	Number of Length frequencies	Number of Otoliths
1	Jun-Jul	HOK	4	8
2	Jun-Jul	HOK	44	135
3	Jul	HOK	15	40
4	Jul	HOK	23	70
5	Jul-Aug	HOK	40	108
6	Jul-Aug	HOK	31	78
7	Jul-Aug	HOK(29), JMA(1)	30	78
8	Aug	HAK(7), HOK(1)	8	11
9	Aug	HAK(1), HOK(7)	8	21
10	Aug	HOK	9	14
11	Aug-Sep	HOK	11	34
12	Aug-Sep	HAK(3), HOK(2)	5	11
13	Aug-Sep	HAK(1), HOK(3)	4	4
14	Aug-Sep	HAK	2	-
15	Aug-Sep	HAK	6	12
16	Sep	HAK	3	-
17	Sep	HAK	2	-
Total			245	748

1. 124 otoliths from market samples

(b) Chatham Rise and ECSI observer data

Trip	Month	Target species	Number of Length frequencies	Number of Otoliths
1	Oct	HOK	12	28
2	Oct	HOK	15	43
3	Nov	HOK	12	48
4	Nov	BOE(1), ORH(3)	4	2
5	Nov	SCI	4	-
6	Nov-Dec	HOK	35	126
7	Nov-Dec	SCI	6	-
8	Dec-Jan	ORH	8	3
9	Jan-Mar	HOK	41	193
10	Feb	HOK	10	47
11	Mar	SSO	1	2
12	Mar	HOK	7	23
13	Apr-May	ORH	8	-
14	Apr-May	HOK	67	213
15	Apr-May	HOK	9	16
16	May	SCI	8	-
17	May	HOK	14	37
18	May-Jun	HOK	71	265
19	May-Jun	HOK	9	17
20	Aug-Sep	HOK	7	20
21	Aug-Sep	HOK	7	10
22	Sep	HAK(4), LIN(2), SWA(2)	8	14
23	Sep	HOK	28	94
24	Sep	HAK	1	-
25	Sep	HAK(2), HOK(4)	6	18
Total			398	1219

(c) Subantarctic 2007–08 observer data

Trip	Month	Target species	Length frequencies	Number of Otoliths
1	Oct	HOK(21), LIN(1)	22	183
2	Oct	HOK(11), LIN(6)	17	144
3	Oct-Nov	HOK	24	69
4	Oct-Nov	LIN	17	50
5	Oct-Nov	HOK(47), LIN(1)	48	282
6	Nov	SCI	5	-
7	Dec	LIN(13), WWA(3)	16	75
8	Jan	LIN	1	5
9	Feb	SQU	1	-
10	Feb	SQU	2	-
11	Feb-Mar	HOK	34	284
12	Feb-Mar	SQU	3	-
13	Mar	SQU	1	-
14	Apr	SQU	1	-
15	Apr	OEO	1	-
16	Jun	HOK	1	9
17	Sep	HOK(15), LIN(1)	16	121
Total			210	1222

Table 9: Number of market landings sampled and observer tows for the same area by month and vessel size category for the 2008 sampling season.

(a) WCSI inside the 25 n.mile line

		Month				Total
Data set		Jun	Jul	Aug	Sep	
Market landings	Vessel length < 40 m	-	6	1	-	7
Observer tows	Vessel length > 40 m	-	-	-	-	-

(b) Cook Strait

		Month				Total
Data set	Stratum	Jun	Jul	Aug	Sep	
Market samples	Wellington	-	-	1	-	1
	Nelson/Picton vessel <30 m	-	9	17	2	28
	Nelson/Picton vessel 30-40m	-	-	3	-	3
Observer tows	Nelson/Picton vessel >40 m	9	20	48	23	100

Table 10: Percentage of female hoki by observer stages on the WCSI for female fish less than and equal to 55 cm (n = 422) and female fish greater than 55 cm (n = 7 938) for the 2008 spawning season.

	Females ≤ 55 cm	Females > 55 cm
Immature and resting	20.4	3.6
Ripening	76.3	66.0
Ripe	3.1	18.9
Running ripe	0.2	3.5
Spent	0	8.0

Table 11: Strata for the Chatham Rise fishery in 2007–08 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.

	Splitting variables		Mean length	Hoki catch (t)		No. of tows sampled			No. of fish	
Stratum	latitude	depth	(cm)	TCEPR	OP	TCEPR	OP	Otoliths	Measured	Aged
1	north of 43.93° S	depth < 650	64	22 078	1 055	4 376	201	176	20 637	575
2	north of 43.93° S	depth < 650	68	11 814	463	1 671	129	123	15 145	467
3		depth ≥ 650	76	29 41	589	919	64	45	4 898	168

Table 12: Strata for the Sub-Antarctic fishery in 2007–08 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.

	Splitting variables		Mean length	Hoki catch (t)		No. of tows sampled			No. of fish	
Stratum	latitude	longitude	(cm)	TCEPR	OP	TCEPR	OP	Otoliths	Measured	Aged
1		west of 167°	74	2 884	796	1311	108	82	11 039	647
2	north of 48.99° S	east of 167°	76	2 835	465	561	40	35	43 07	292
3	south of 48.99° S	east of 167°	86	2 830	243	858	61	31	55 39	227

Table 13: Relative biomass estimates of hoki on the Chatham Rise from *Tangaroa* trawl surveys, January 1992–2009. The c.v. is the coefficient of variation as % (in parentheses).

	1+ hoki			2+ hoki			3++ hoki		Total hoki	
Survey	Year-class	'000 t	c.v	Year-class	'000 t	c.v	'000 t	c.v	'000 t	c.v
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)

Table 14: Relative biomass estimates of hoki in core 300–800 m strata from Sub-Antarctic *Tangaroa* trawl surveys. c.v. is the coefficient of variation as % (in parentheses).

Survey	Total hoki	
Summer series	'000 t	c.v.
1991	80.3	(7)
1992	87.4	(6)
1993	99.7	(9)
2000	55.7	(13)
2001	38.1	(16)
2002	39.9	(14)
2003	14.3	(13)
2004	17.6	(11)
2005	20.4	(13)
2006	14.8	(11)
2007	46.0	(16)
2008	47.5	(14)
Autumn series		
1992	67.8	(8)
1993	53.5	(10)
1996	89.0	(9)
1998	67.7	(11)

Table 15: Acoustic biomass estimates by snapshot and stratum for the 2008 Cook Strait from *Kaharoa* (from O'Driscoll 2009). c.v. is the coefficient of variation. Stratum names: 1, Narrows Basin; 2, Cook Strait Canyon; 3, Nicholson Canyon; 5A, Cook Strait Canyon extension; 5B, deepwater outside Nicholson and Wairarapa Canyons; 6, Terawhiti Sill.

		Stratum						Biomass	
Snapshot	Dates	1	2	3	5A	5B	6	('000 t)	c.v.
1	17–19Jul	14	83	9	28	31	3	169	19
2	28–29 Jul	33	64	14	20	37	12	180	17
3	31 Jul – 2 Aug	19	79	2	10	10	3	124	20
4	5–7 Aug	31	101	2	21	16	3	174	18
5	10–11 Aug	26	128	2	11	12	1	180	32
6	17–18 Aug	16*	75	4	16	24	5	140	29
7	20–21 Aug	16	130	3	22	27	2	201	24
mean		22	94	5	18	23	4	167	9

* Stratum 1 was not surveyed during snapshot 6 because of rapidly deteriorating weather conditions.

Table 16: Acoustic indices of hoki abundance for Cook Strait 1988–2008 (from O'Driscoll 2009). Indices normalised to the series mean (273 000 t). c.v. is the assessment model weighting and includes uncertainty due survey timing, sampling precision, acoustic detectability, mark identification, calibration, and target strength.

Year	Biomass ('000 t)	Normalised abundance index	No of snapshots	c.v.
1991	180	0.66	4	0.41
1993	583	2.13	4	0.52
1994	592	2.16	3	0.91
1995	427	1.56	4	0.61
1996	202	0.74	5	0.57
1997	295	1.08	6	0.40
1998	170	0.62	5	0.44
1999	243	0.89	6	0.36
2001	220	0.80	11	0.30
2002	320	1.17	9	0.35
2003	225	0.82	9	0.34
2005	132	0.48	9	0.32
2006	126	0.46	7	0.34
2007			4	
*	216	0.79		0.46
2008	167	0.61	7	0.30

* Industry survey from FV *Thomas Harrison*

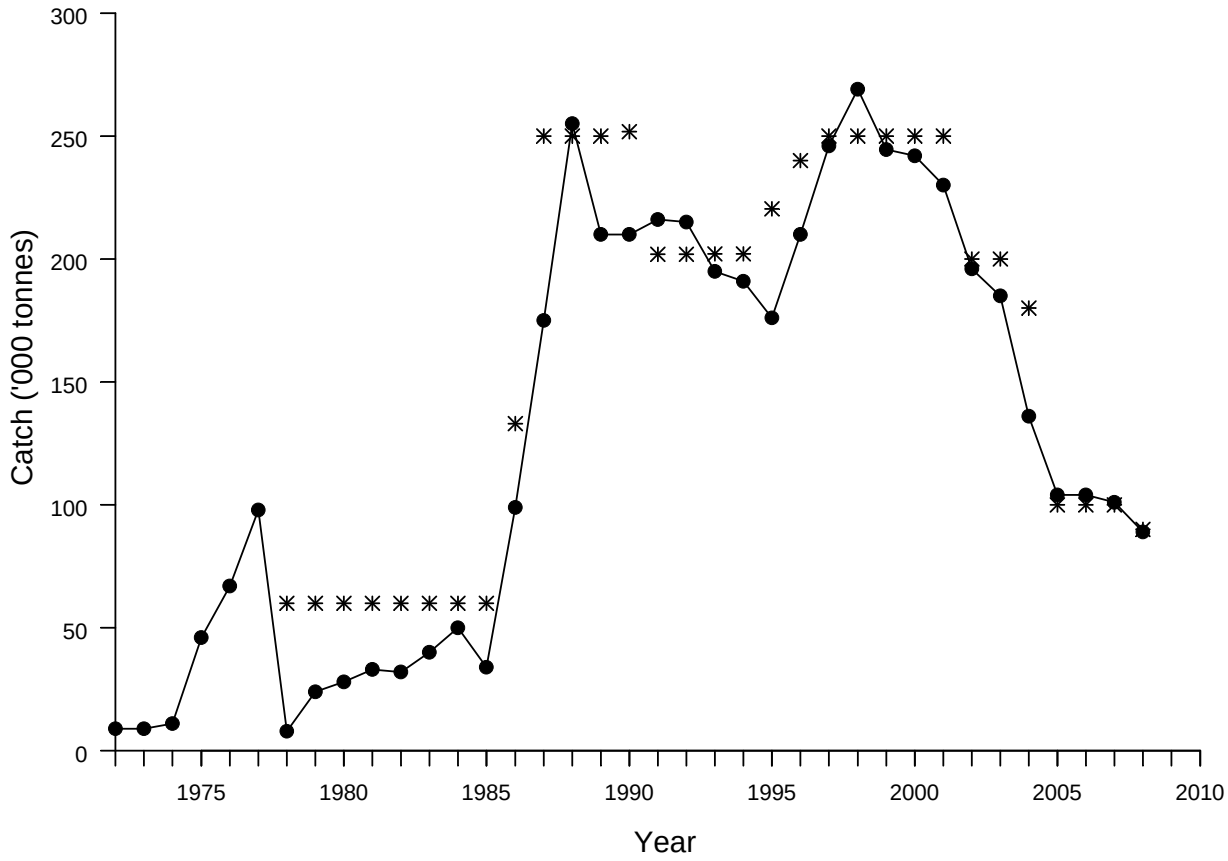

Figure 1: Total New Zealand hoki catch estimated from reported landings for calendar years 1972 to 1983 and fishing years 1983–84 (1984) to 2007–08. Stars are the TACC (t) for HOK 1 for each year.

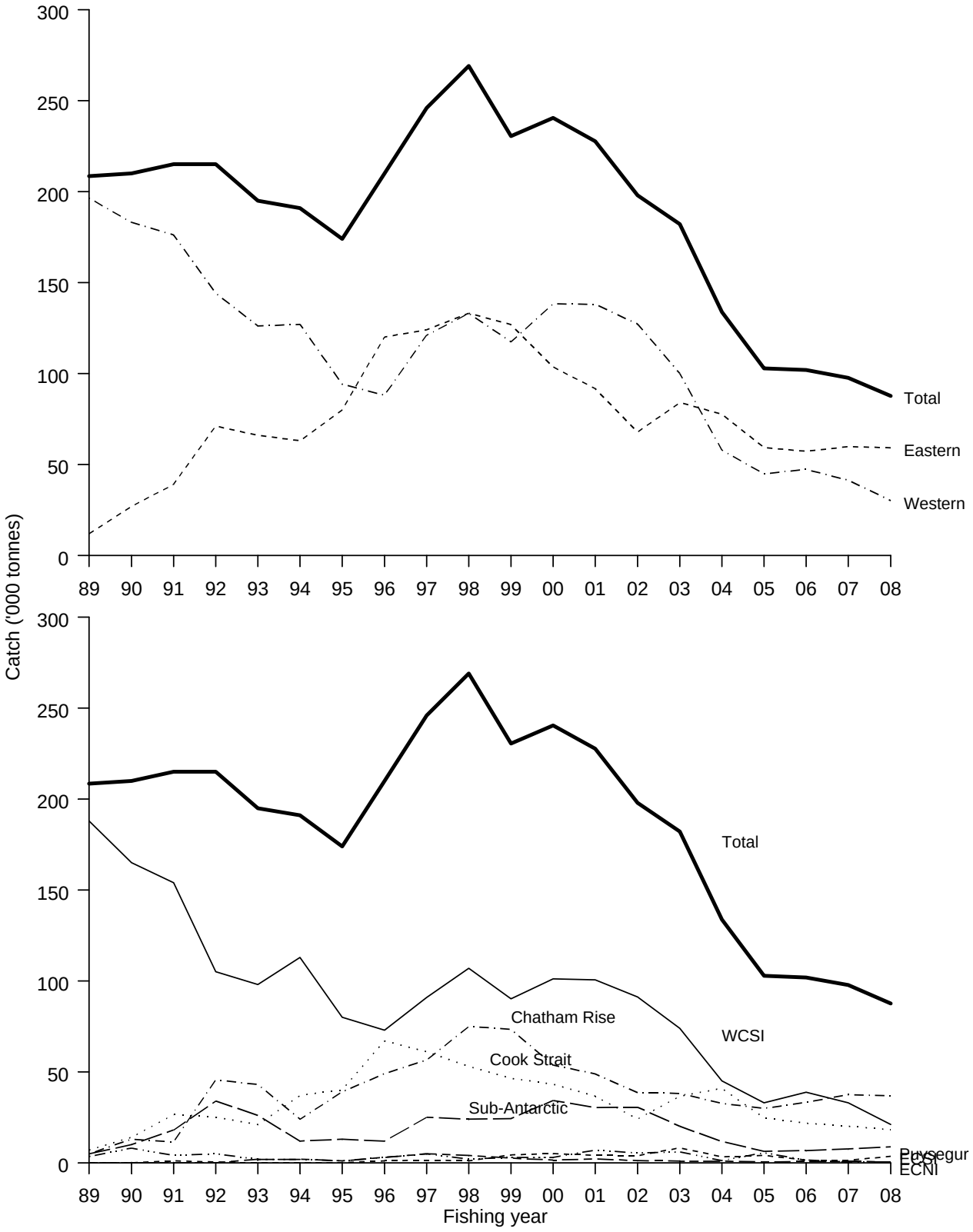

Figure 2: Estimated total catch (t) of hoki by 'stock' area (upper panel) and fishing area (lower panel) from 1988–89 (89) to 2007–08 (08). "Eastern" areas include Chatham Rise, east coast South Island (ECSI), Cook Strait, and east coast North Island (ECNI). "Western" areas include west coast South Island (WCSI), Sub-Antarctic, and Puysegur.

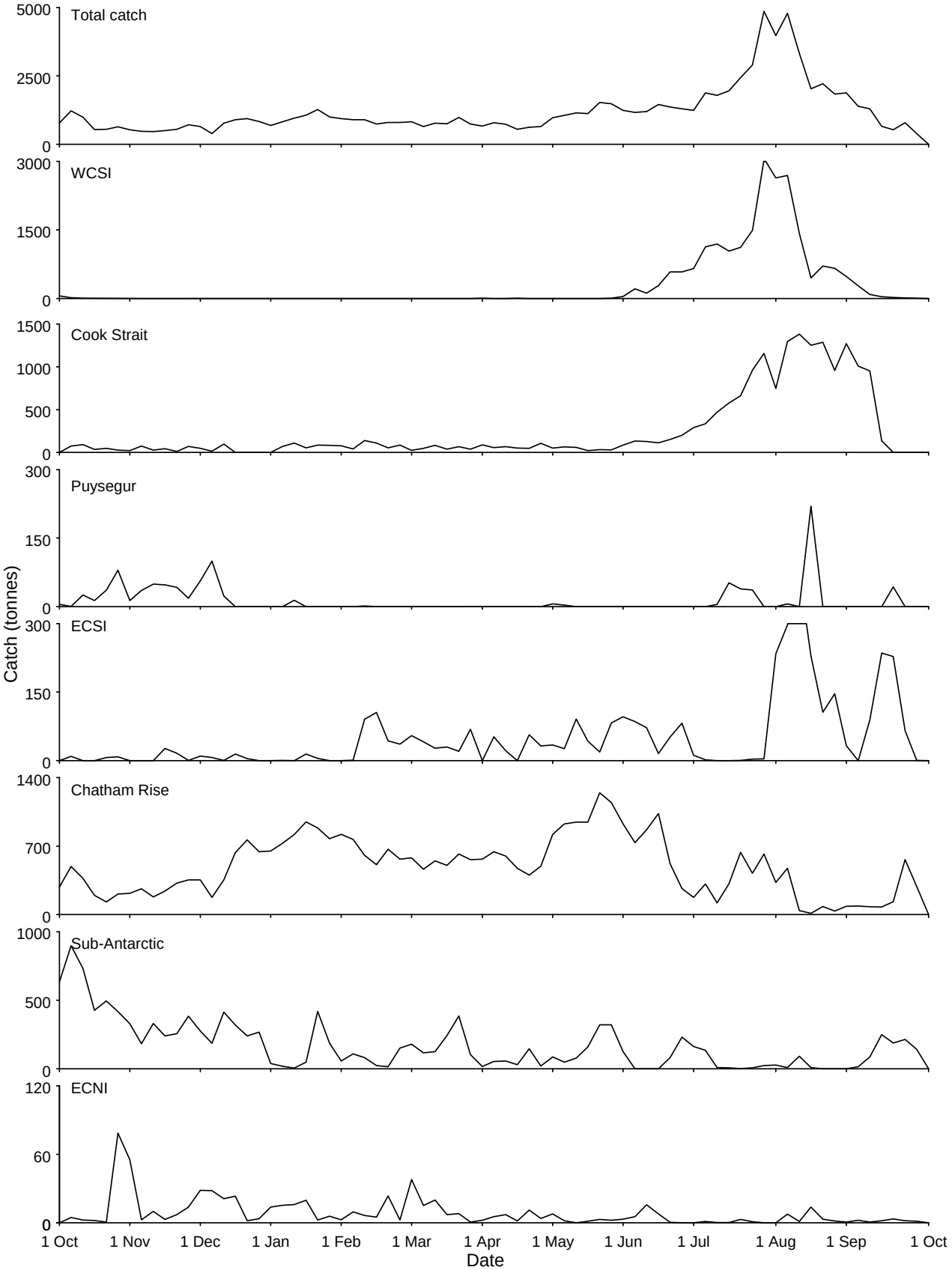

Figure 3: Distribution of hoki catch (in 5 day bins) by area in the 2007–08 fishing year.

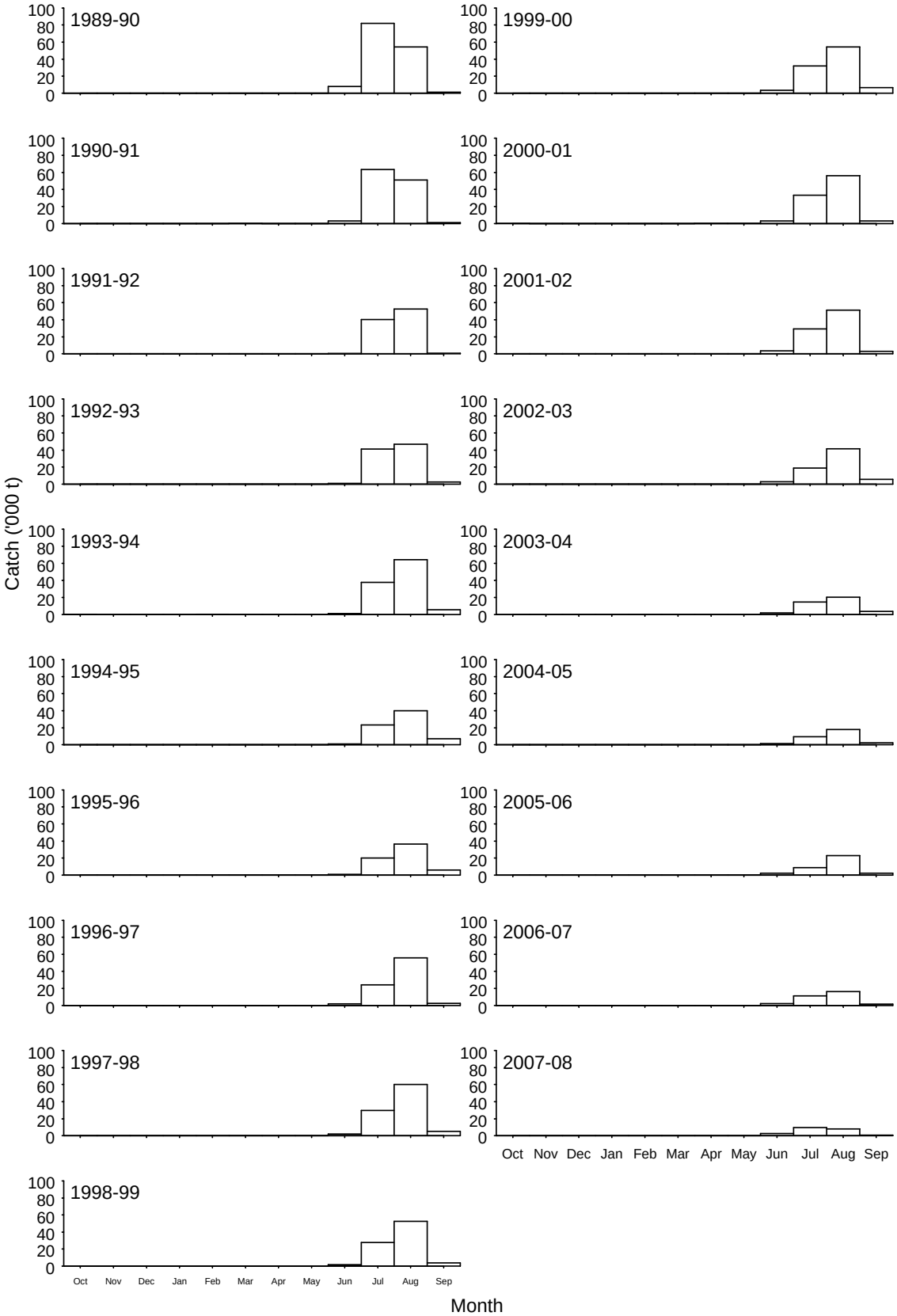

Figure 4a: Monthly distribution of WCSI hoki catch for the 1989–90 to 2007–08 fishing years.

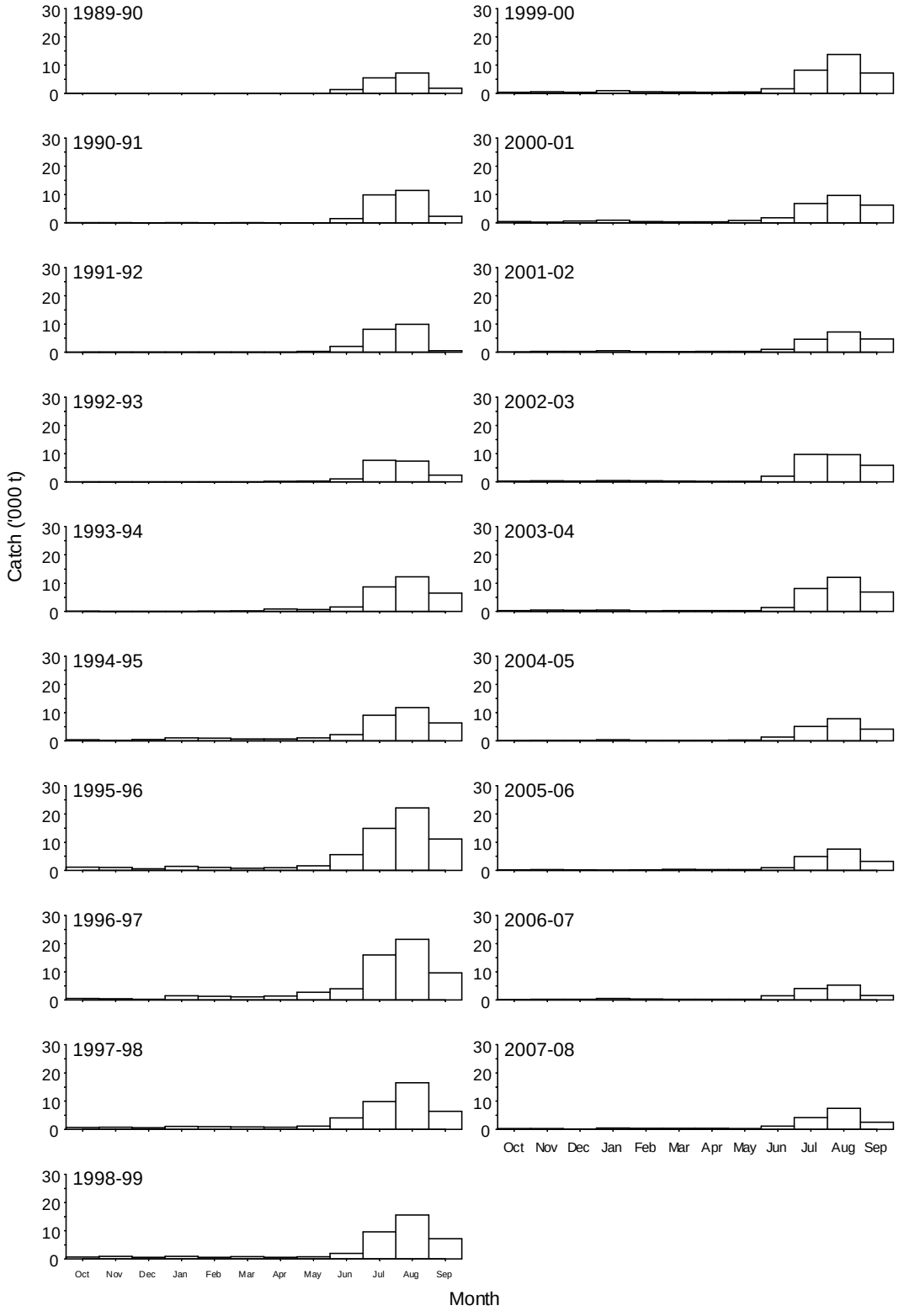

Figure 4b: Monthly distribution of Cook Strait hoki catch for the 1989–90 to 2007–08 fishing years.

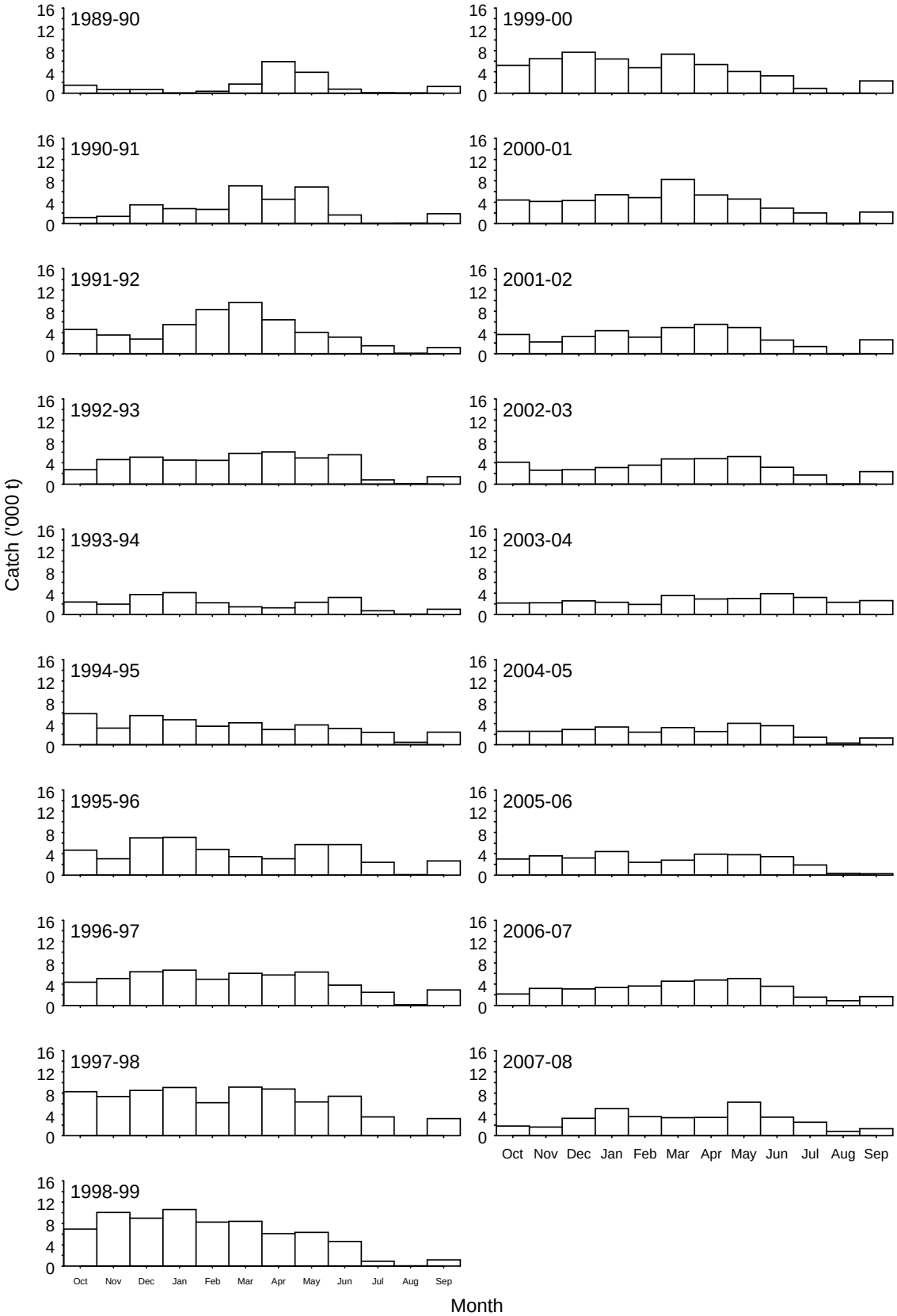

Figure 4c: Monthly distribution of Chatham Rise hoki catch for the 1989–90 to 2007–08 fishing years.

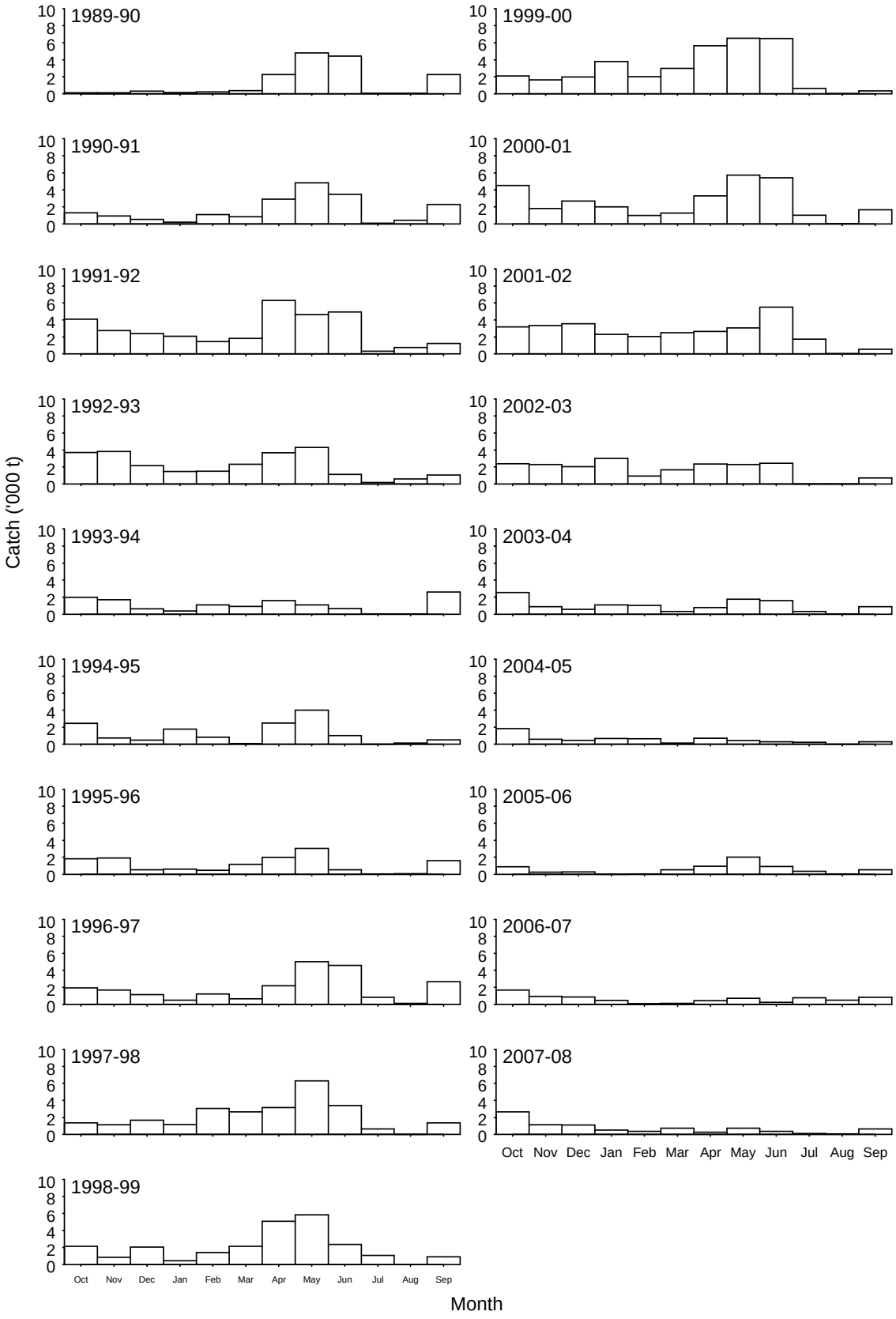

Figure 4d: Monthly distribution of Sub-Antarctic hoki catch for the 1989–90 to 2007–08 fishing years.

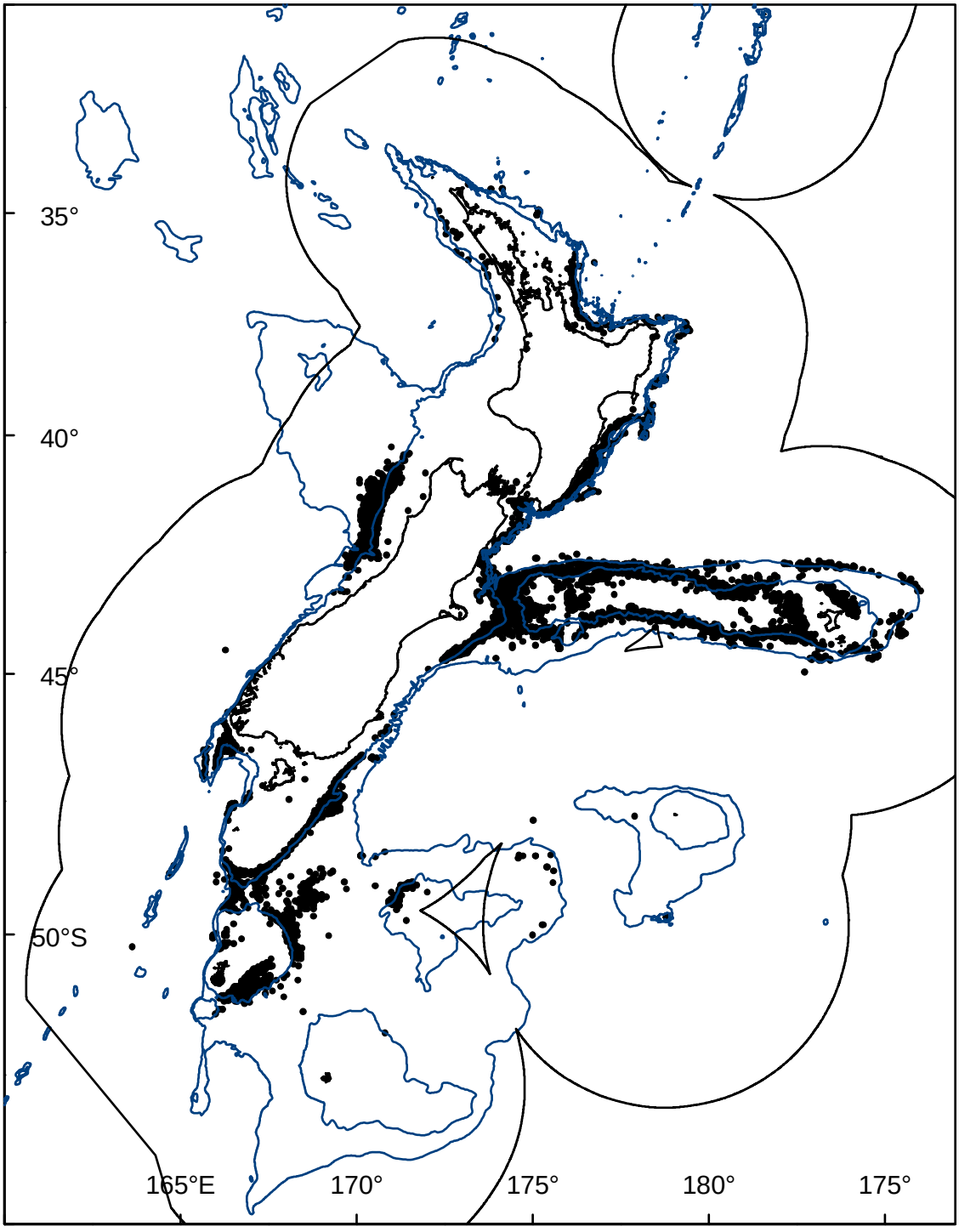

Figure 5a: Positions of all commercial trawls where hoki was the reported target species in the 2007–08 fishing year.

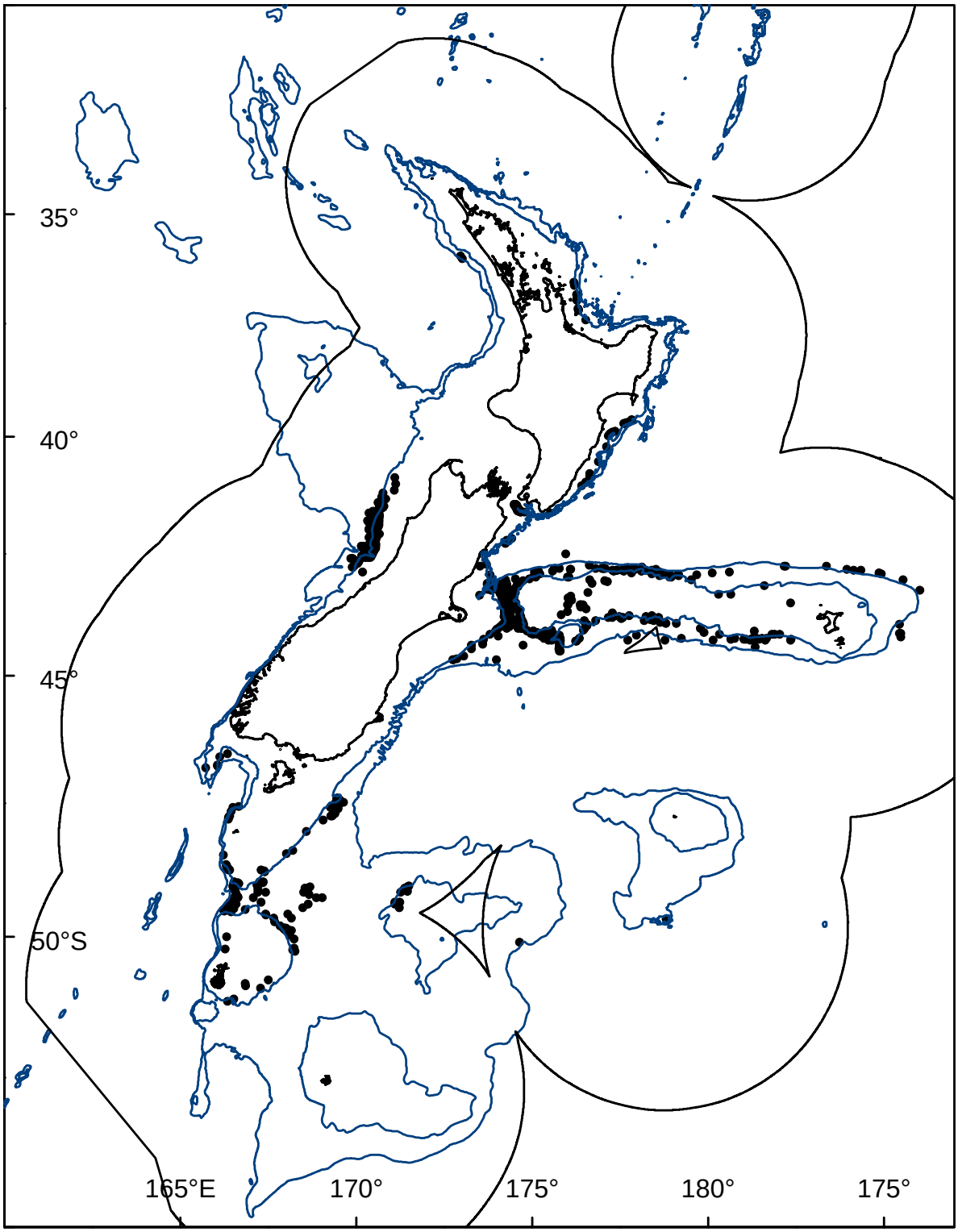

Figure 5b: Positions of all trawls where hoki were measured by observers from the MFish Observer Programme in the 2007–08 fishing year.

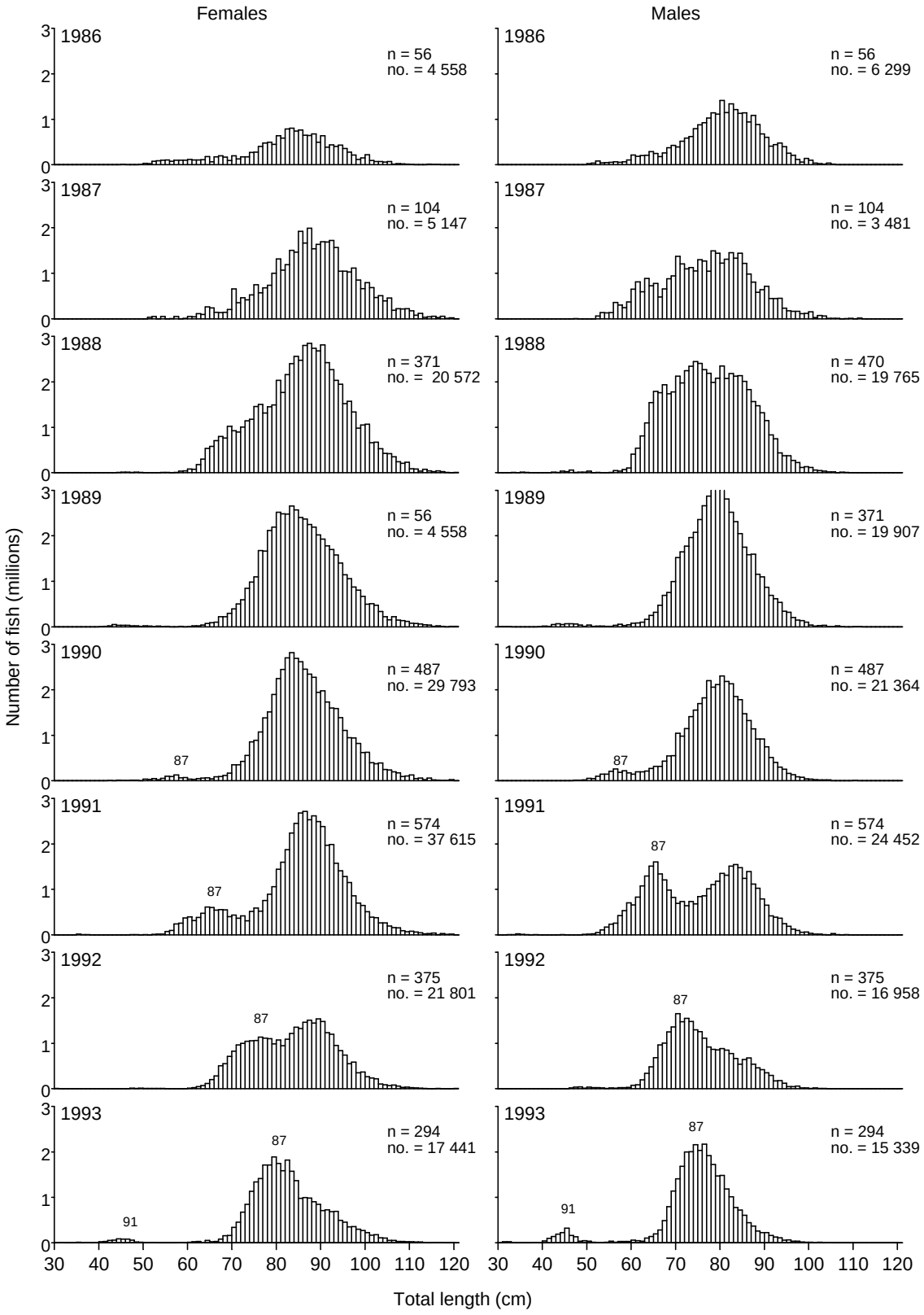

Figure 6: Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 1989 to 1993 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled. Numbers above the histograms mark estimated year-class modes, e.g., 91 = 1991 year-class.

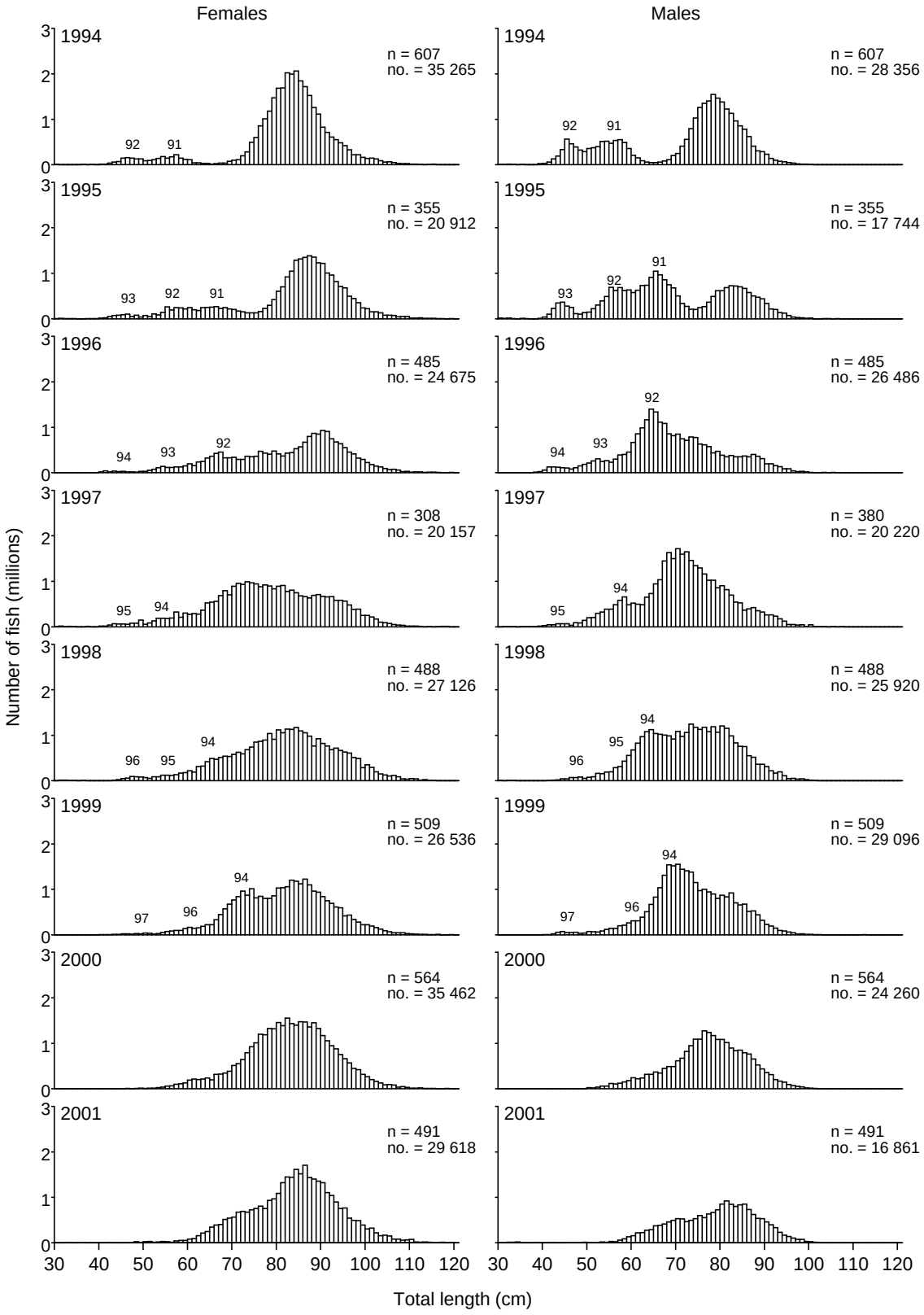

Figure 6 continued: Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 1996 to 2001 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled; N, number of landings sampled. Numbers above the histograms mark estimated year-class modes, e.g., 91 = 1991 year-class.

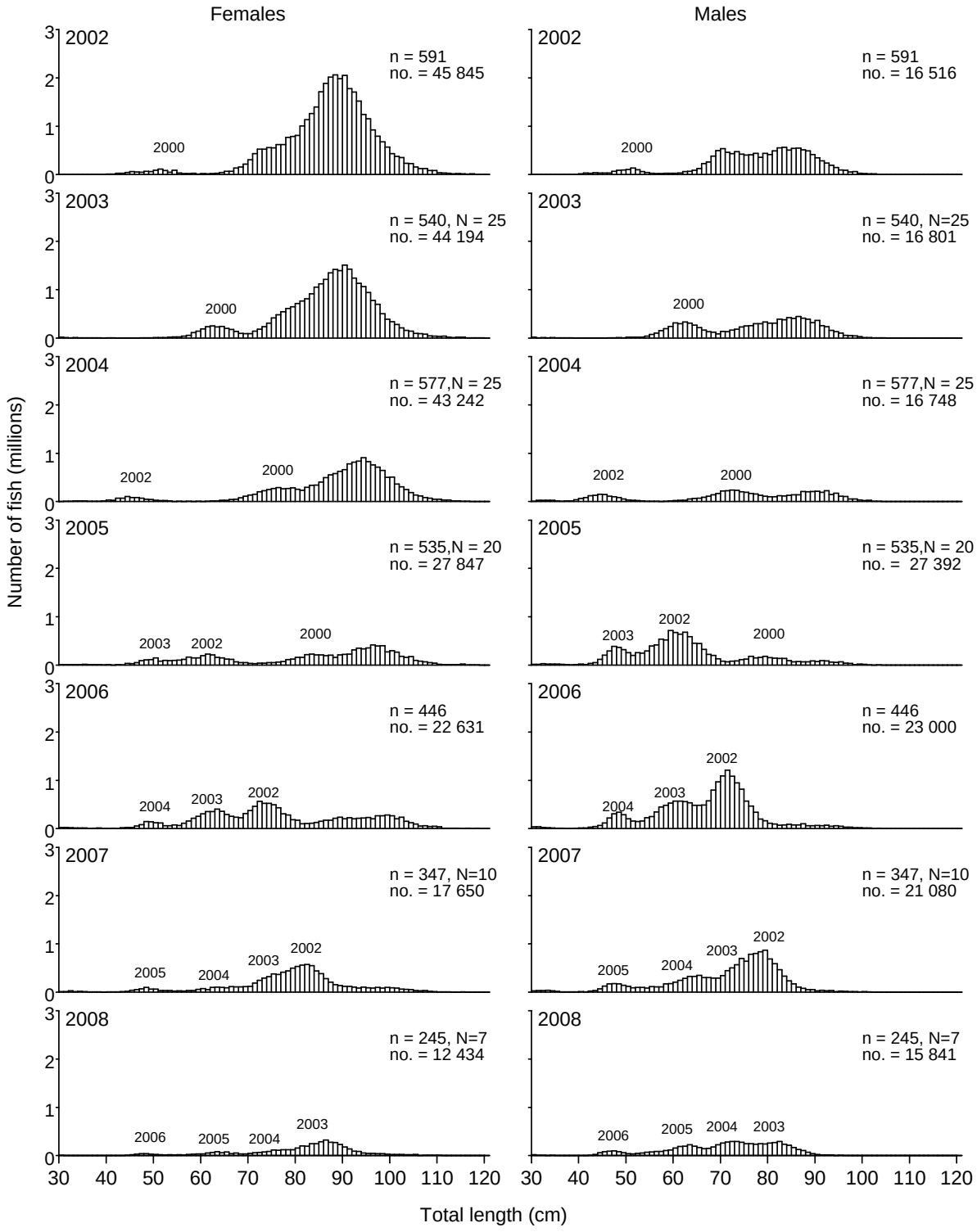

Figure 6 continued: Length frequency of hoki in commercial catches from the west coast South Island spawning fishery from 2002 to 2008. In 2003–05 and 2007–08, Observer Programme data are combined with samples of landings from inside the 25 n. mile line sampled by NIWA. n, number of tows sampled; no., number of fish sampled; N, number of landings sampled. Numbers above the histograms mark estimated year-class modes, e.g., 91 = 1991 year-class.

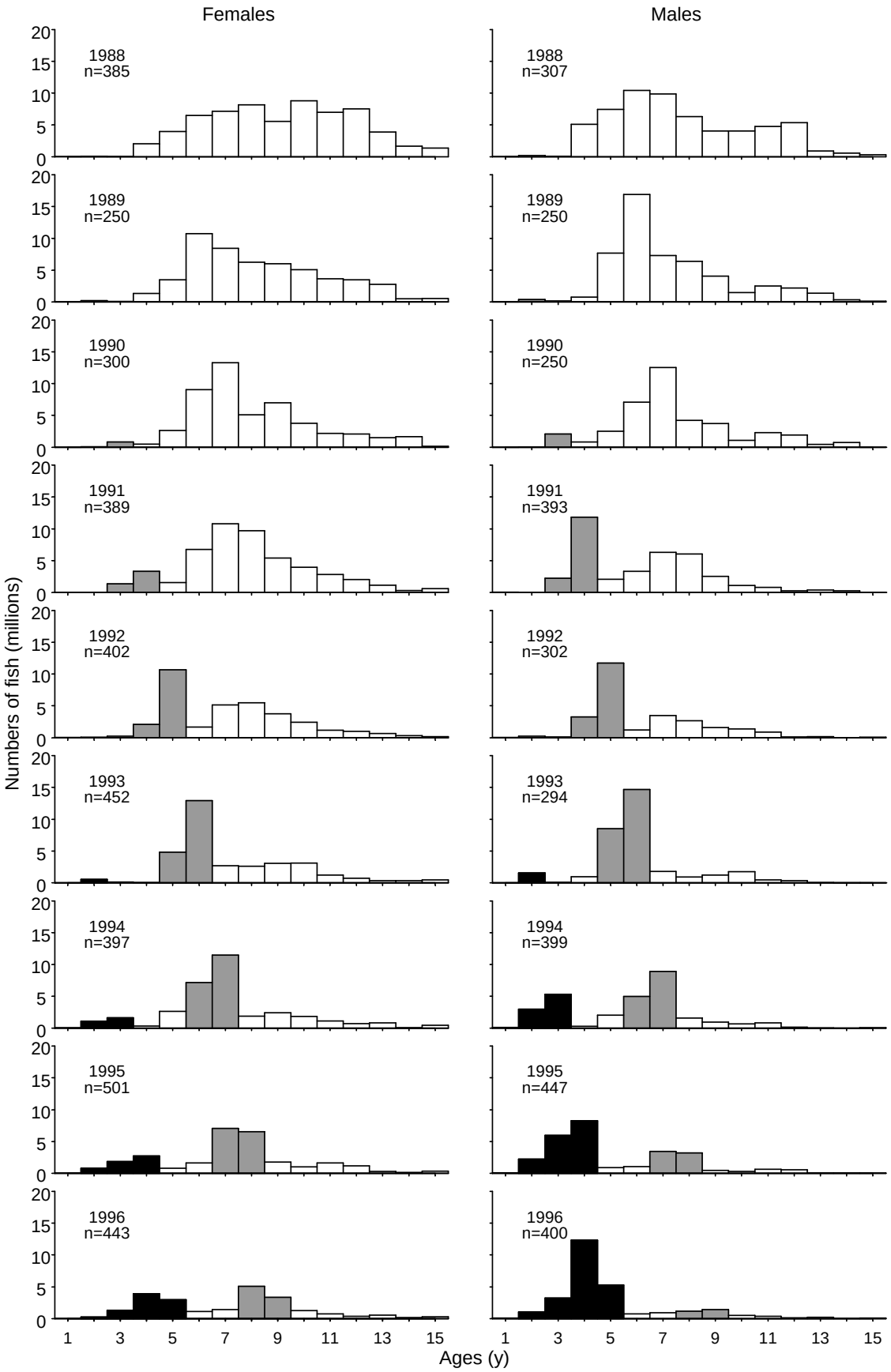

Figure 7: Catch at age of hoki in commercial catches from the west coast South Island spawning fishery from 1988 to 2008. n, number of fish aged. Grey bars for the years 1990 to 2000 show 1987 and 1988 year-classes, black bars show 1991–94 year-classes, and grey bars in the 2004–2007 seasons represent the 2002 year class.

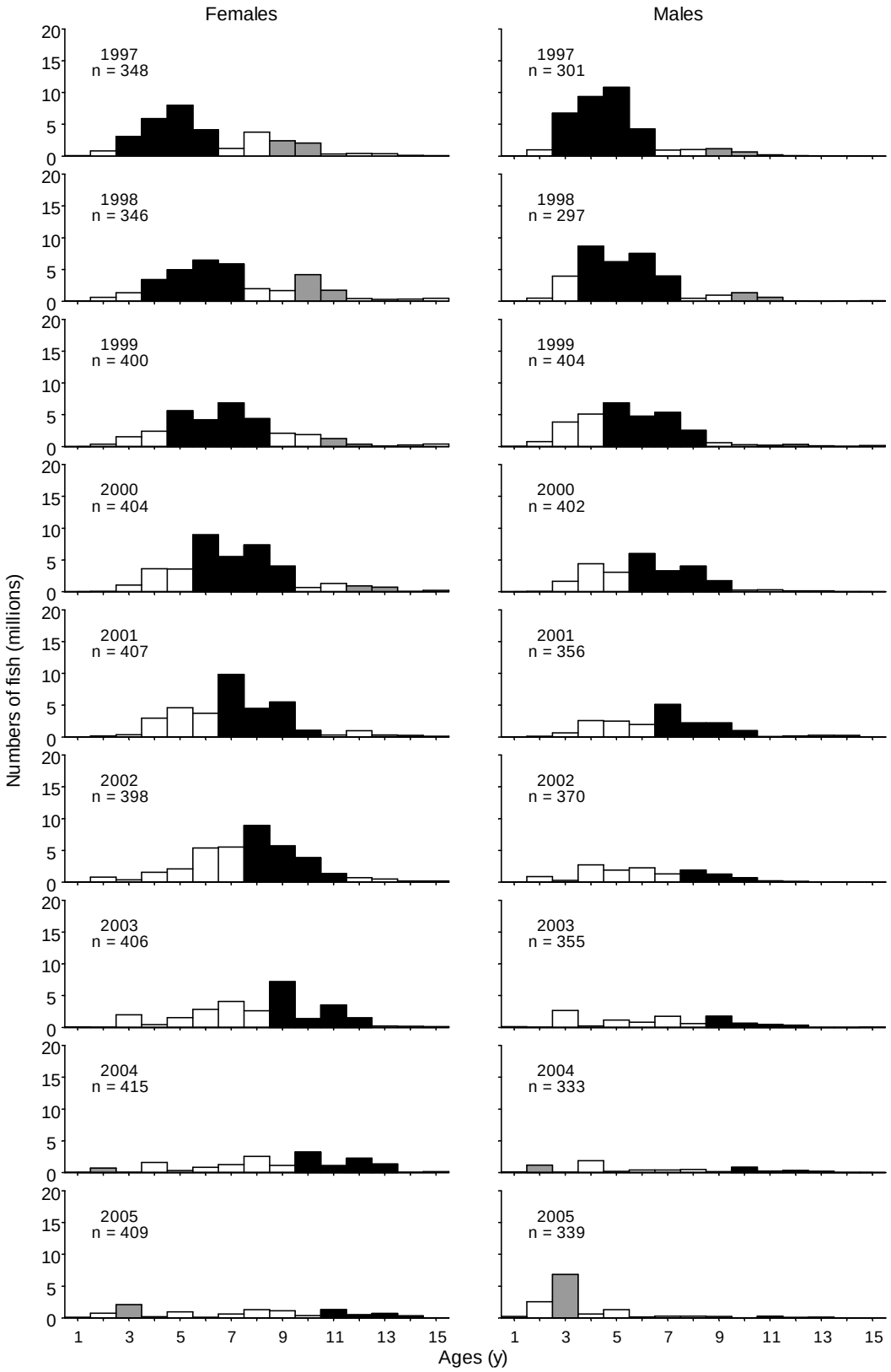

Figure 7: continued.

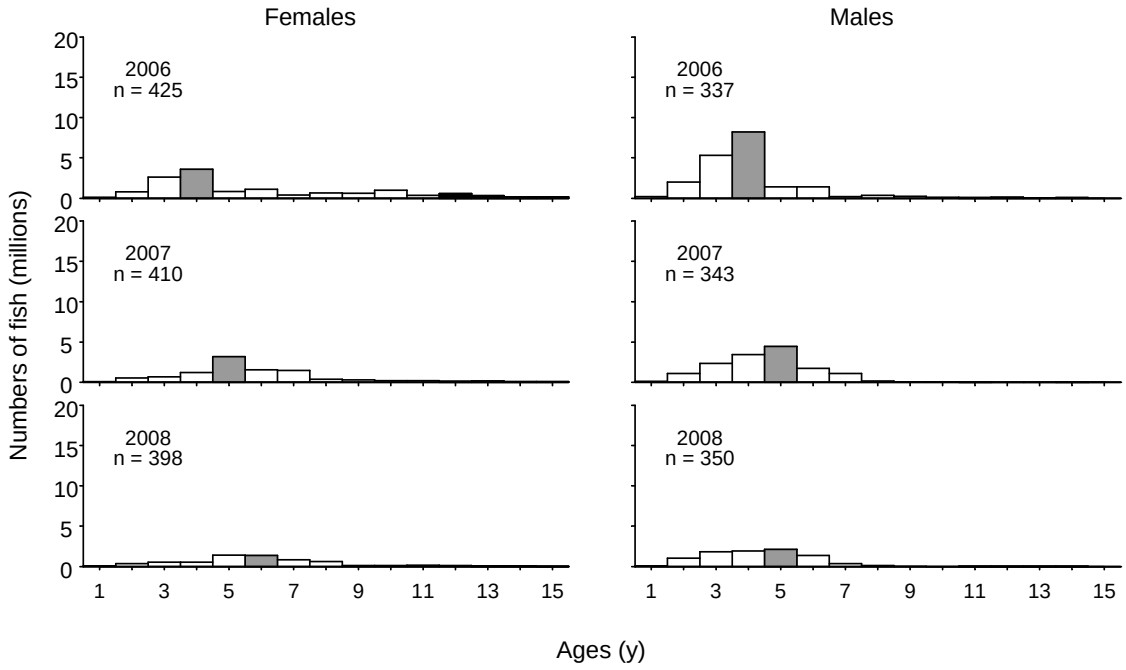

Figure 7: continued.

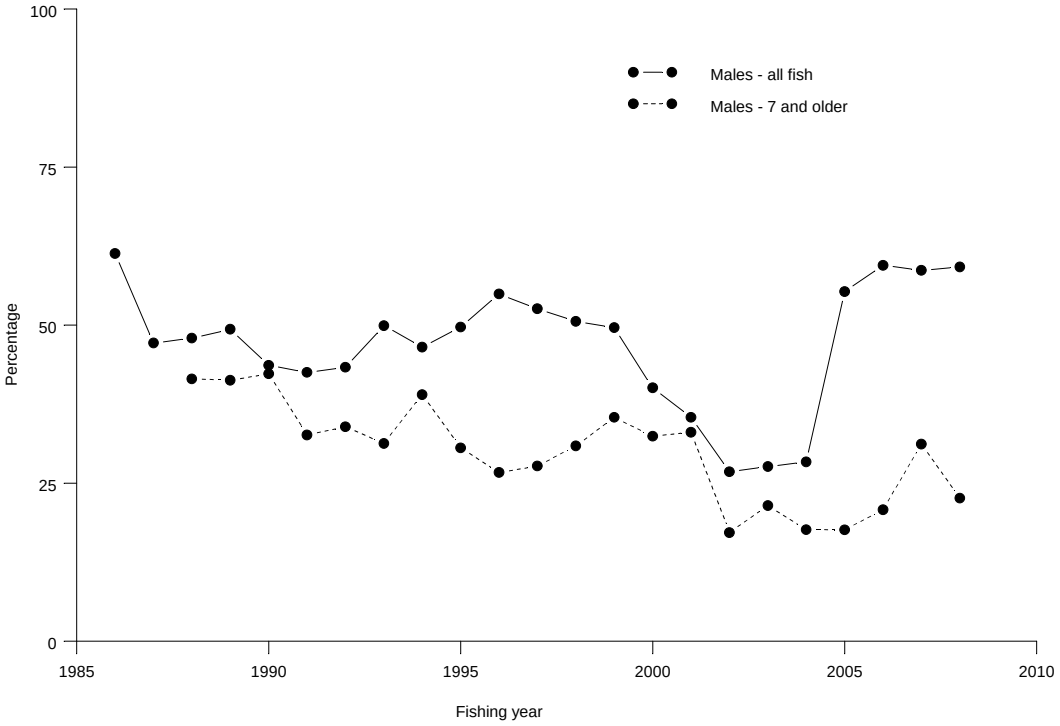

Figure 8: Percentage of males in the catch on the WCSI for all fish (solid line) and for fish aged 7 and older (dotted line).

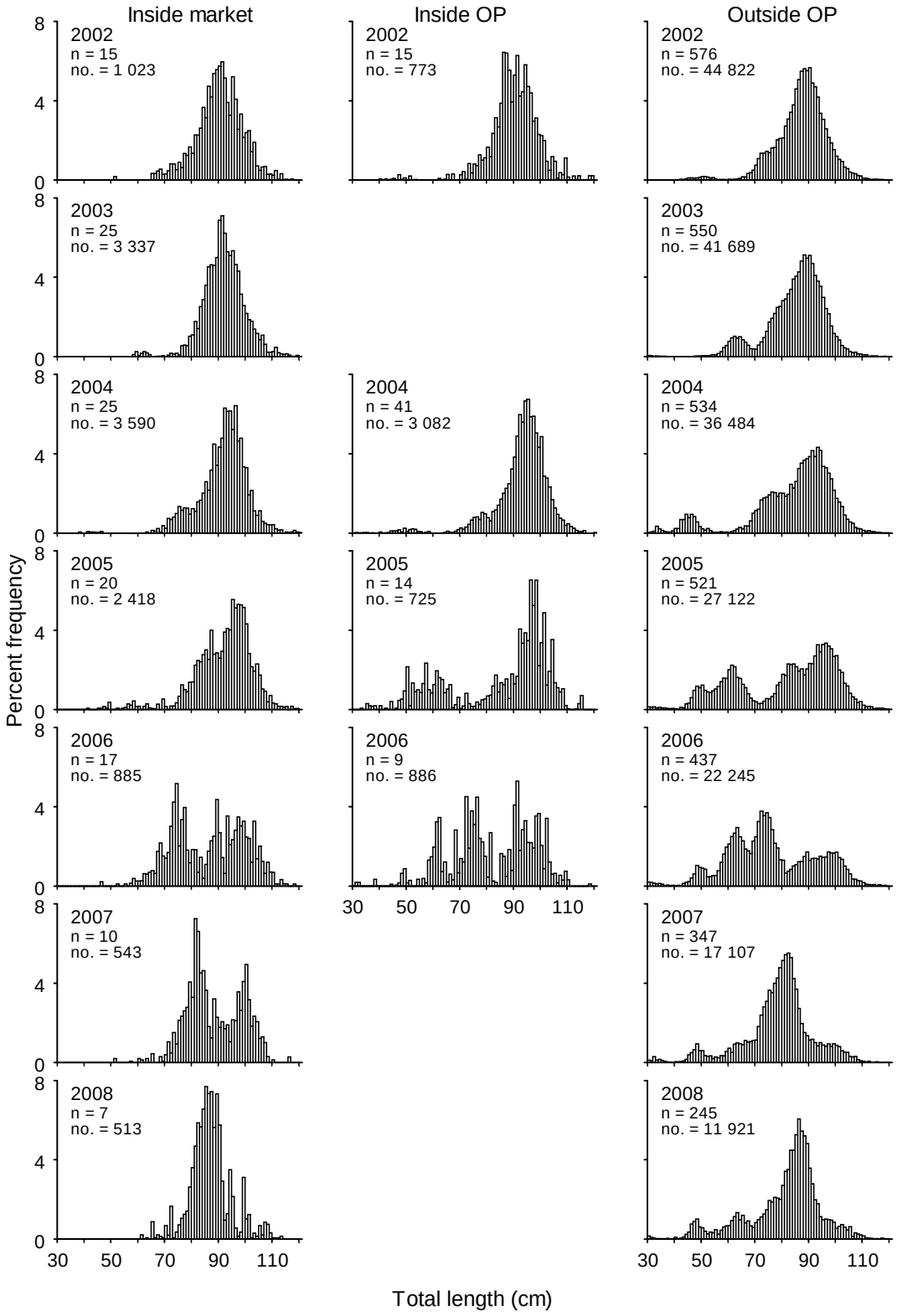

Figure 9a: Female length frequencies from inside the 25 n. mile line sampled by NIWA (market) and OP, and outside the 25 n. mile line sampled at sea by the Observer Programme (OP) in 2002–08. n, number of landings or tows sampled; no., number of fish sampled.

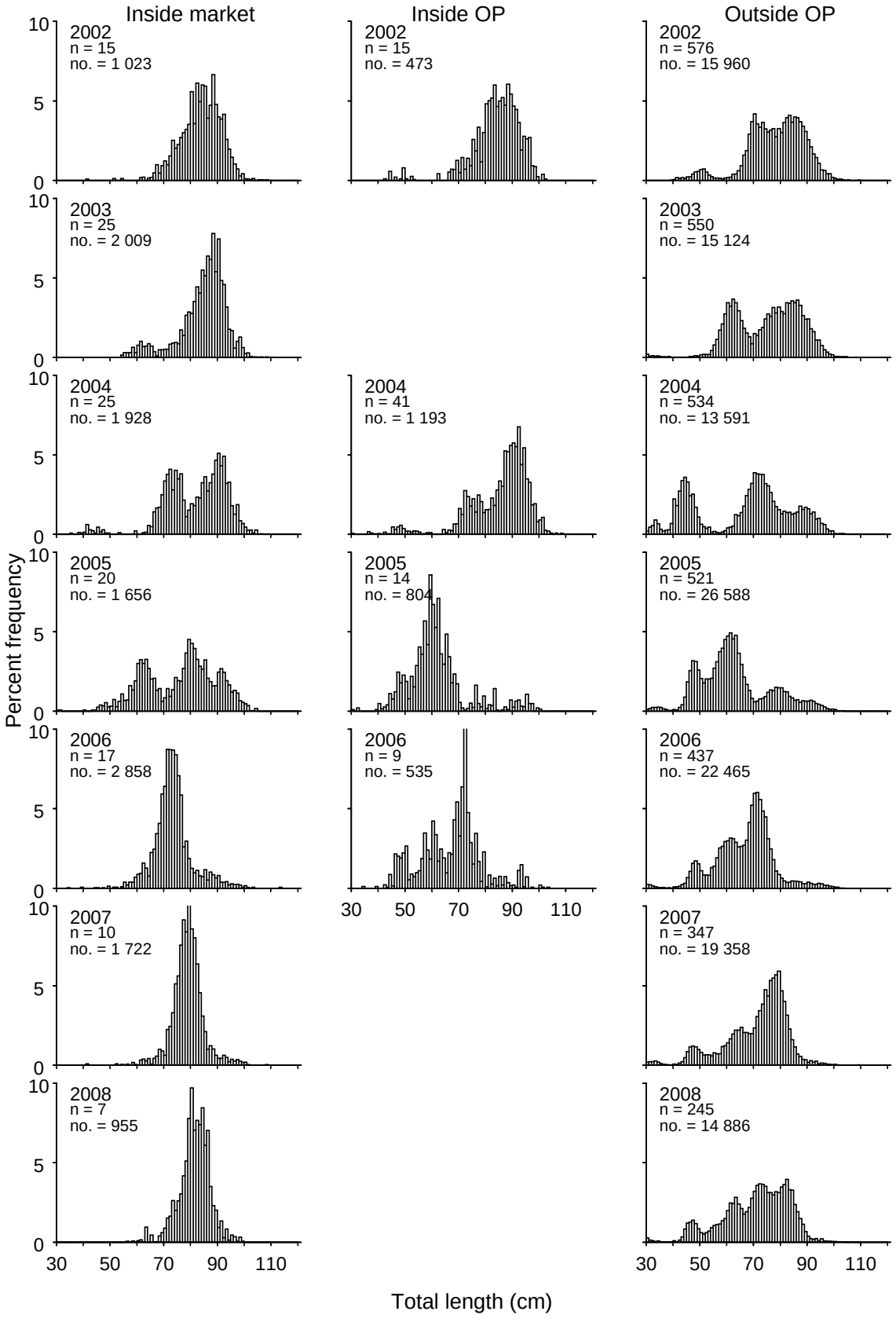

Figure 9b: Male length frequencies from inside the 25 n. mile line sampled by NIWA (market) and OP, and outside the 25 n. mile line sampled at sea by the Observer Programme (OP) in 2002–08. n, number of landings or tows sampled; no., number of fish sampled.

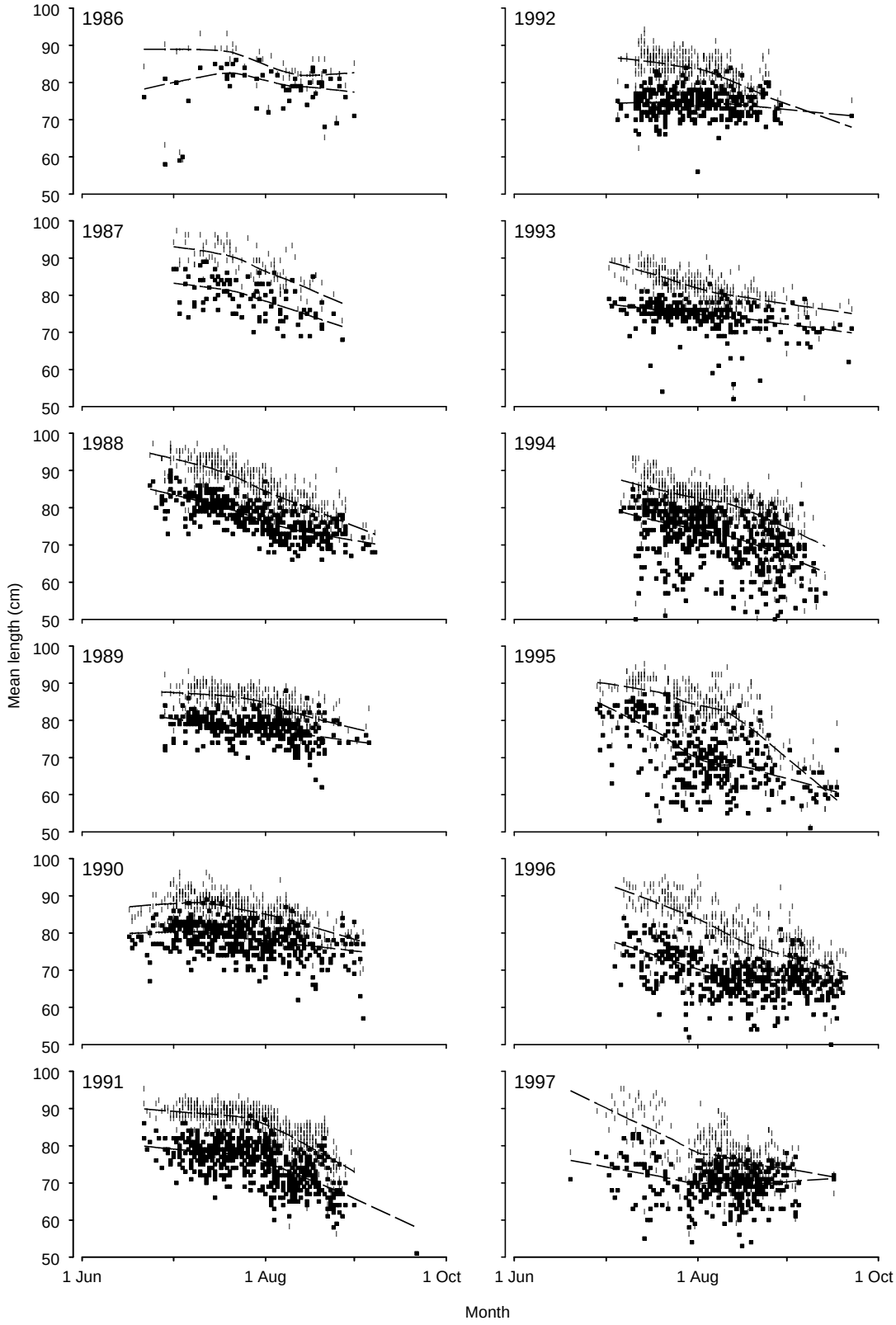

Figure 10: Mean length of female (dashes) and male (squares) hoki taken in commercial catches from the west coast South Island spawning fishery 1986–97 sampled at sea by the Observer Programme. Lines are a loess fit.

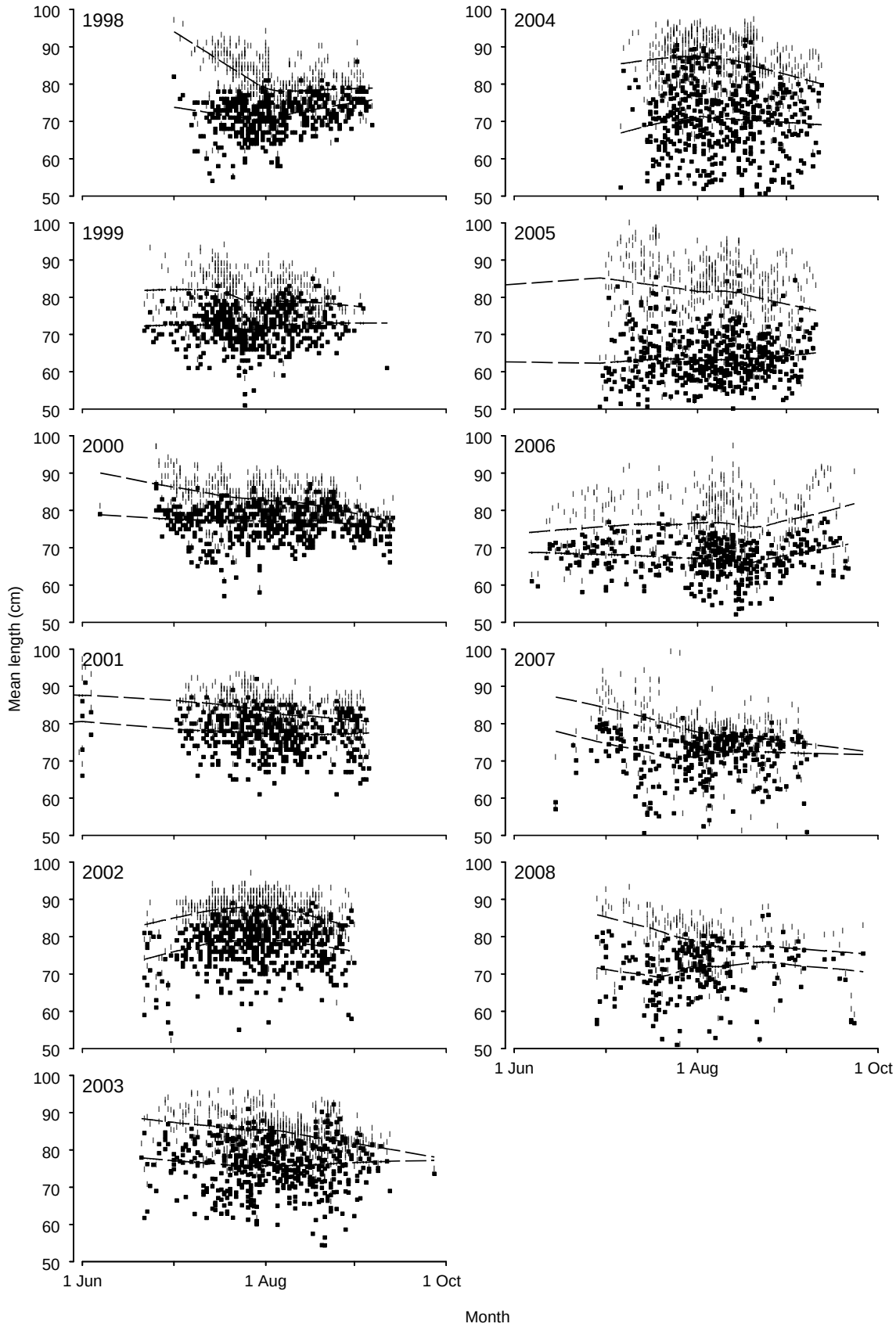

Figure 10 cont: Mean length of female (dashes) and male (squares) hoki taken in commercial catches from the west coast South Island spawning fishery 1998–2008 sampled at sea by the Observer Programme. Lines are a loess fit.

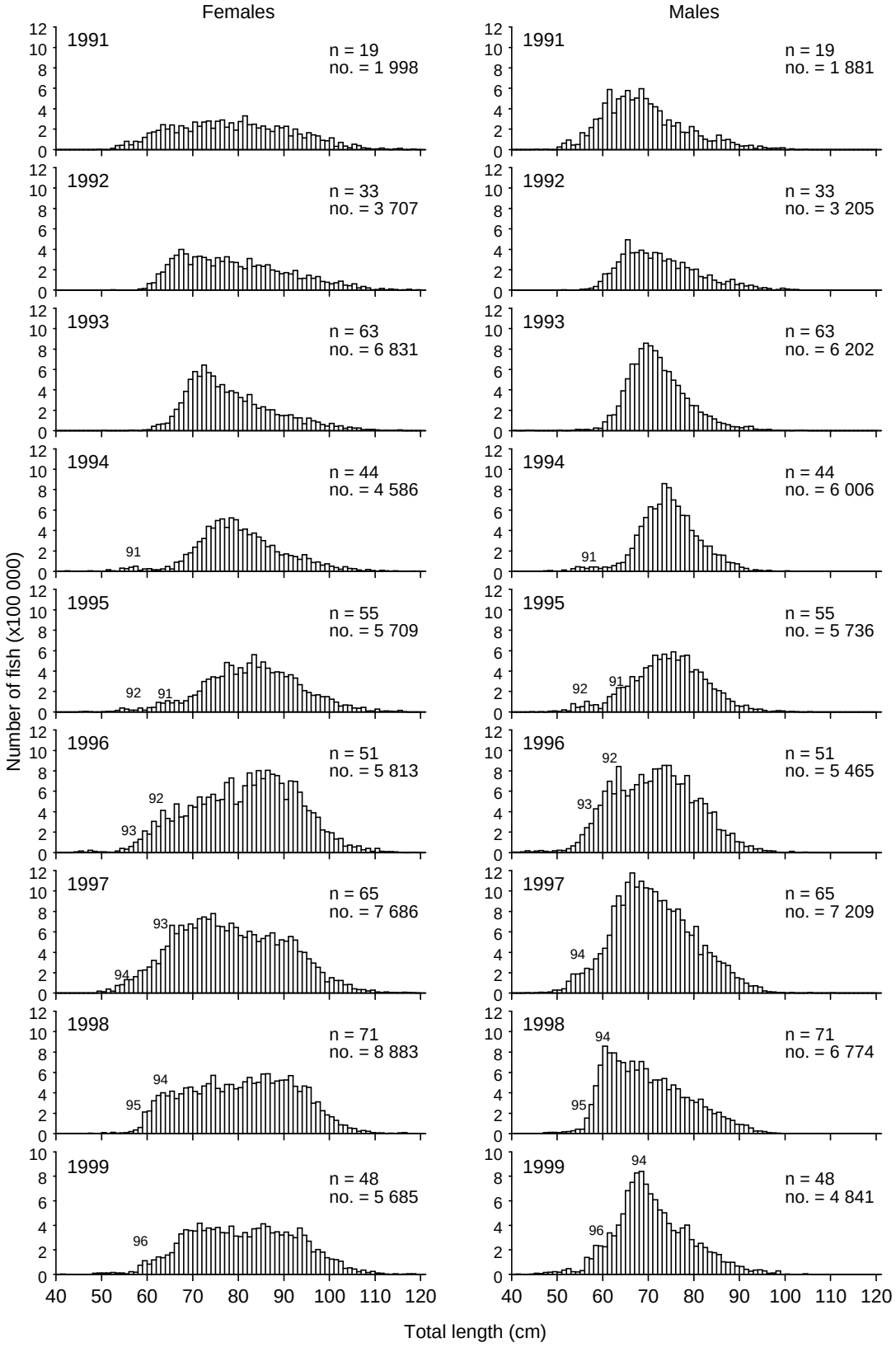

Figure 11: Length frequency of hoki in commercial catches from the Cook Strait spawning fishery from 1991 to 2008 sampled in sheds by the Stock Monitoring Programme and NIWA. n, number of landings sampled; no., number of fish sampled. Numbers above the histograms mark year-class modes, e.g., 91 = 1991 year-class.

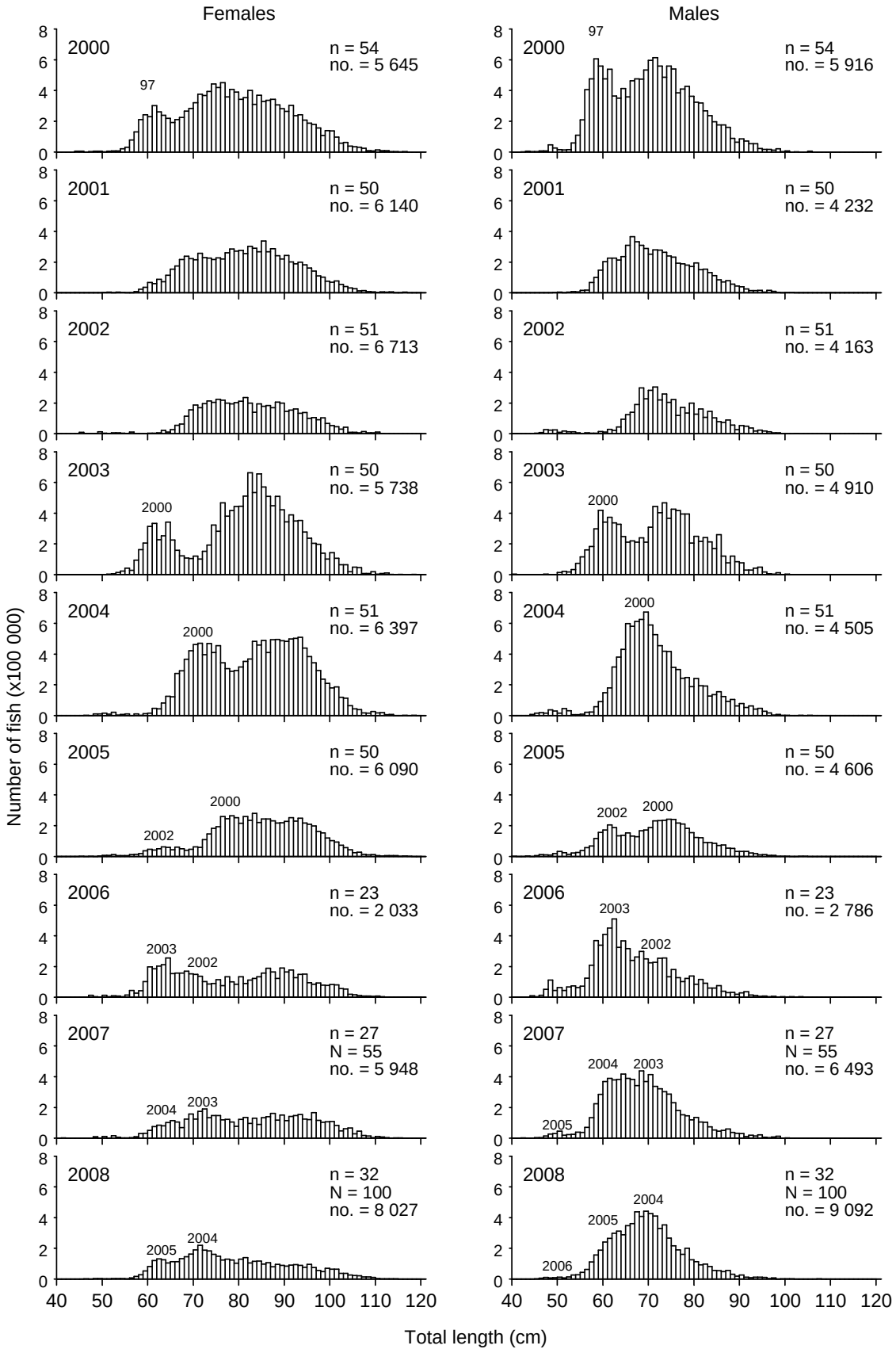

Figure 11: continued. 2006 data excludes Nelson vessels ≥ 40 m which sorted their catch at sea. 2007 and 2008 data includes shed samples (vessels < 40 m) and observer samples vessels ≥ 40 m). n, number of landings sampled; N, number of observed tows; no., number of fish sampled. Numbers above the histograms mark year-class modes, e.g., 91 = 1991 year-class.

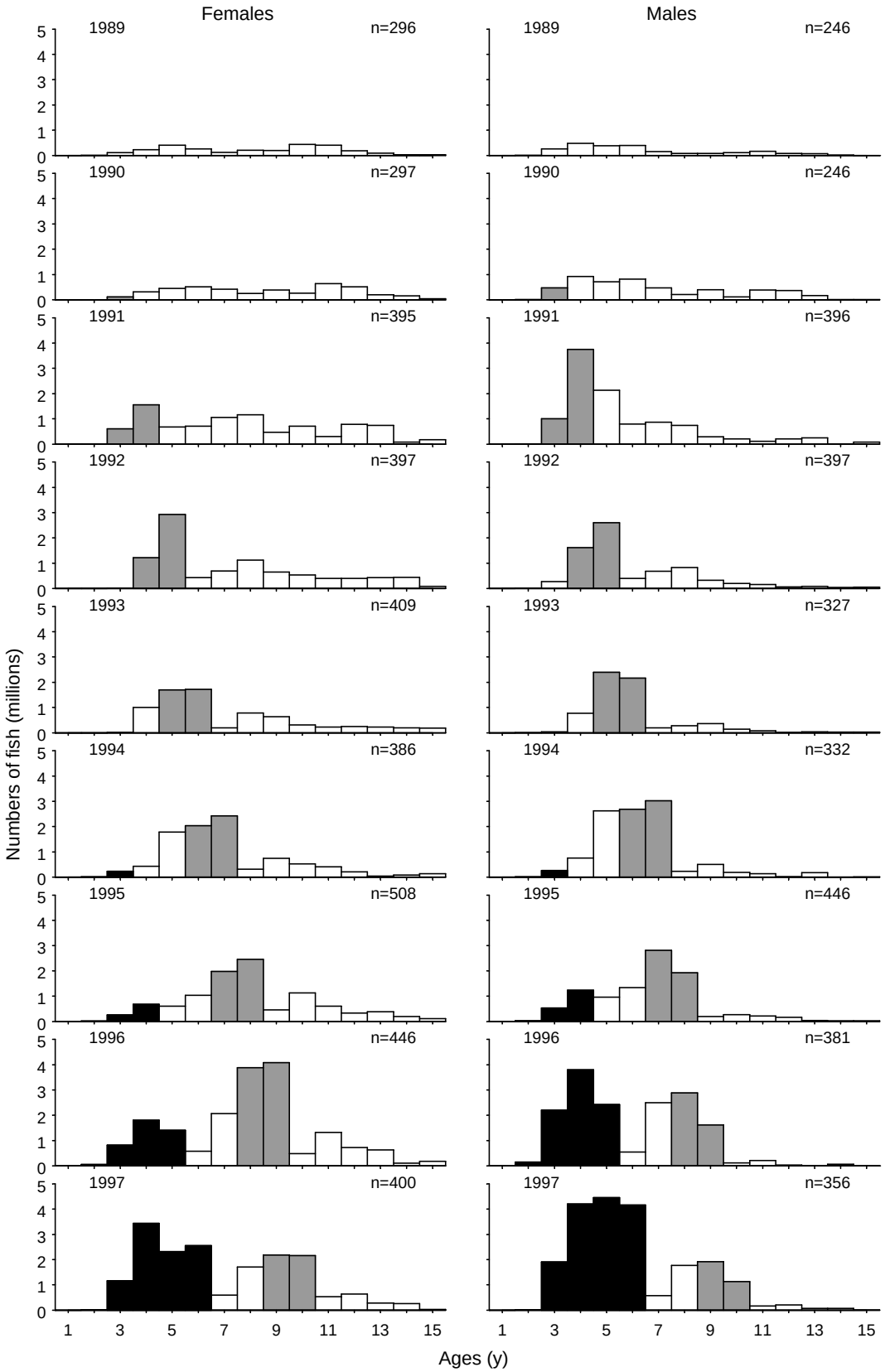

Figure 12: Catch at age of hoki in commercial catches from the Cook Strait spawning fishery from 1988 to 2008 sampled in sheds by the Stock Monitoring Programme and NIWA. n, number of fish aged. Grey bars show 1987 and 1988 year-classes, black bars show 1991–94 year-classes, and light grey the 2000 year-class.

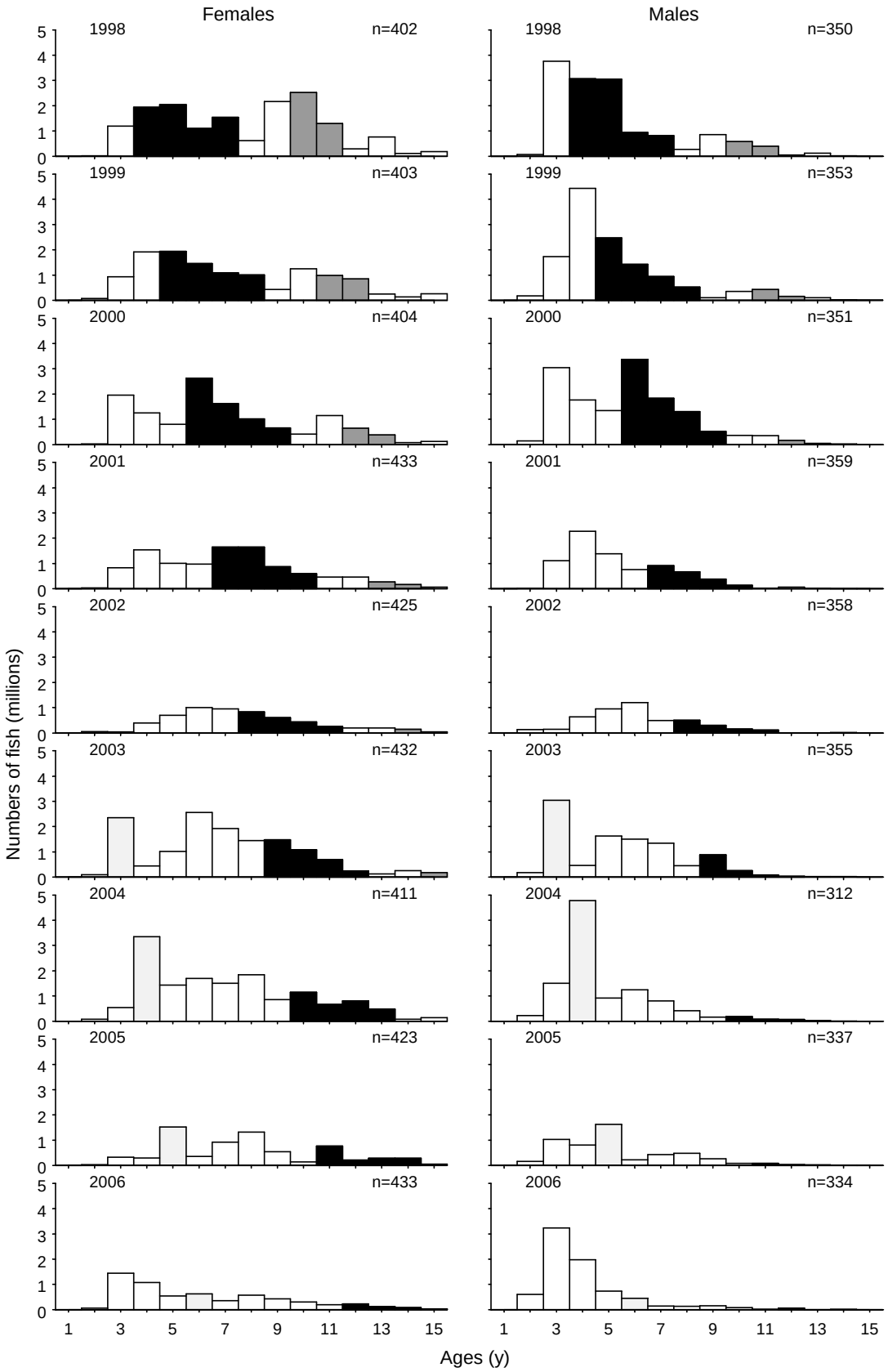

Figure 12: Continued.

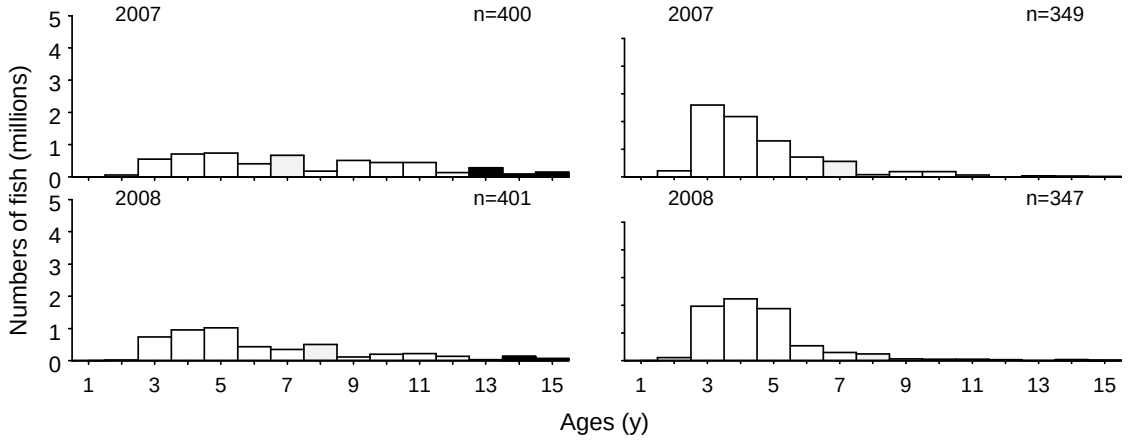

Figure 12: Continued.

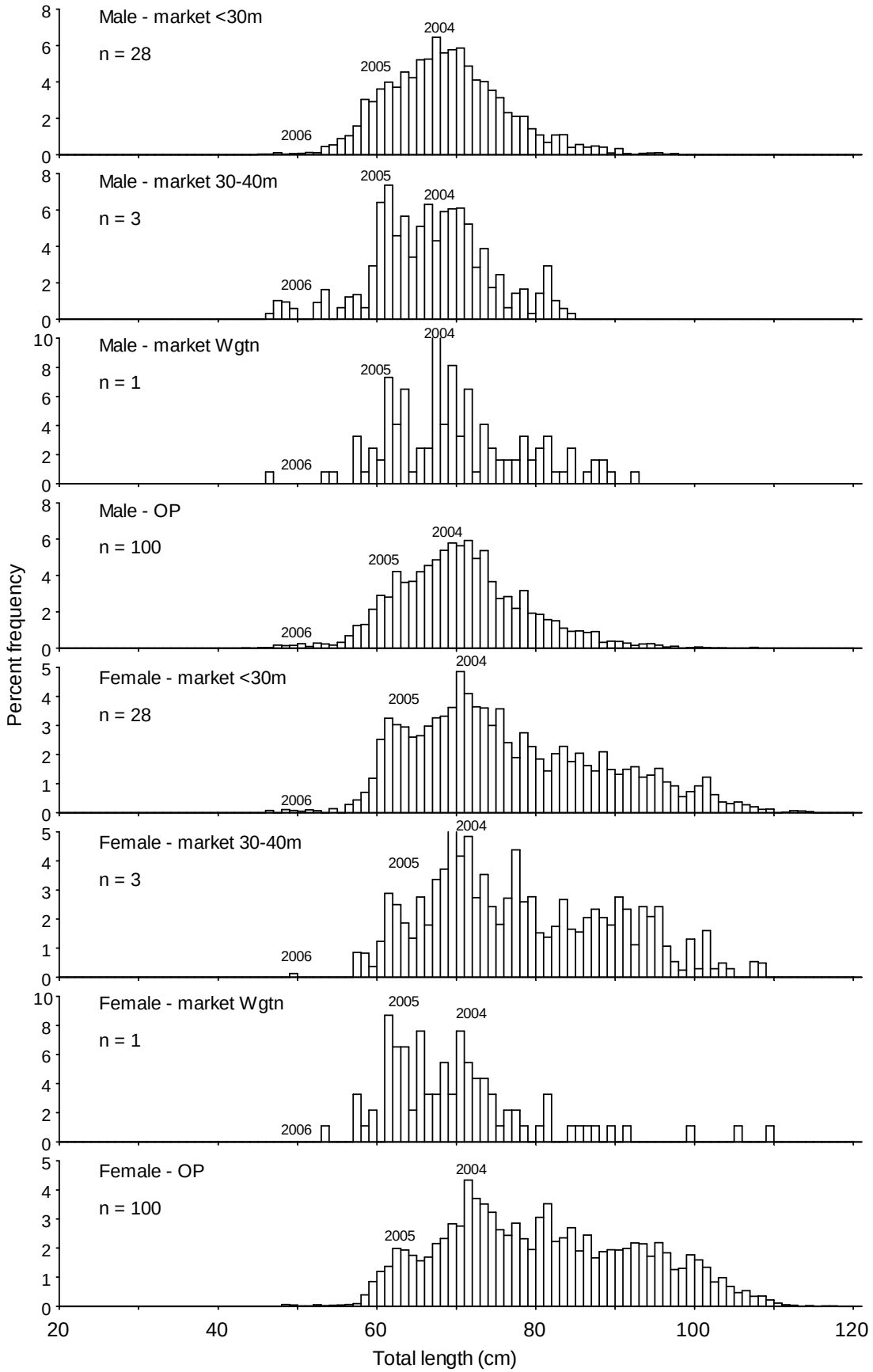

Figure 13: Comparison of NIWA (market) and Observer Programme (OP) length frequencies of hoki taken in commercial catches from Cook Strait during 2008 by port and vessel length categories.

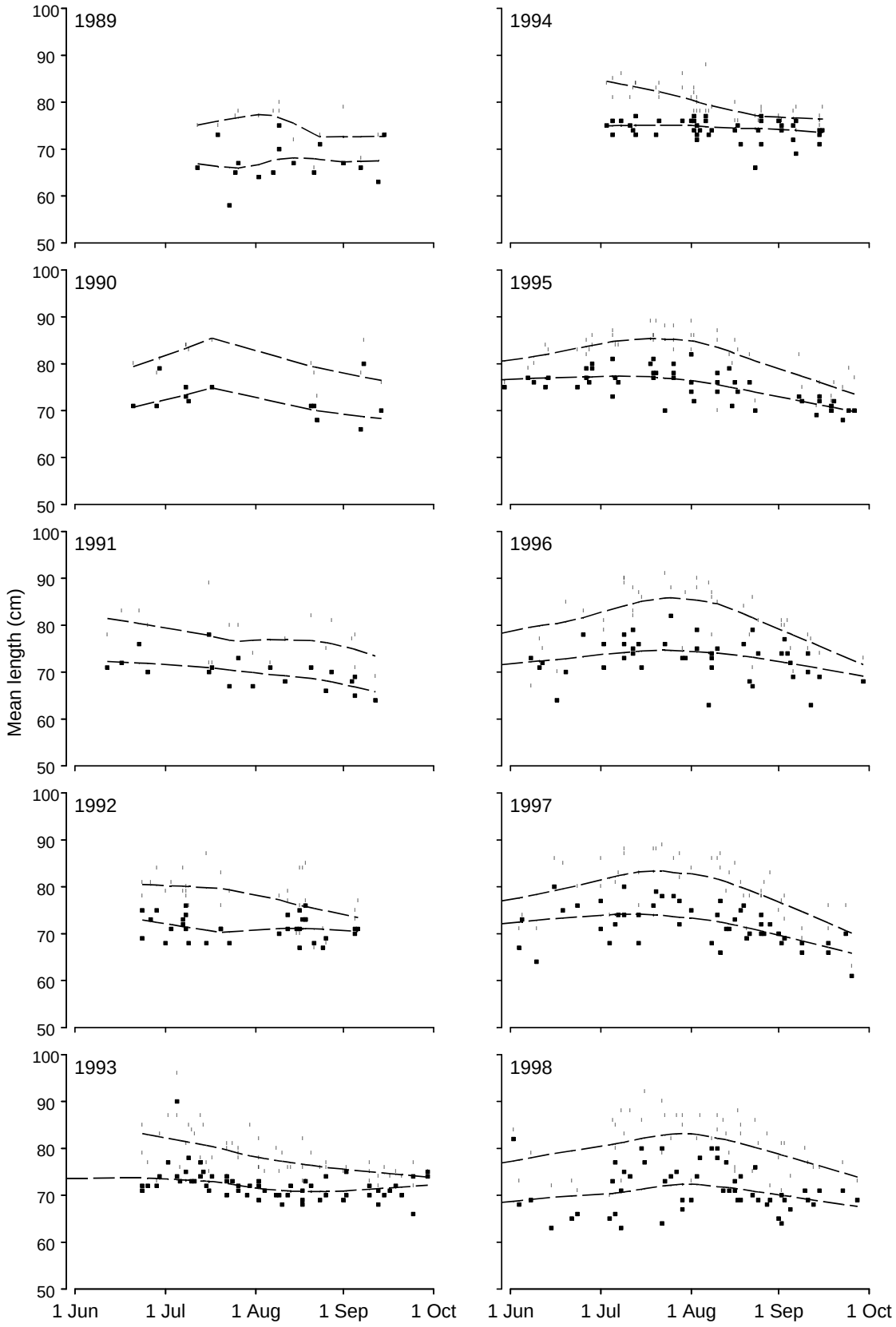

Figure 14: Mean length of female (dashes) and male (squares) hoki taken in commercial catches from the Cook Strait spawning fishery 1989–2008 from landings sampled by the Stock Monitoring Programme and NIWA. Lines are a loess fit. 2006 landing data excludes vessels ≥40m.

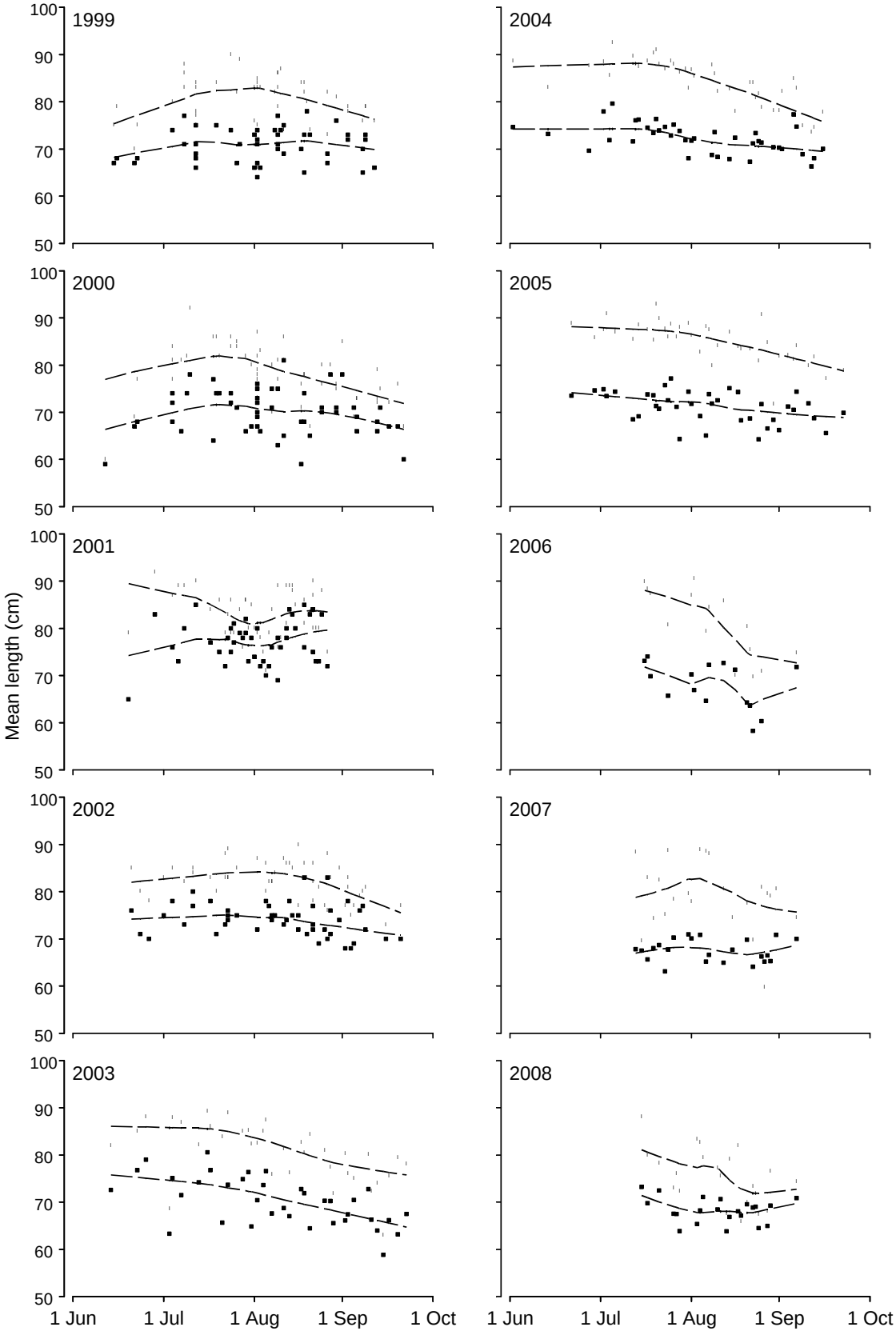

Figure 14: continued.

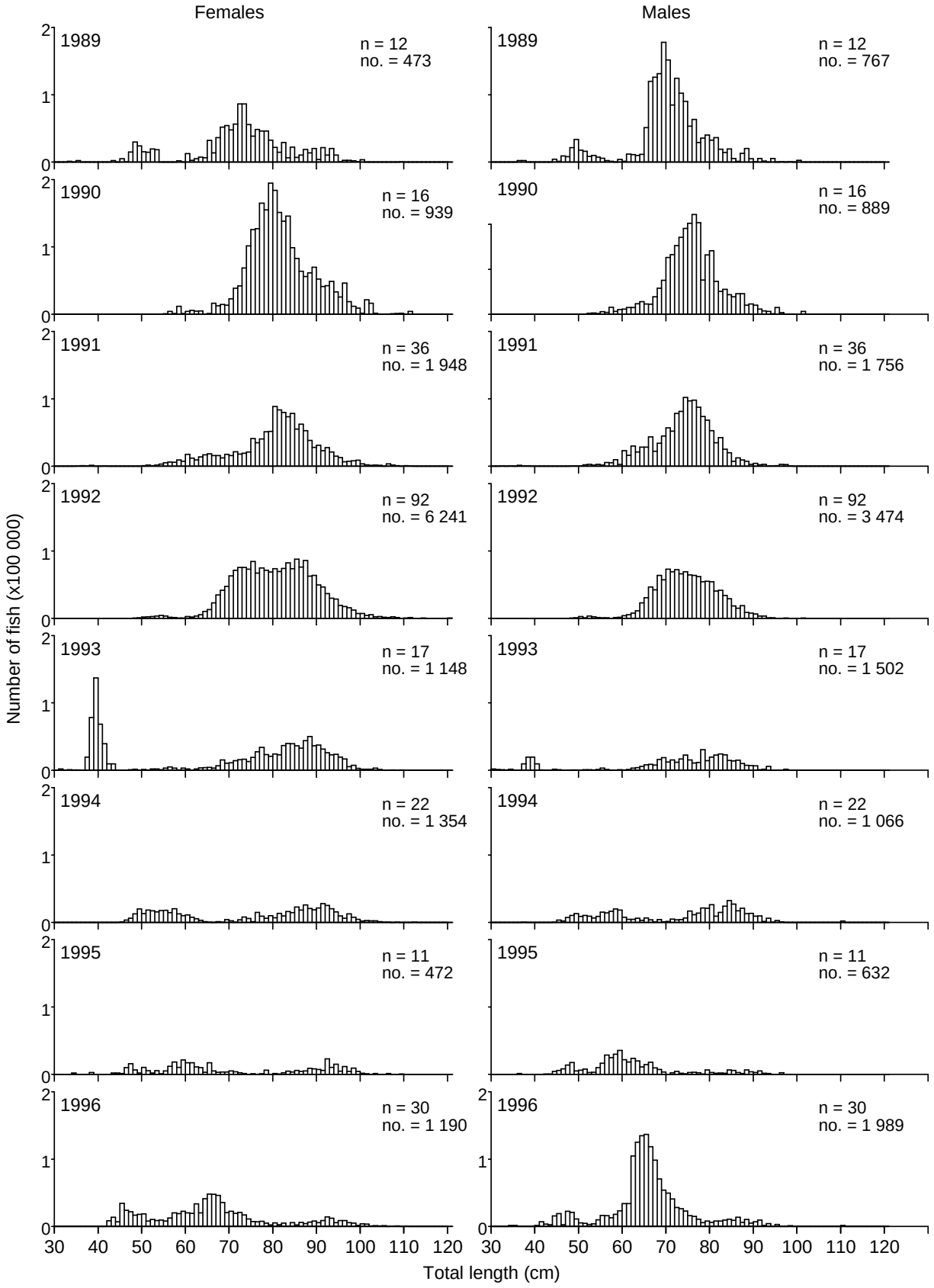

Figure 15: Length frequency of hoki in commercial catches from the Puysegur spawning fishery from 1989 to 1997, and 1999 to 2008 sampled at sea by the Observer Programme. n, number of tows sampled; no., number of fish sampled.

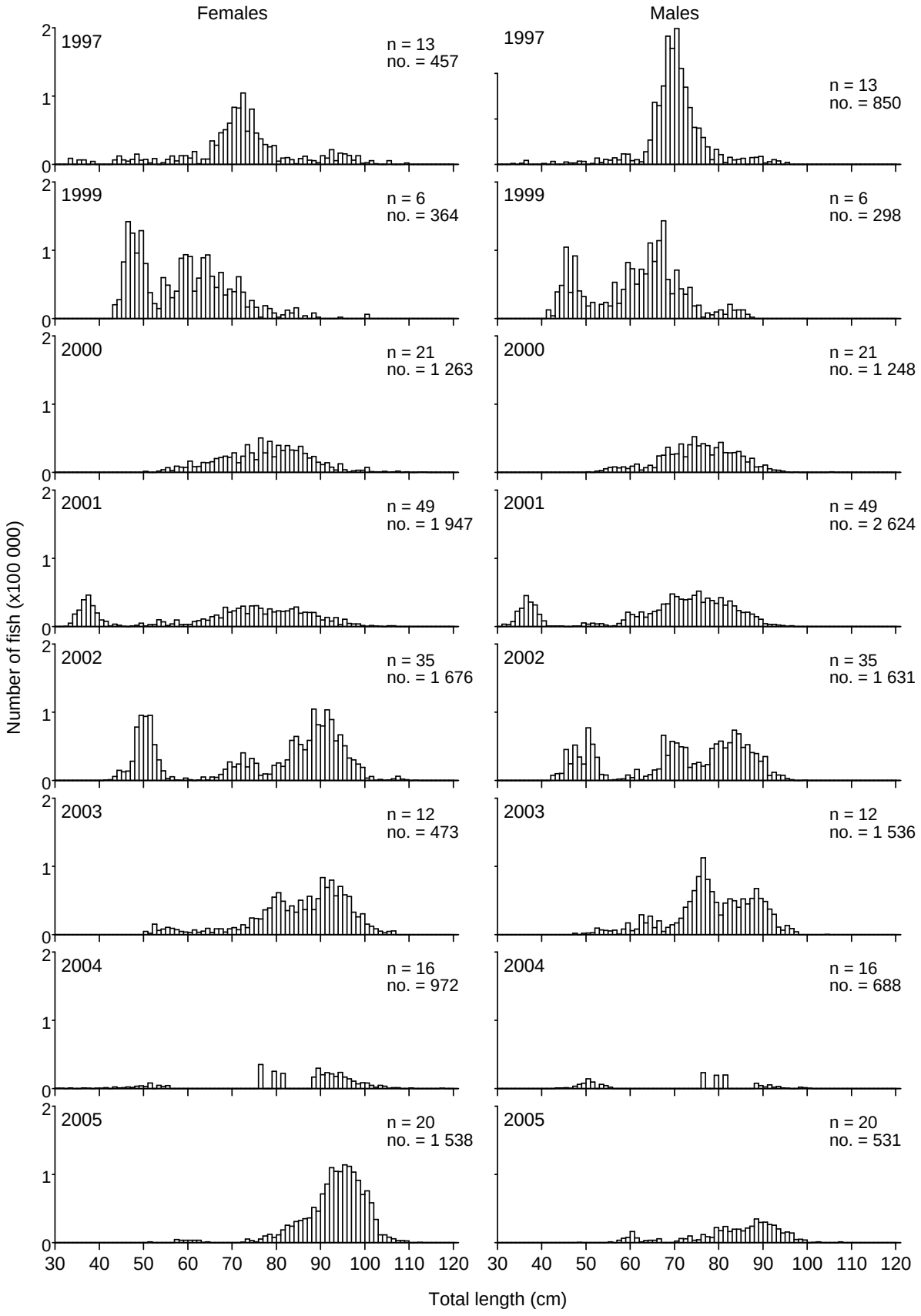

Figure 15: continued.

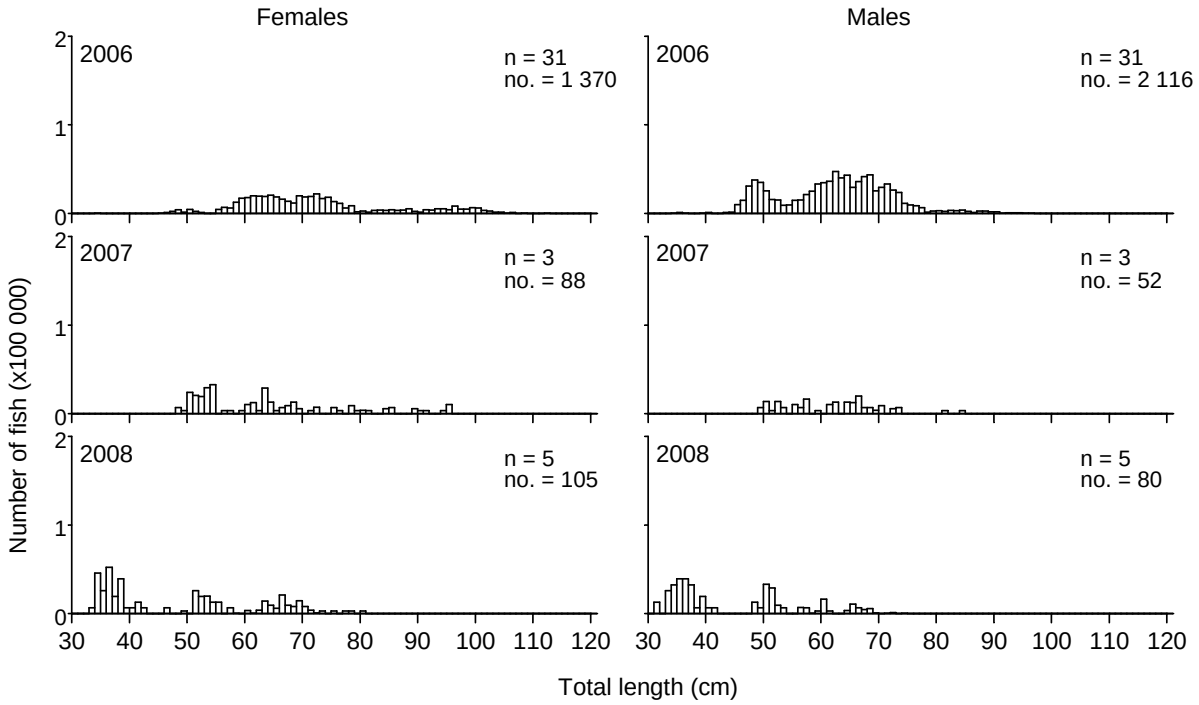

Figure 15: continued.

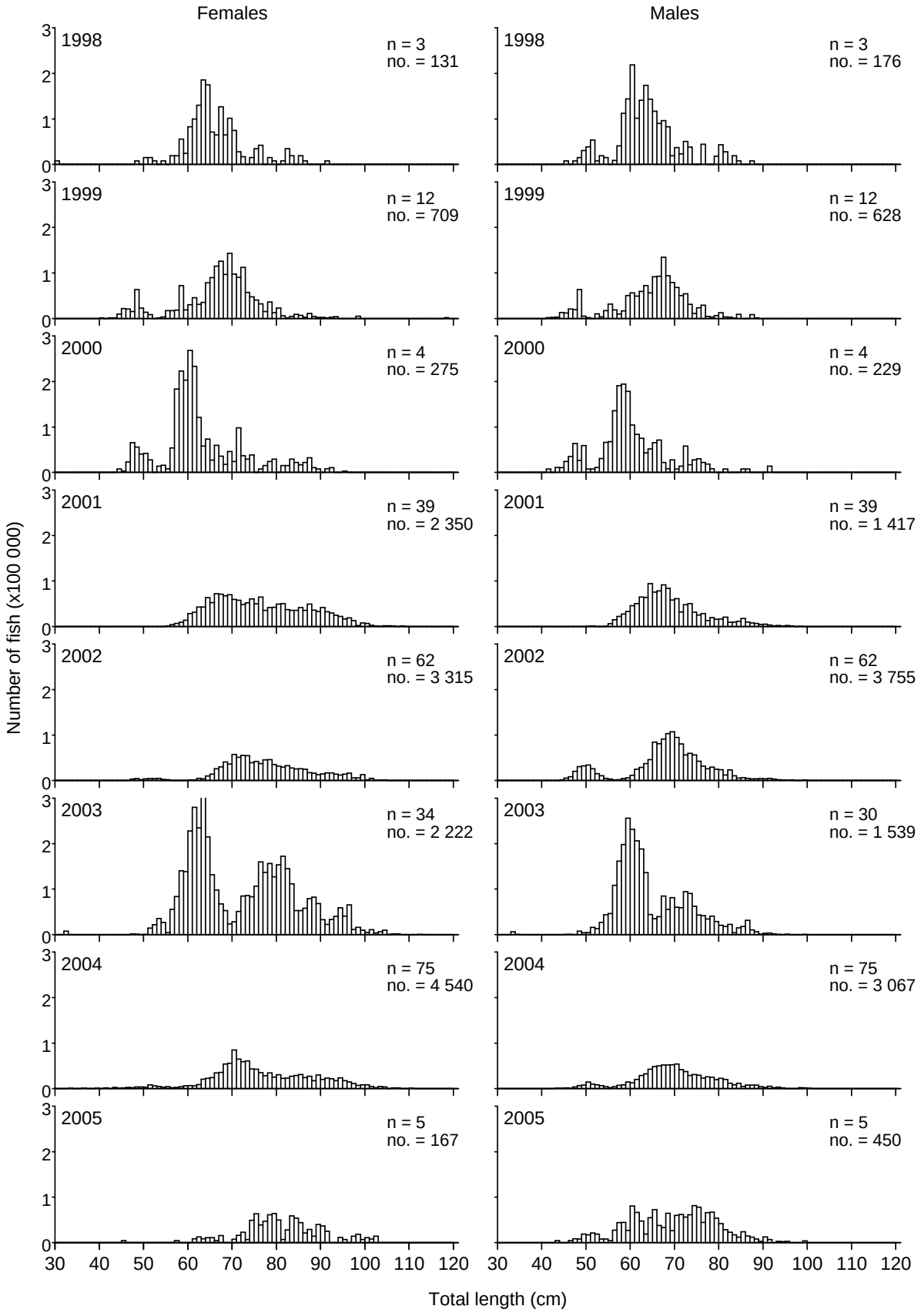

Figure 16: Length frequency of hoki taken in commercial catches from the ECSI spawning fishery from 1998 to 2008 sampled by the Scientific Observer Programme (1998–2006, 2008) and combined with Hoki Management Company data (2001 to 2005). No samples in 2007. n is the number of tows sampled, no is the number of fish sampled.

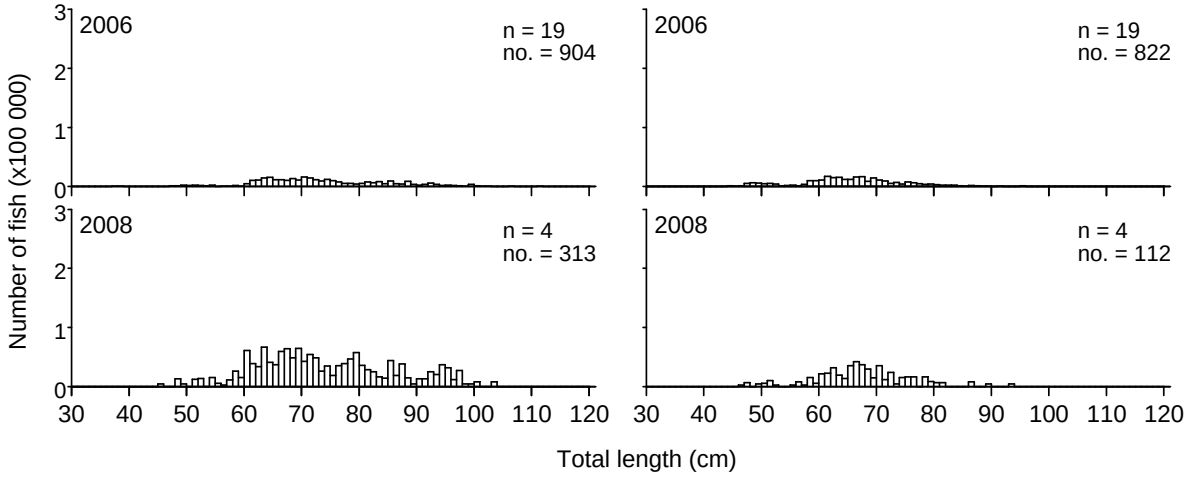

Figure 16: continued.

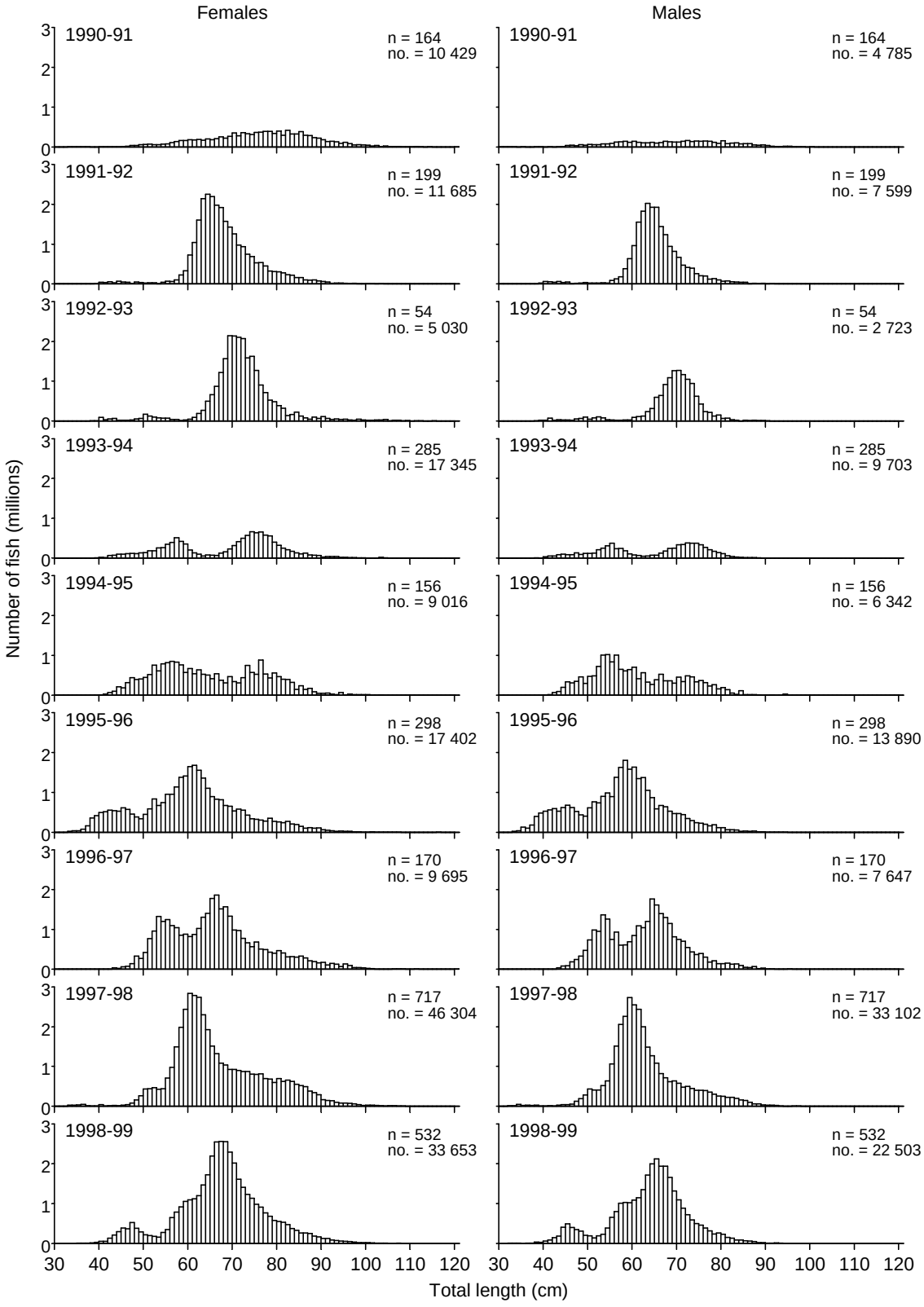

Figure 17: Length frequency of hoki taken in commercial catches from the Chatham Rise fishery from 1990–91 to 2007–08 sampled by the Observer Programme (and combined with Hoki Management Company data in 2000–01 to 2003–04). 2006–07 data only include target hoki or hake tows. n, number of tows sampled; no., number of fish sampled.

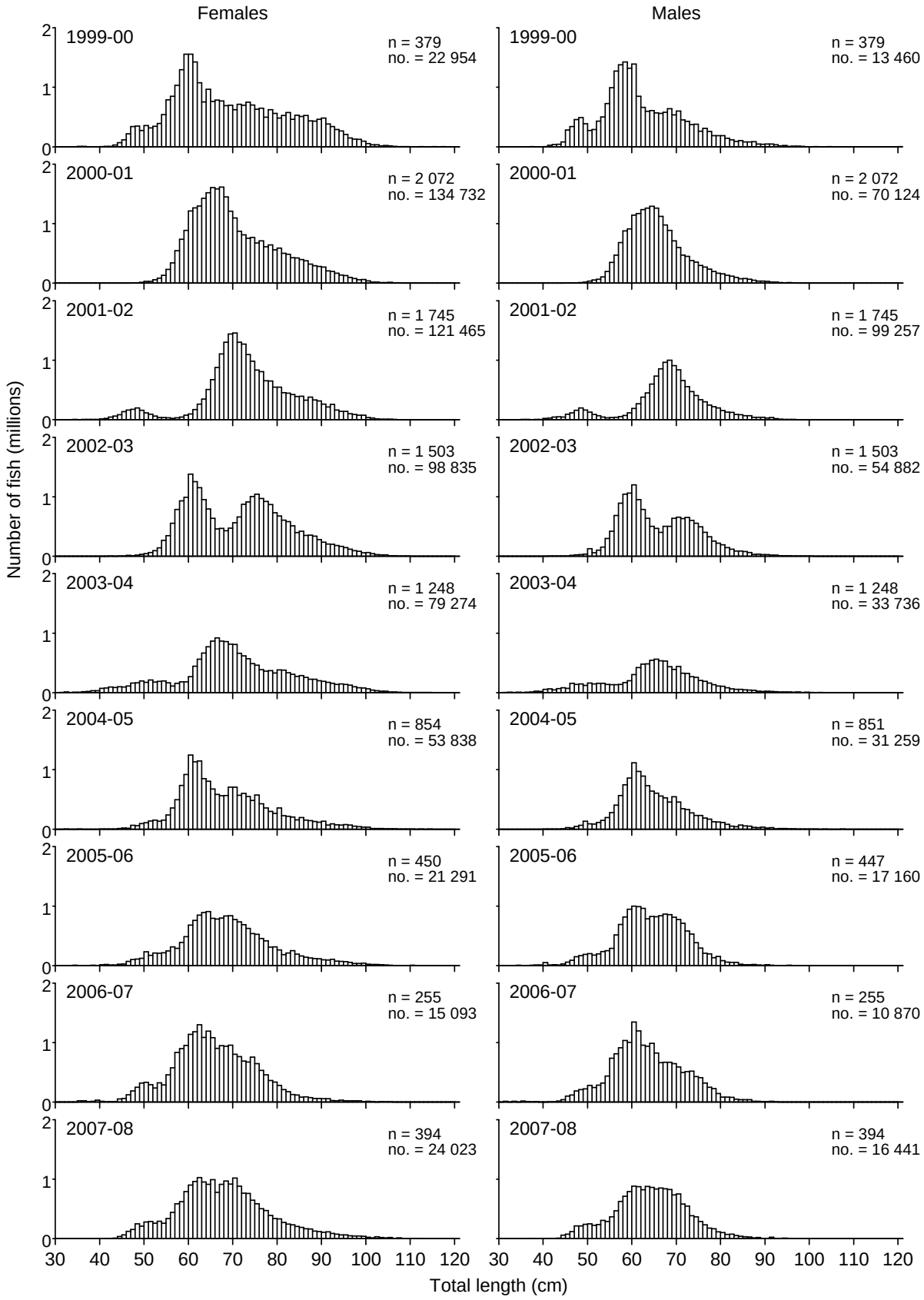

Figure 17: continued.

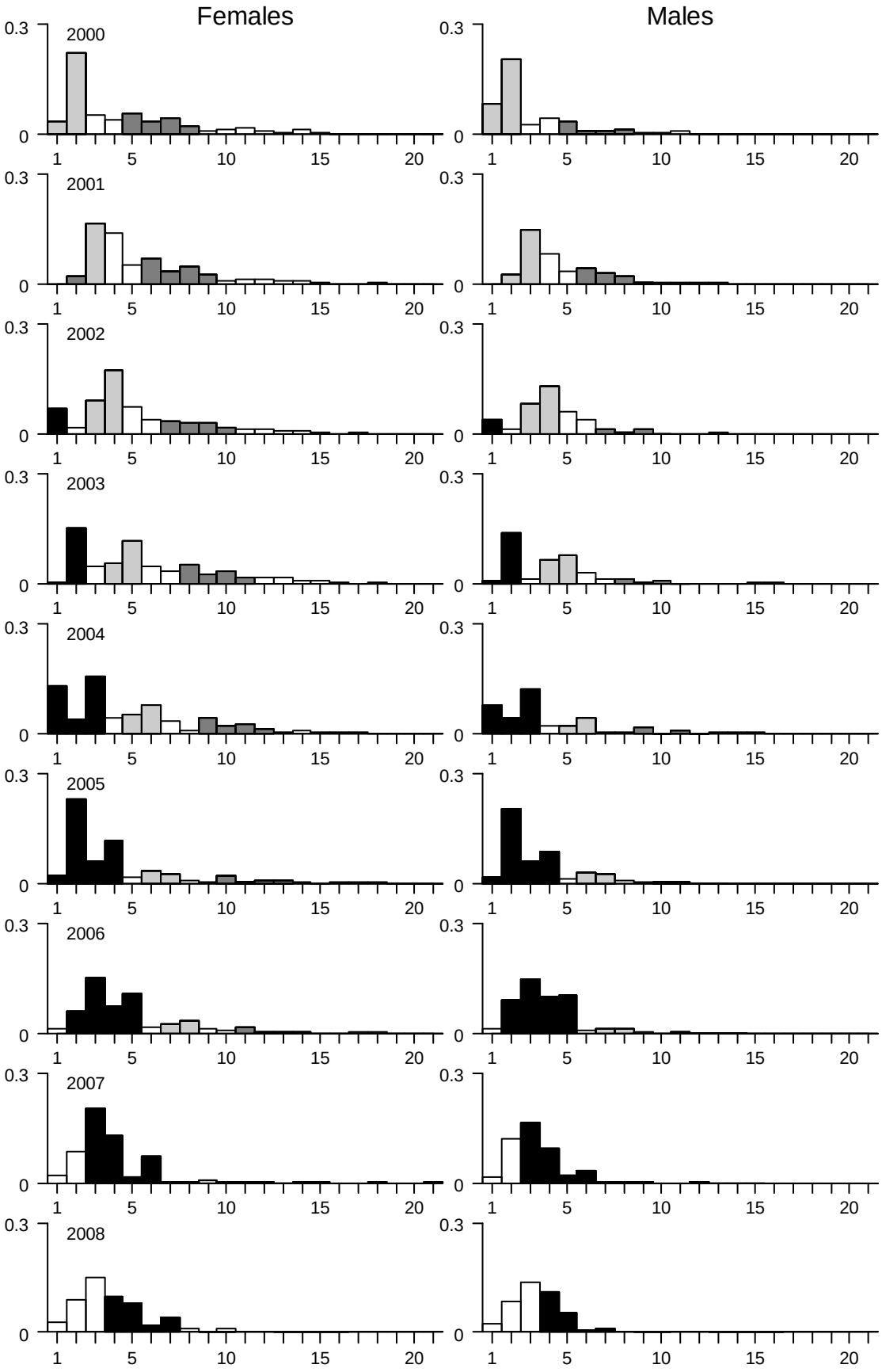

Figure 18: Proportions at age and sex in the catch from the Chatham Rise fishery as estimated by direct ageing of otoliths from 1998–99 to 2007–08. Dark grey bars show 1991–94 year-classes, light grey bars show 1997–98 year-classes, and black bars show 2000–2003 year class.

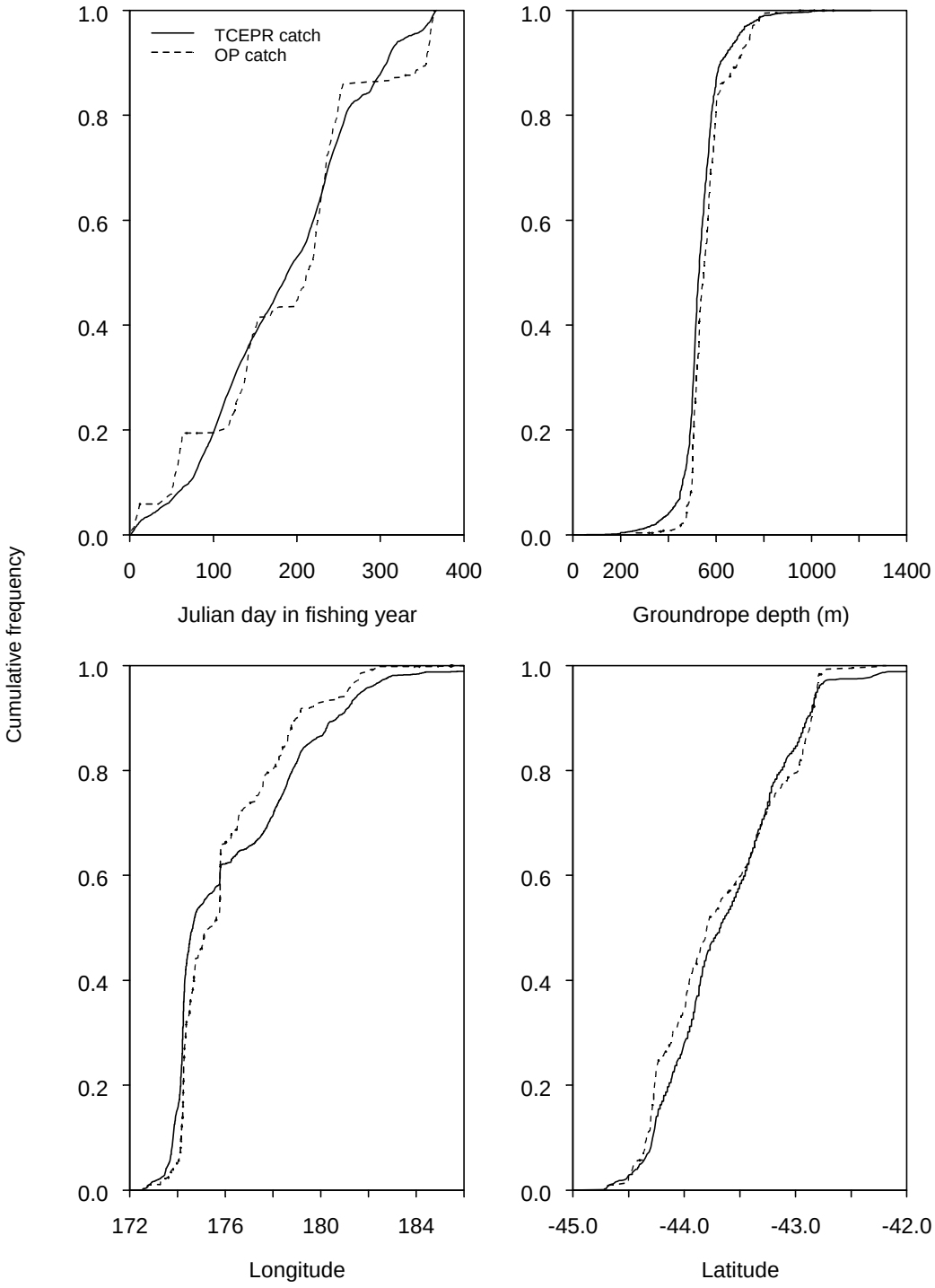

Figure 19: Comparison of Chatham Rise 2007–08 Observer Programme (OP) observer catch coverage with TCEPR catches by day of year, depth, latitude and longitude. If sampling is representative of the fishery, then dotted lines (observed catches) should overlay solid line (TCEPR catch).

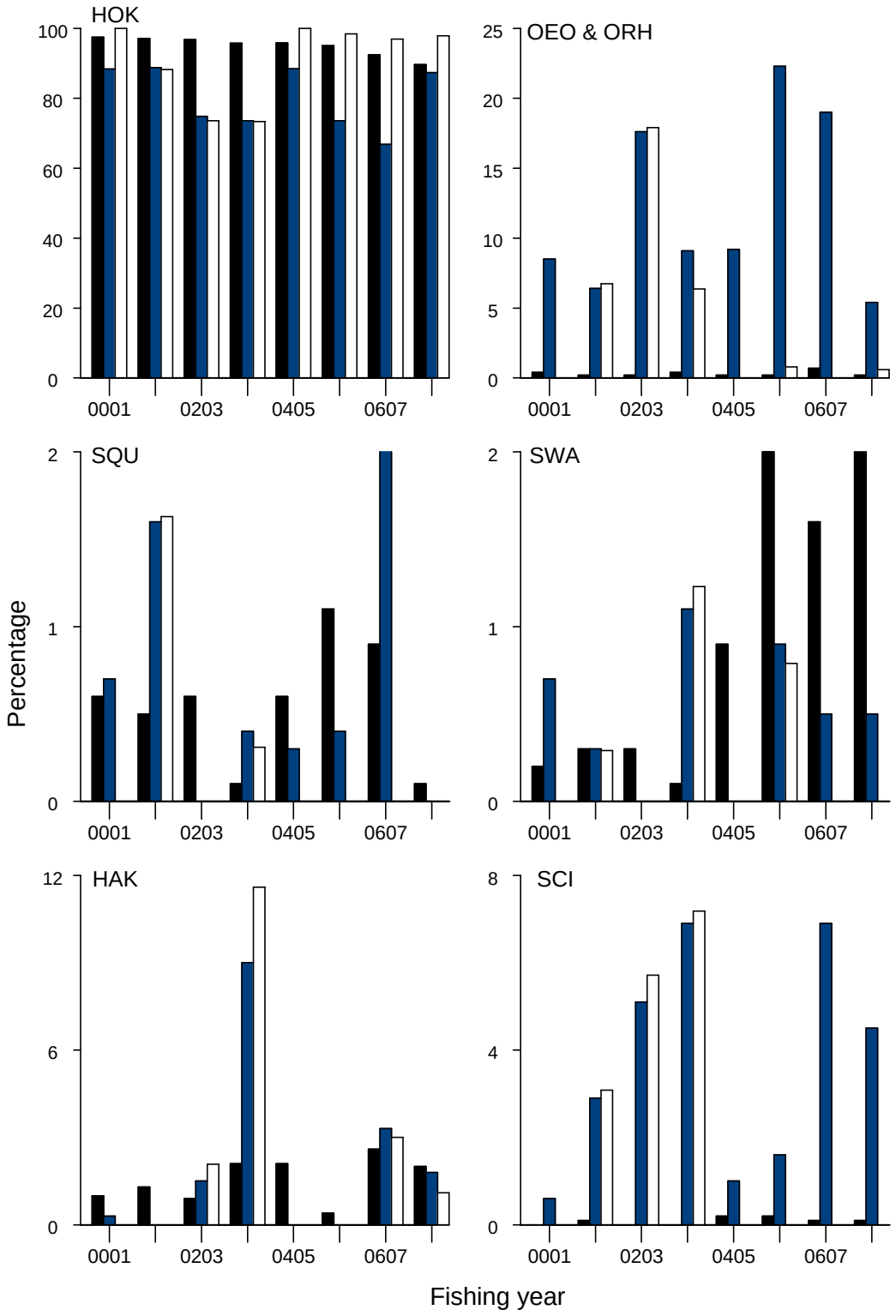

Figure 20: Proportions of hoki TCEPR catch (black bars), hoki length frequencies (shaded bars) and hoki otoliths (clear bars) collected by the Observer Programme by target species for the Chatham Rise fishery from 2000–01 to 2007–08. Three-letter codes denote target species: HOK, hoki; OEO & ORH, oreos and orange roughy; SQU, squid; SWA, silver warehou; HAK, hake; SCI, scampi.

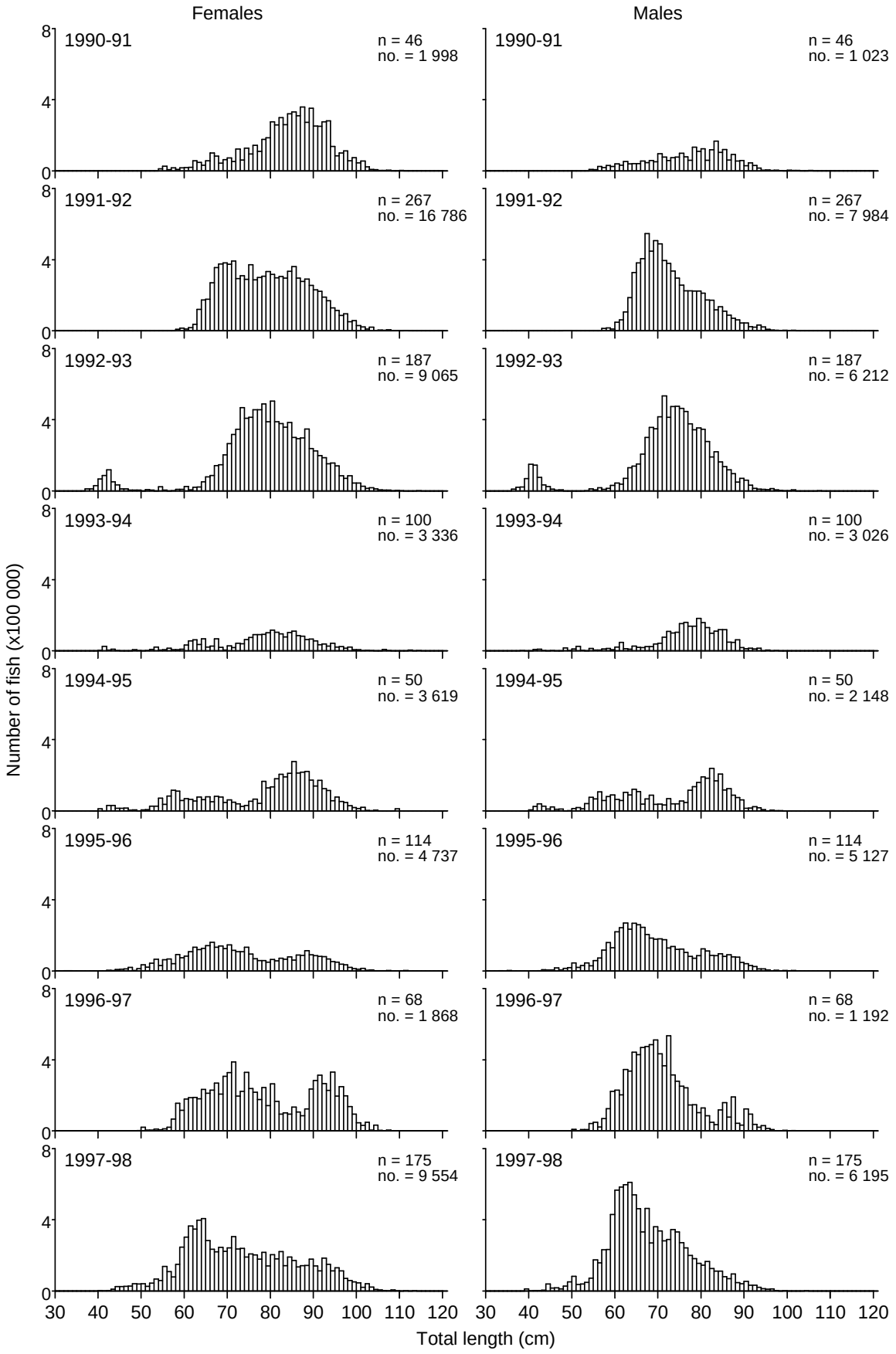

Figure 21: Length frequency of hoki taken in commercial catches from the Sub-Antarctic fishery from 1990–91 to 2007–08 sampled by the Observer Programme (and combined with Hoki Management Company data in 2000–01 to 2004–05). 2006–07 data only includes target hoki or ling tows. n, number of tows sampled; no., number of fish sampled.

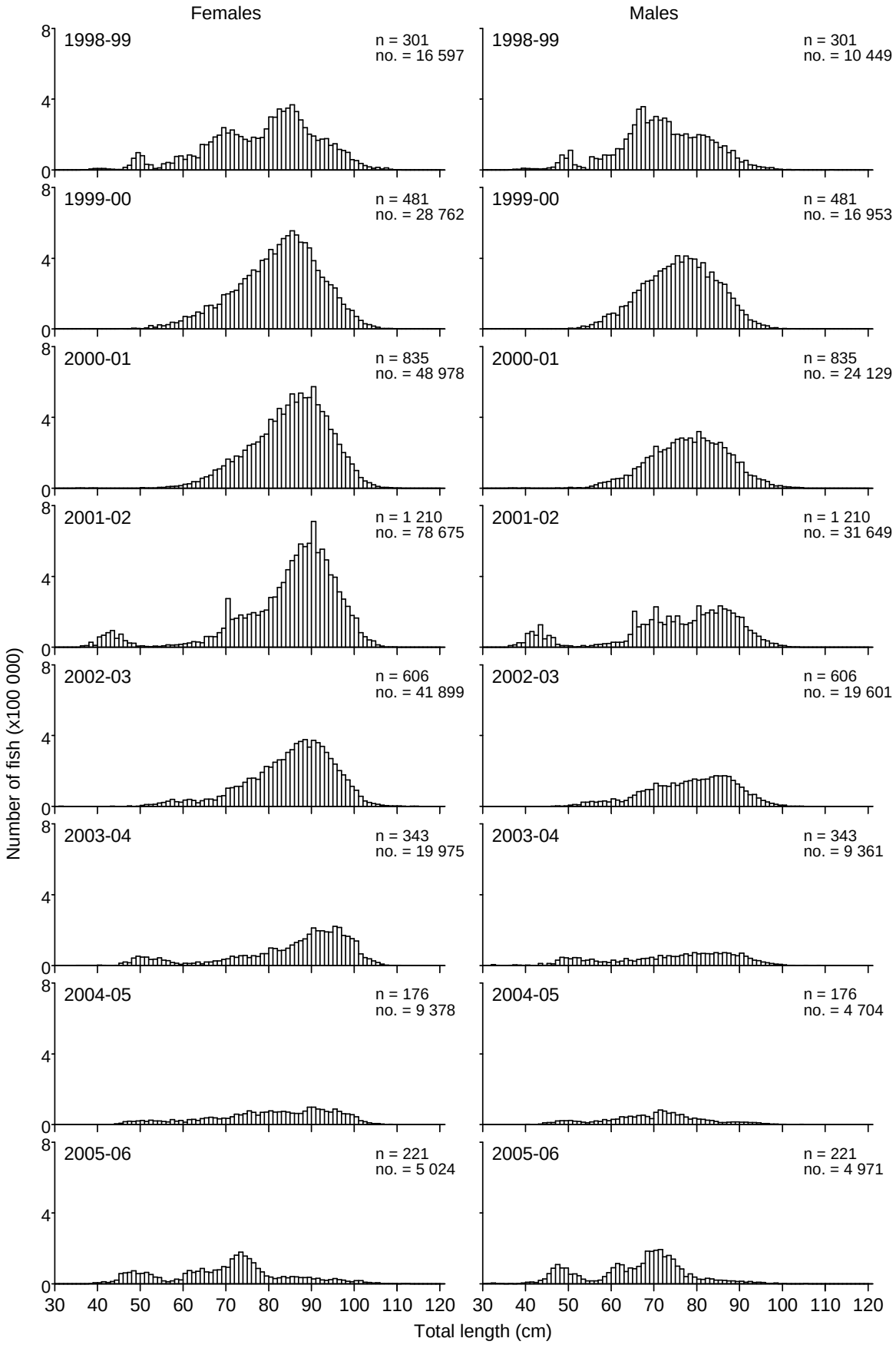

Figure 21: continued.

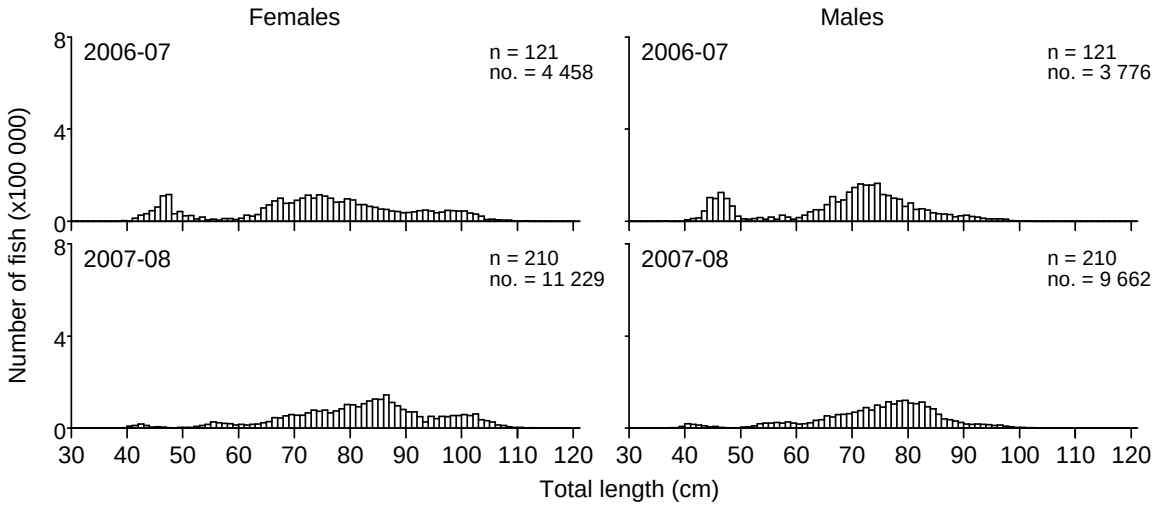

Figure 21: continued.

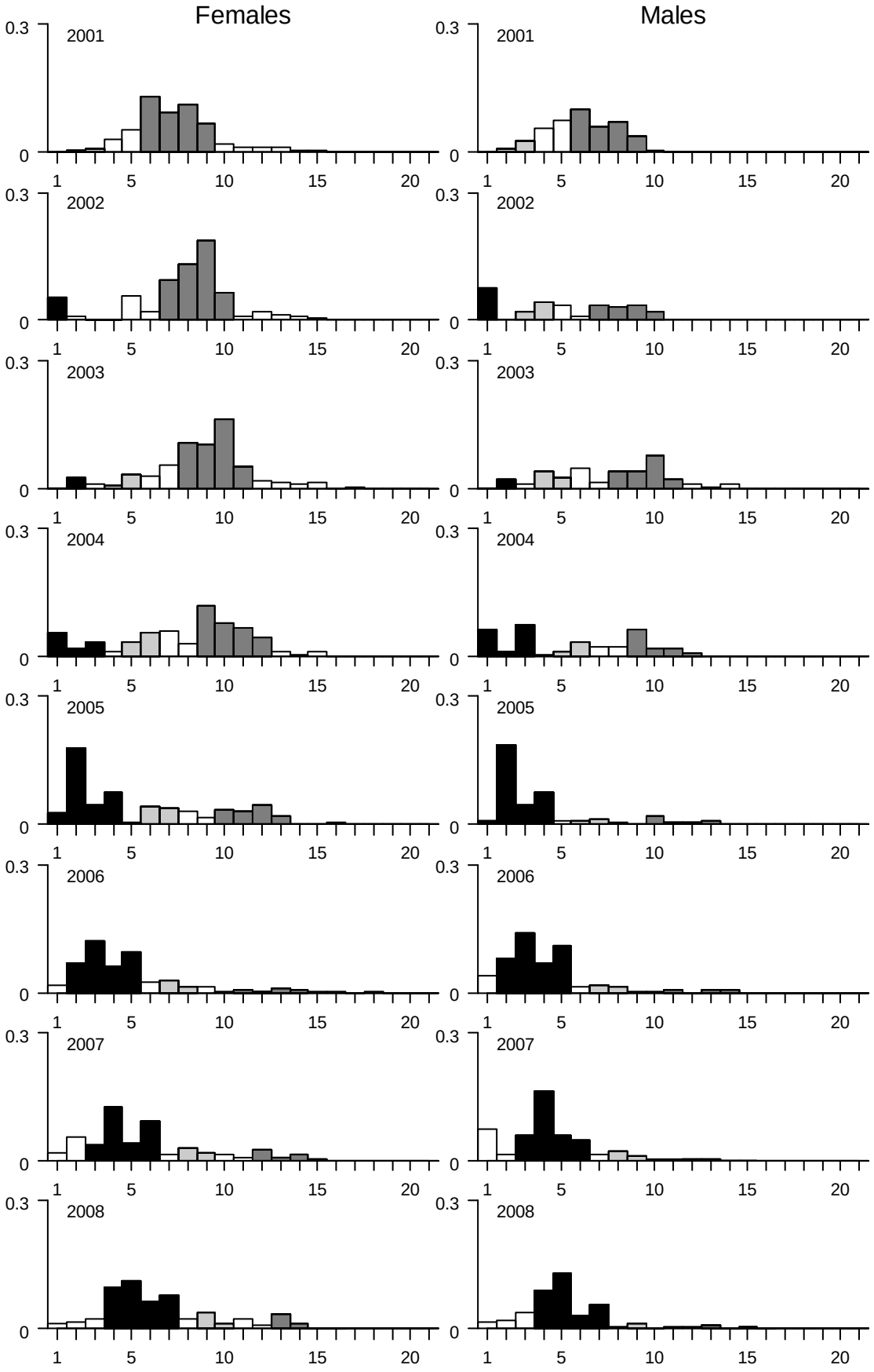

Figure 22: Proportions at age and sex in the catch from the Sub-Antarctic fishery as estimated by direct ageing of otoliths from 2000–01 to 2007–08. Dark grey bars show 1991–94 year-classes, light grey bars show 1997–98 year-classes, and black bars show 2000–2003 year class.

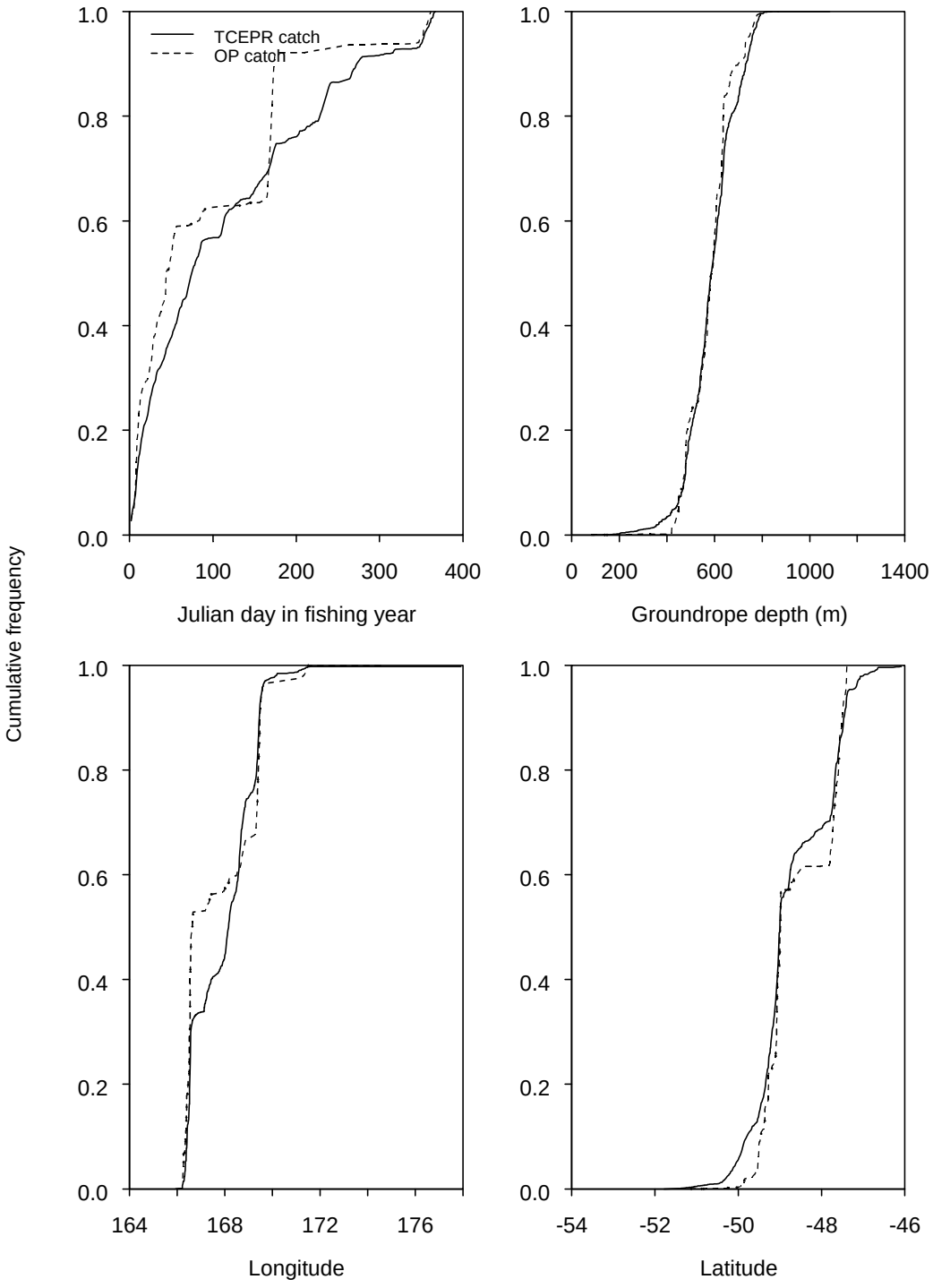

Figure 23: Comparison of Sub-Antarctic 2007–08 Observer Programme (OP) catch coverage with TCEPR catches by day of year, depth, latitude and longitude. If sampling is representative of the fishery, then dotted lines (observed catches) should overlay solid line (TCEPR catch).

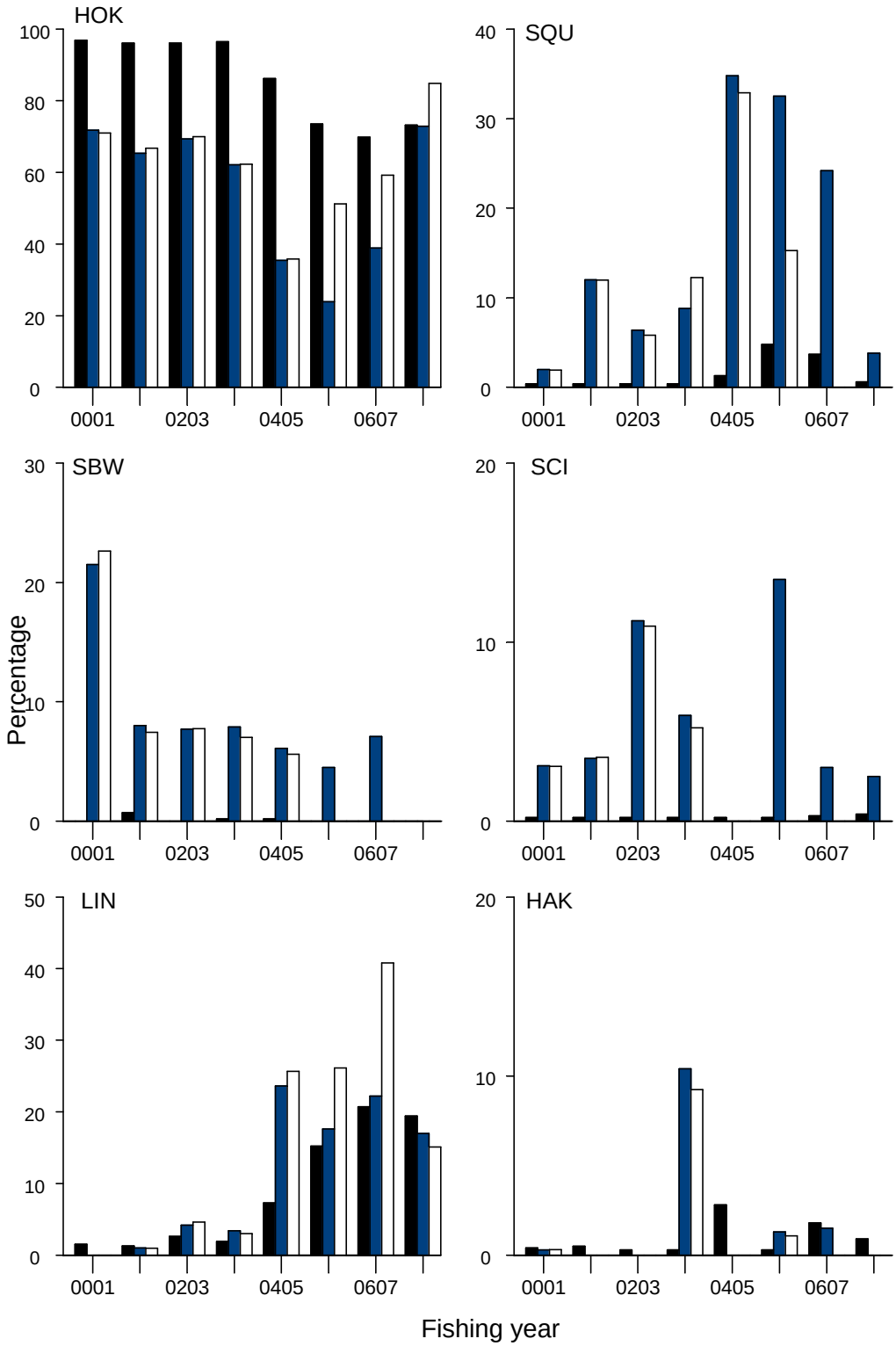

Figure 24: Proportions of hoki TCEPR catch (black bars), and hoki length frequencies (shaded bars) and hoki otoliths (clear bars) collected by the Observer Programme (grey bars) by target species for the Sub-Antarctic fishery from 2000–01 to 2007–08. Three-letter codes denote target species: HOK, hoki; SQU, squid; SBW, southern blue whiting; SCI, scampi; LIN, ling; HAK, hake.

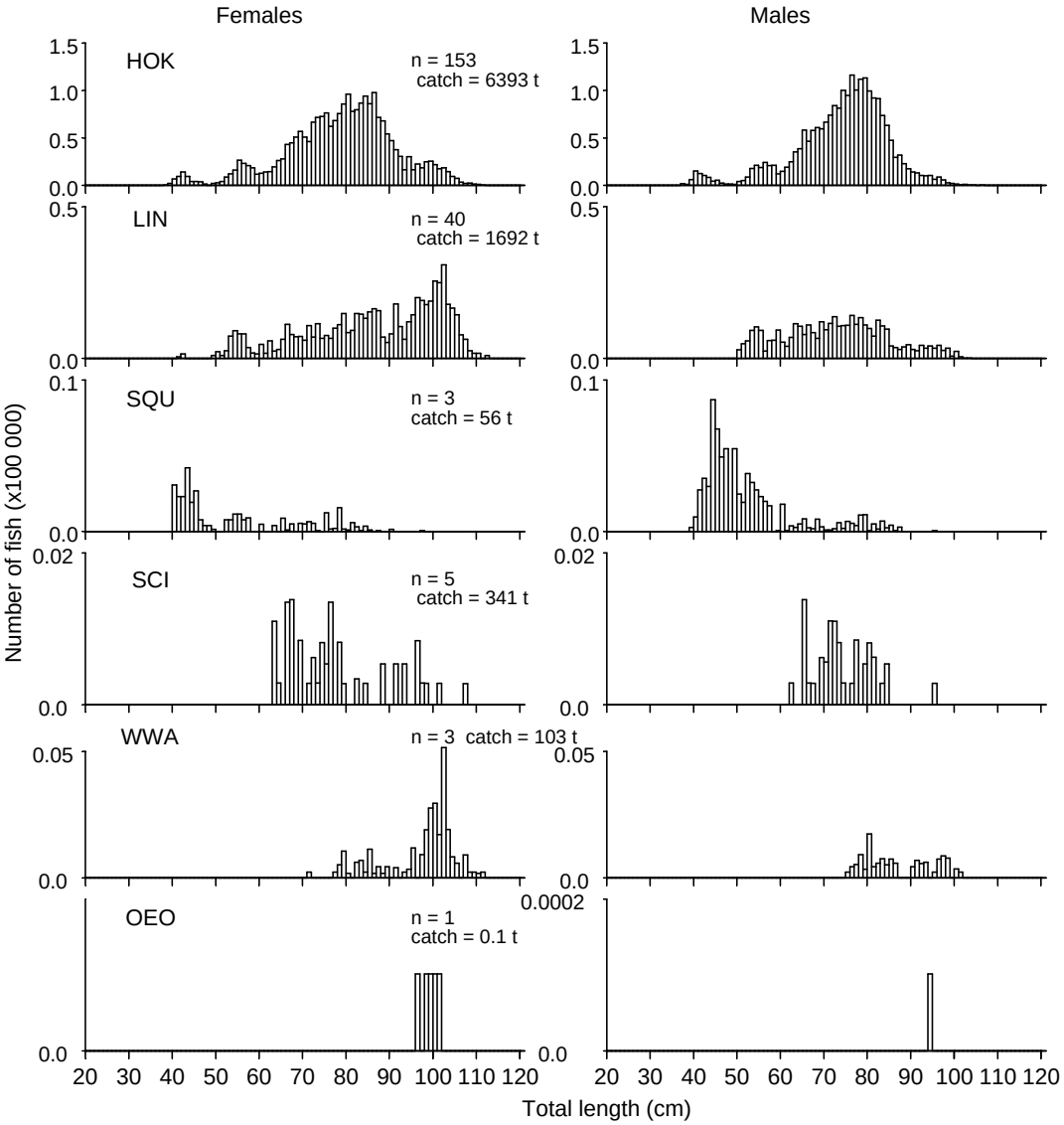

Figure 25: Comparison of length frequency of hoki taken in commercial catches from the 2007–08 Sub-Antarctic fishery sampled by Observer Programme by target species. n, number of tows sampled. Three-letter codes denote target species: HOK, hoki; LIN, ling; SQU, squid; SCI, scampi; WWA, white warehou; OEO, oreos.

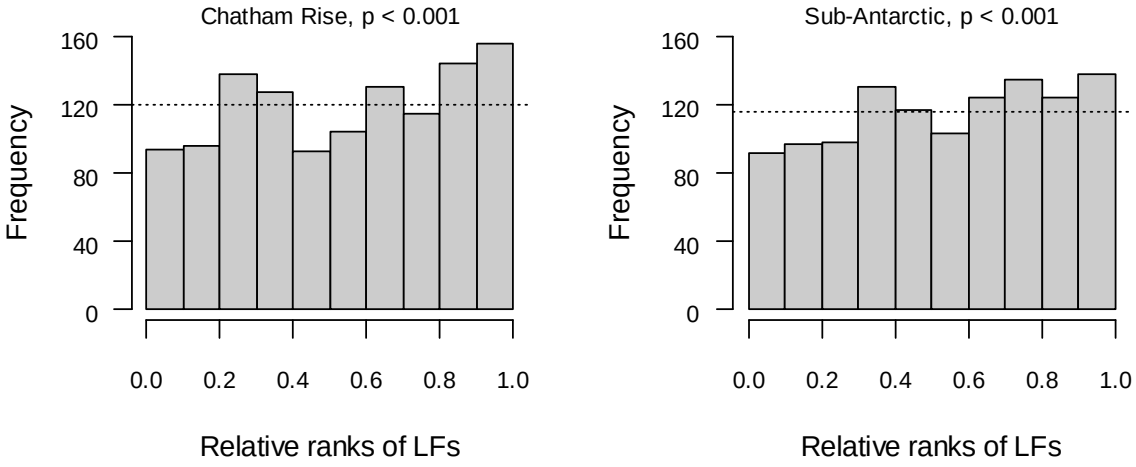

Figure 26: Histograms of the ranks of the lengths of fish that yielded 2007–08 otoliths relative to the lengths of hoki measured for each tow. If sampling is random then the expected counts are given by the dotted line. The p-value is calculated using the rank-sum test.

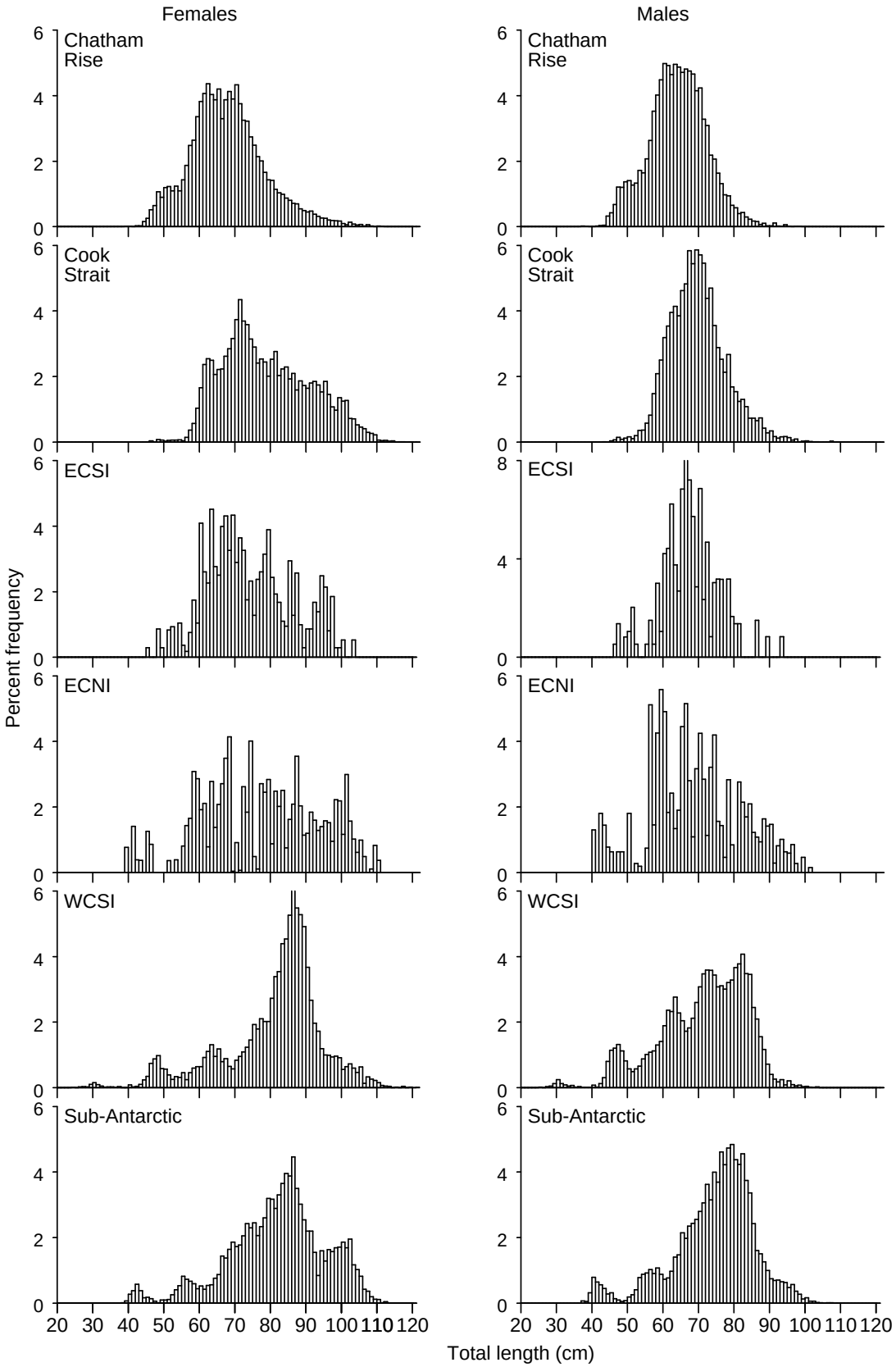

Figure 27: Length frequency of female hoki taken in commercial catches from different areas during the 2007–08 fishing year. Cook Strait and WCSI sampled by the Stock Monitoring Programme and Observer Programme, and other areas sampled only by the Observer Programme.

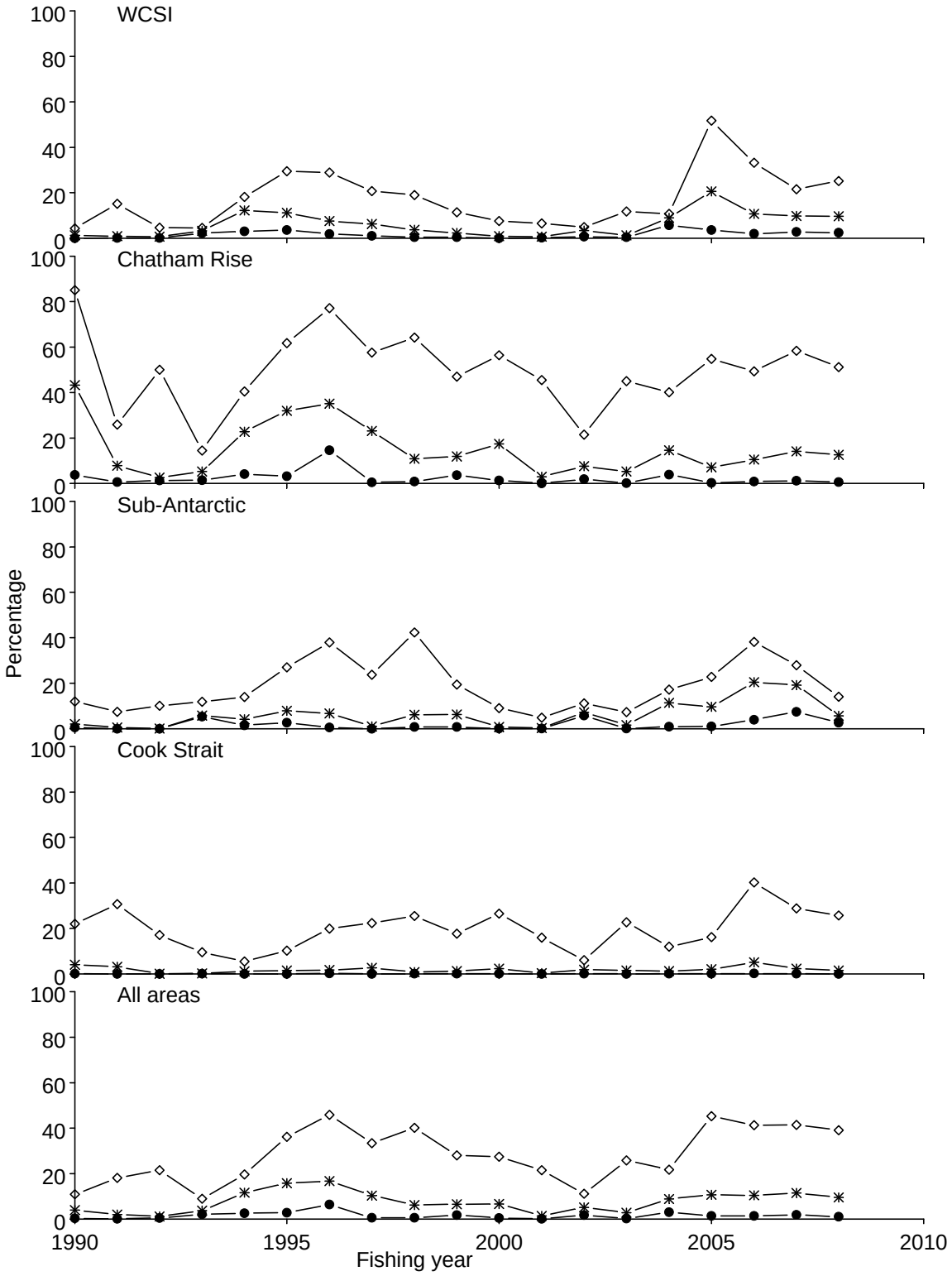

Figure 28: Percentage of small fish in the catch by area and fishing year Closed circle, fish ≤ 45 cm; star, fish ≤ 55 cm, and open diamond, fish ≤ 65 cm.

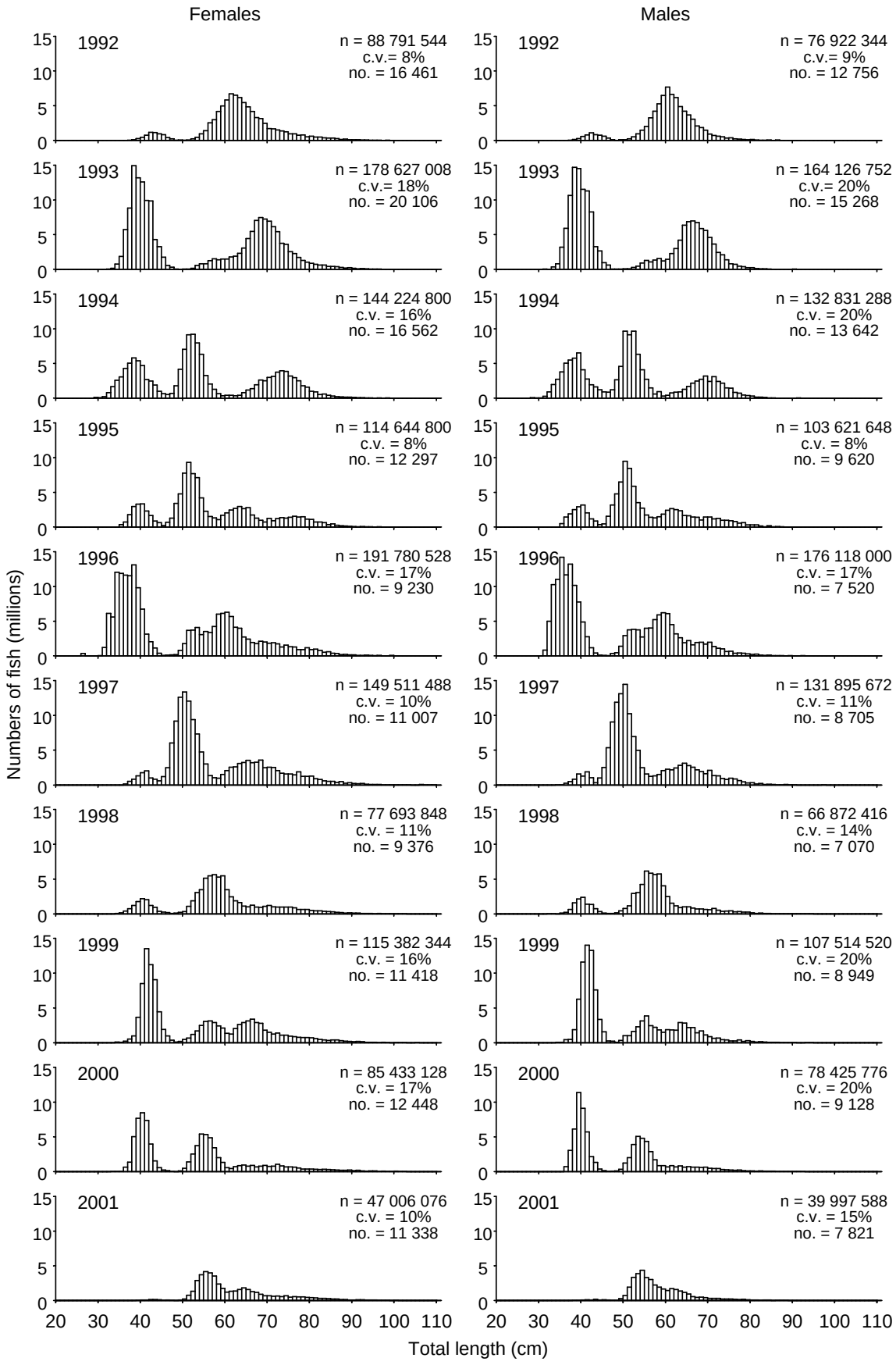

Figure 29: Scaled length frequency for hoki from Chatham Rise *Tangaroa* trawl surveys. n, population numbers of fish; c.v., coefficients of variation; no, number of fish measured.

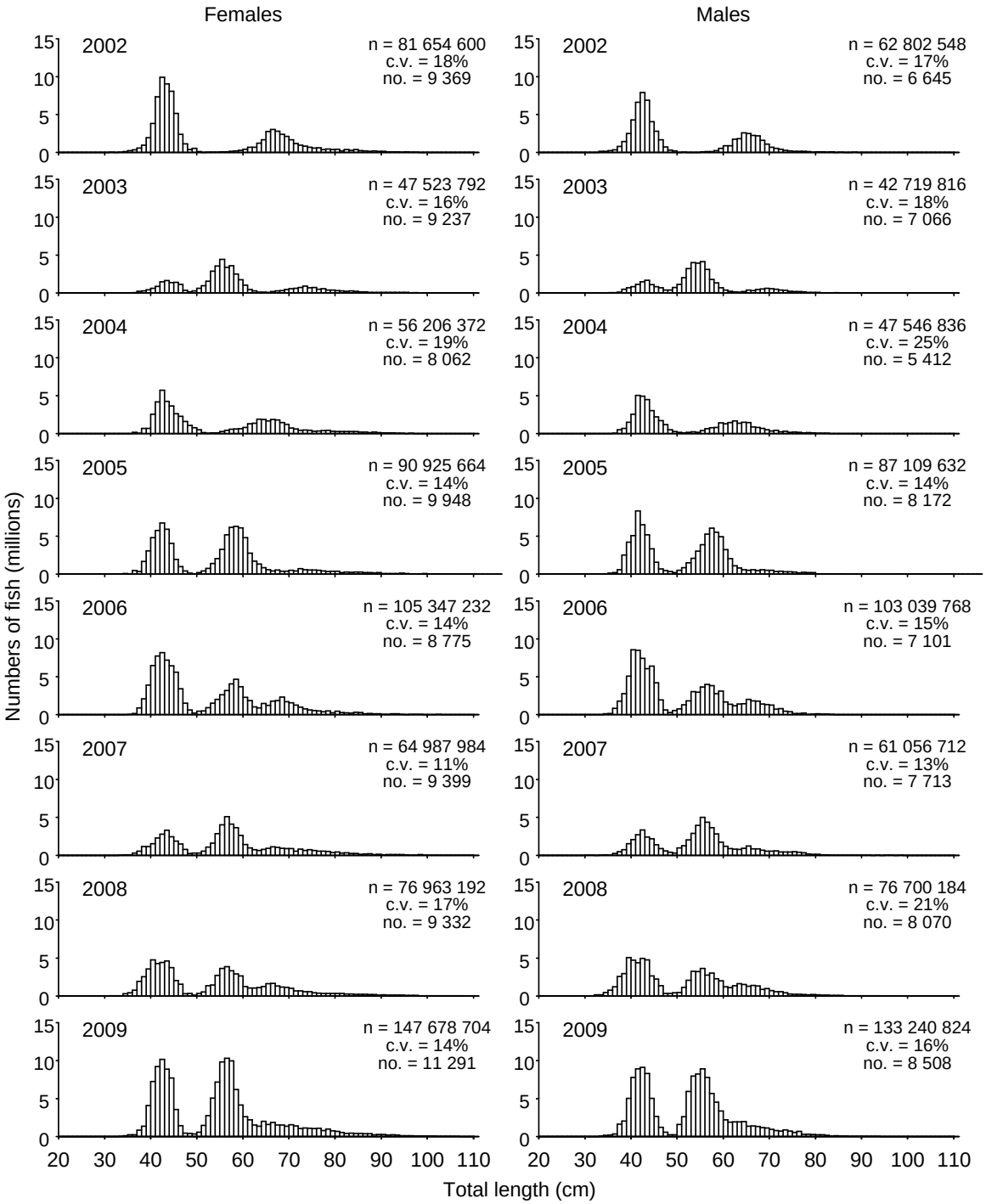

Figure 29: continued.

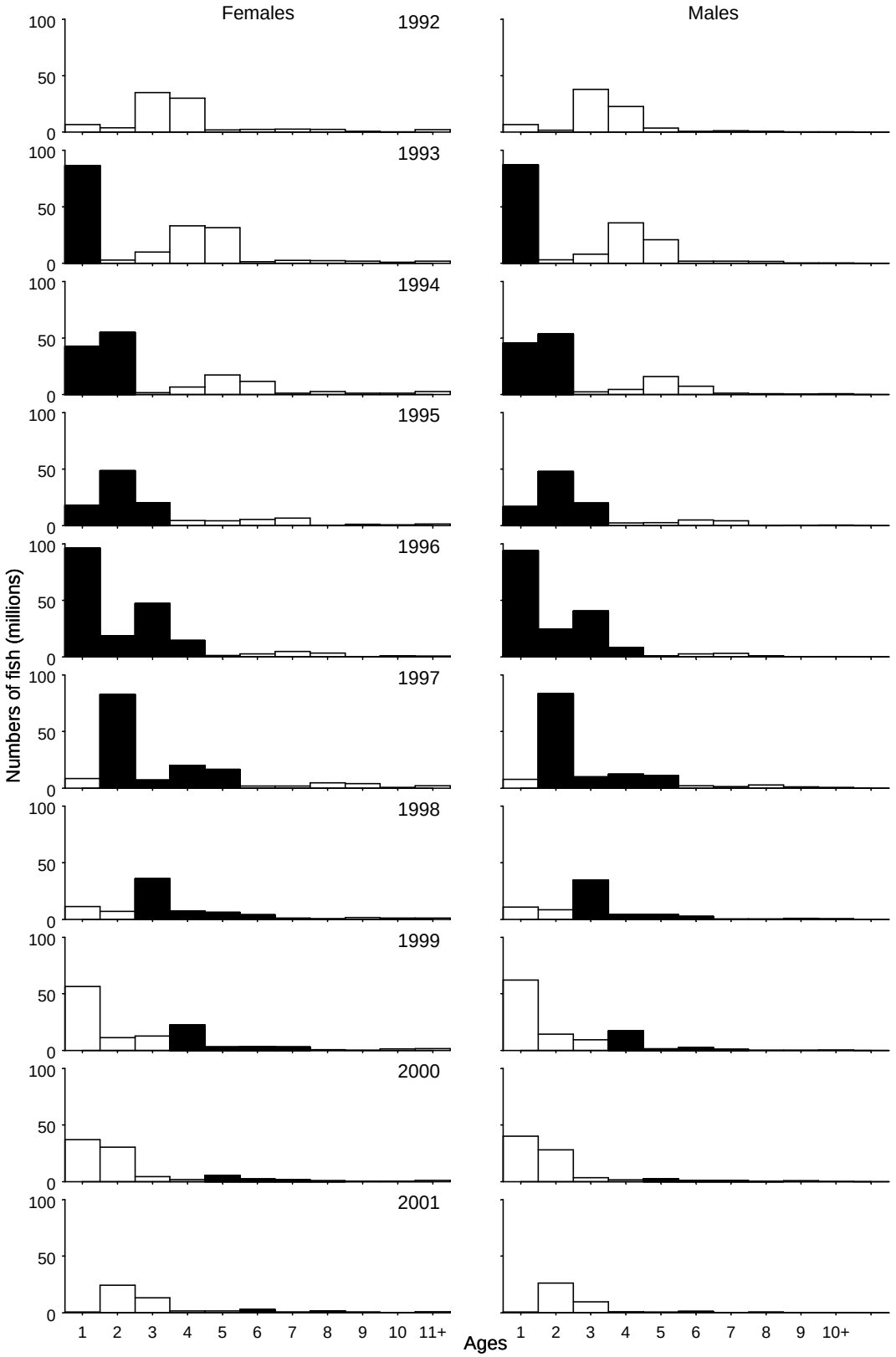

Figure 30: Scaled age frequency for hoki from Chatham Rise *Tangaroa* trawl surveys 1992–2009. Black bars show the 1991–1994 year classes.

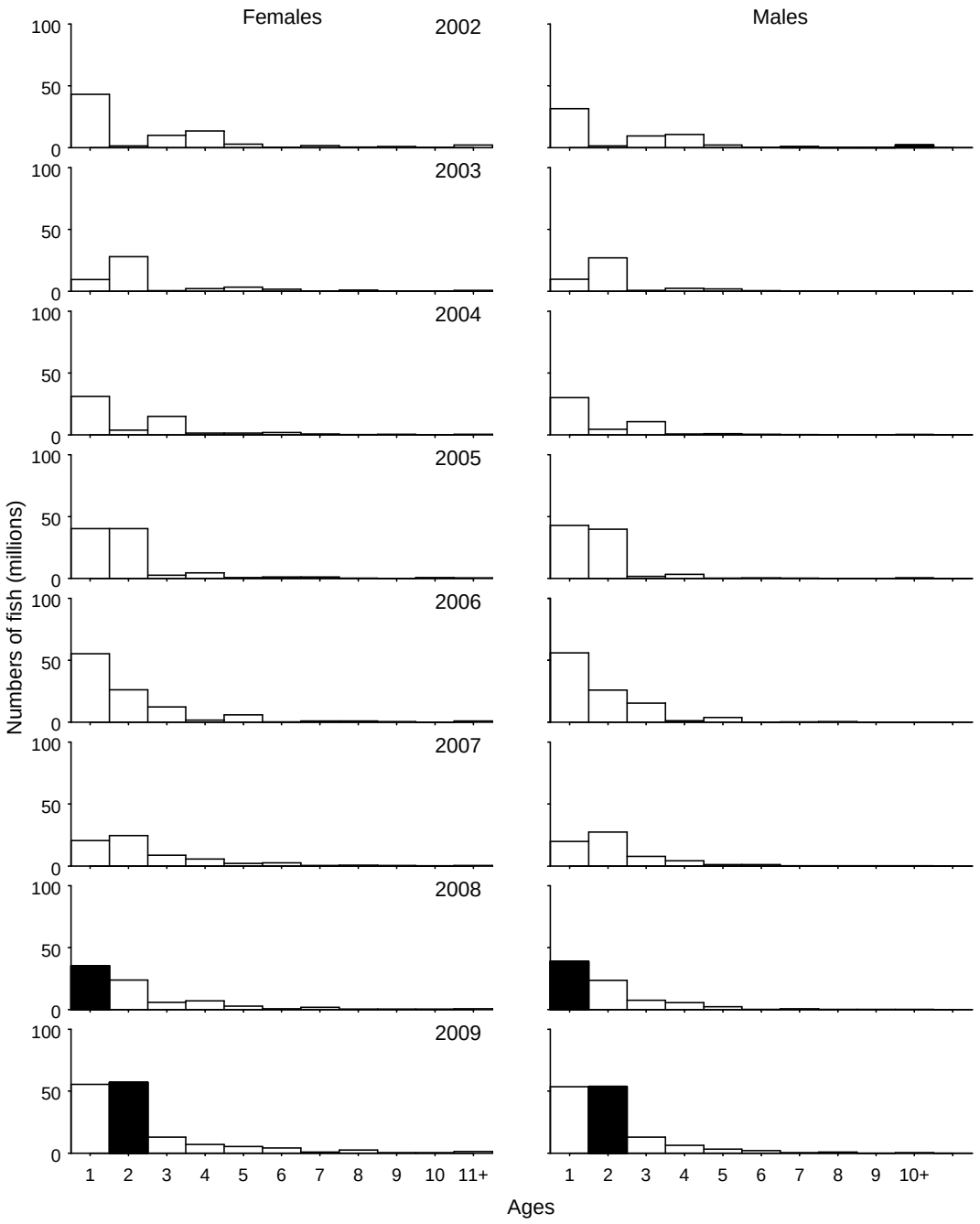

Figure 30: continued. Black bars show the 2006 year class.

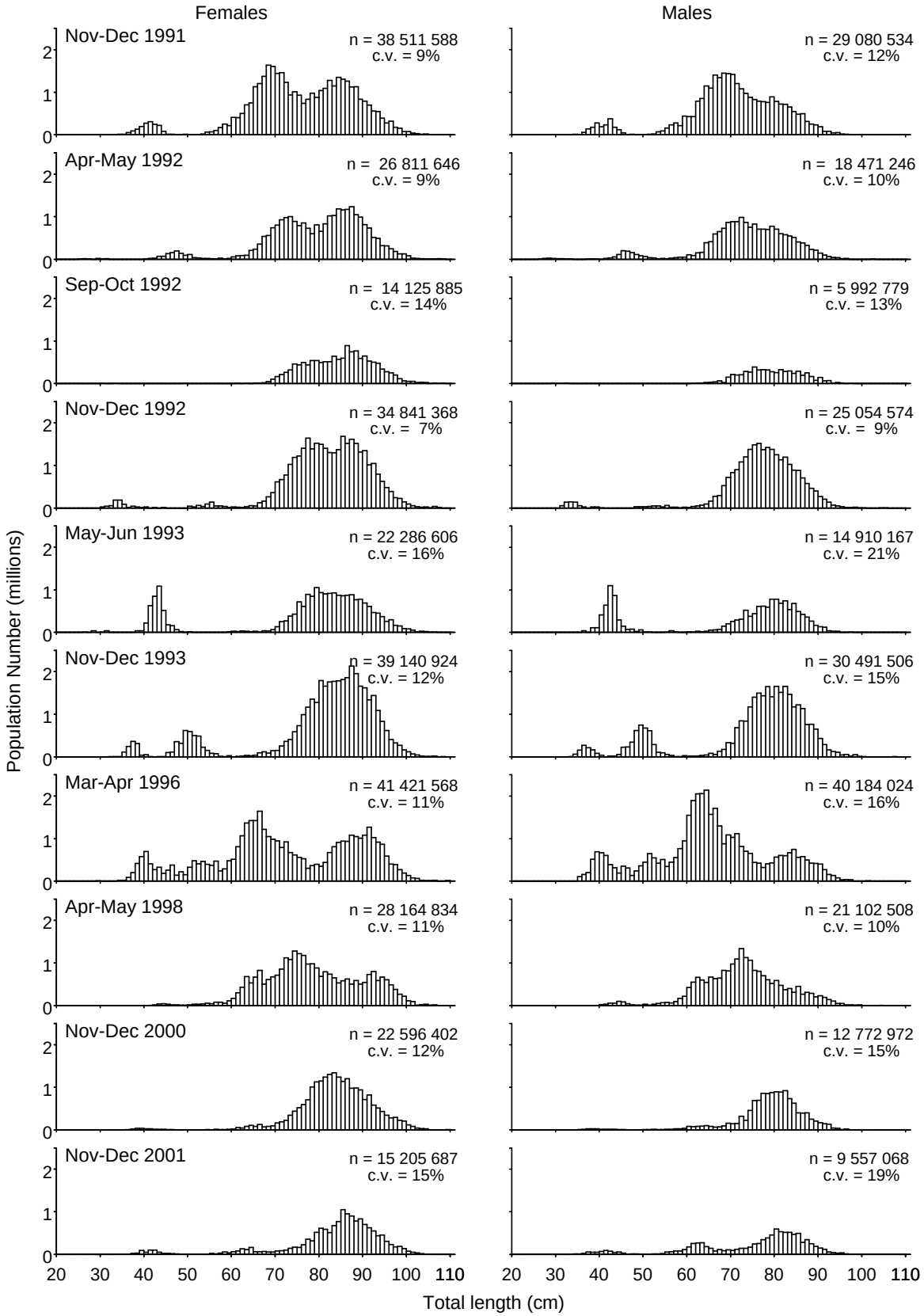

Figure 31: Scaled length frequency for hoki from all Sub-Antarctic *Tangaroa* trawl surveys for the core 300–800 m survey area. n, population numbers of fish; c.v., coefficients of variation.

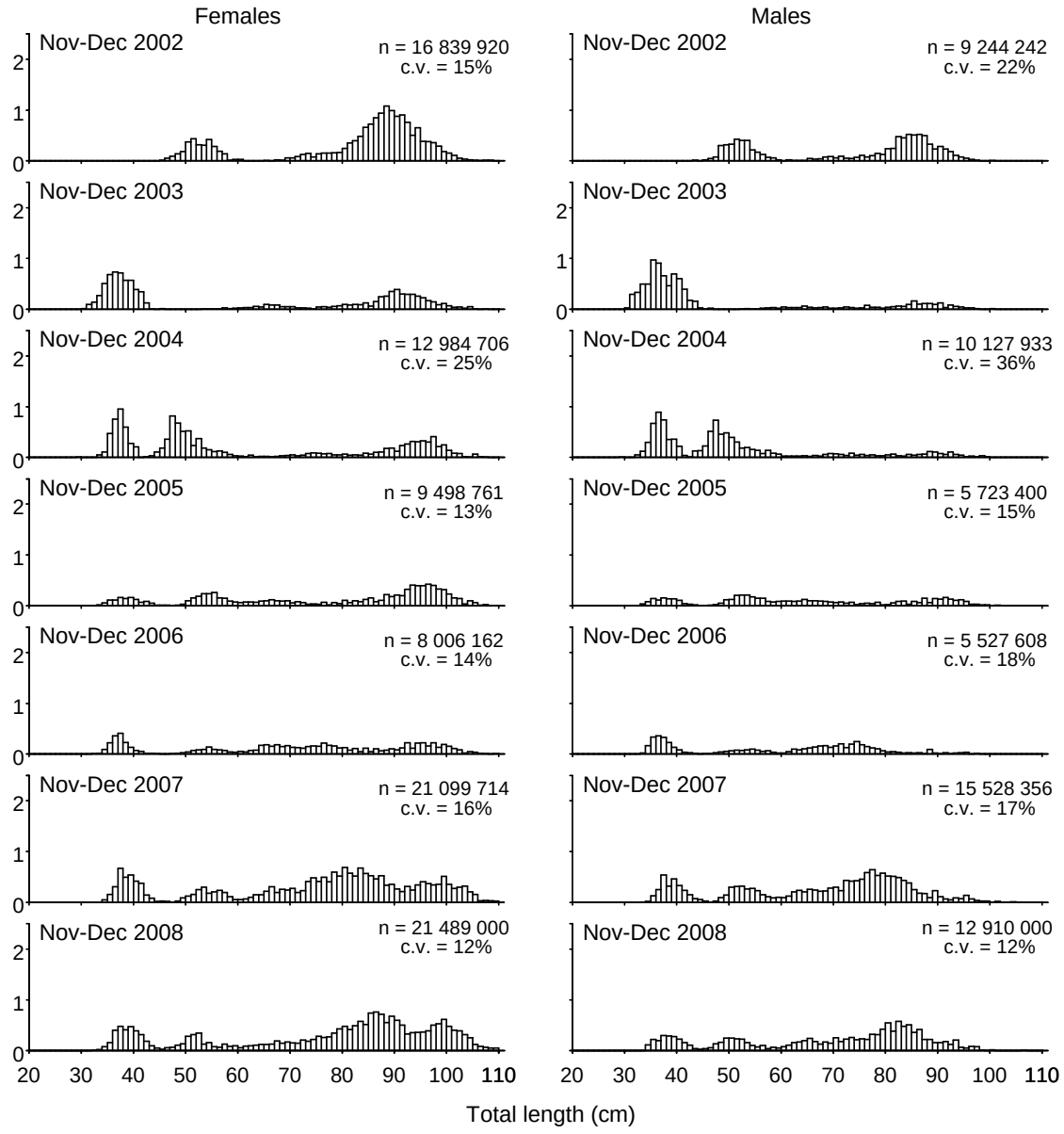

Figure 31: continued.

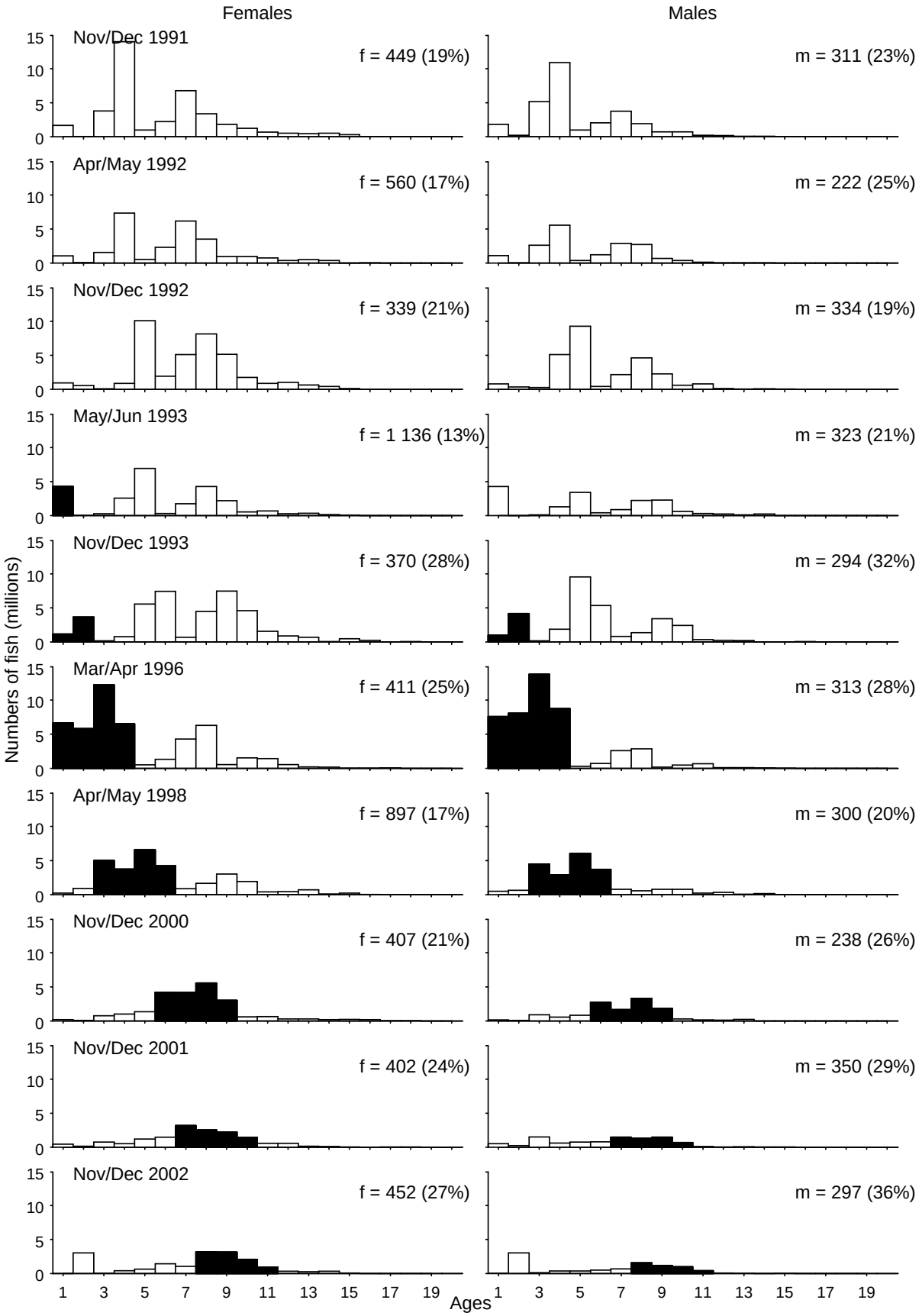

Figure 32: Scaled age frequency for hoki from all Sub-Antarctic *Tangaroa* trawl surveys for the core 300–800 m survey area. Number of fish aged (*f* female and *m* male values) are given with c.v.s in parentheses. Black bars show the 1991–94 year classes.

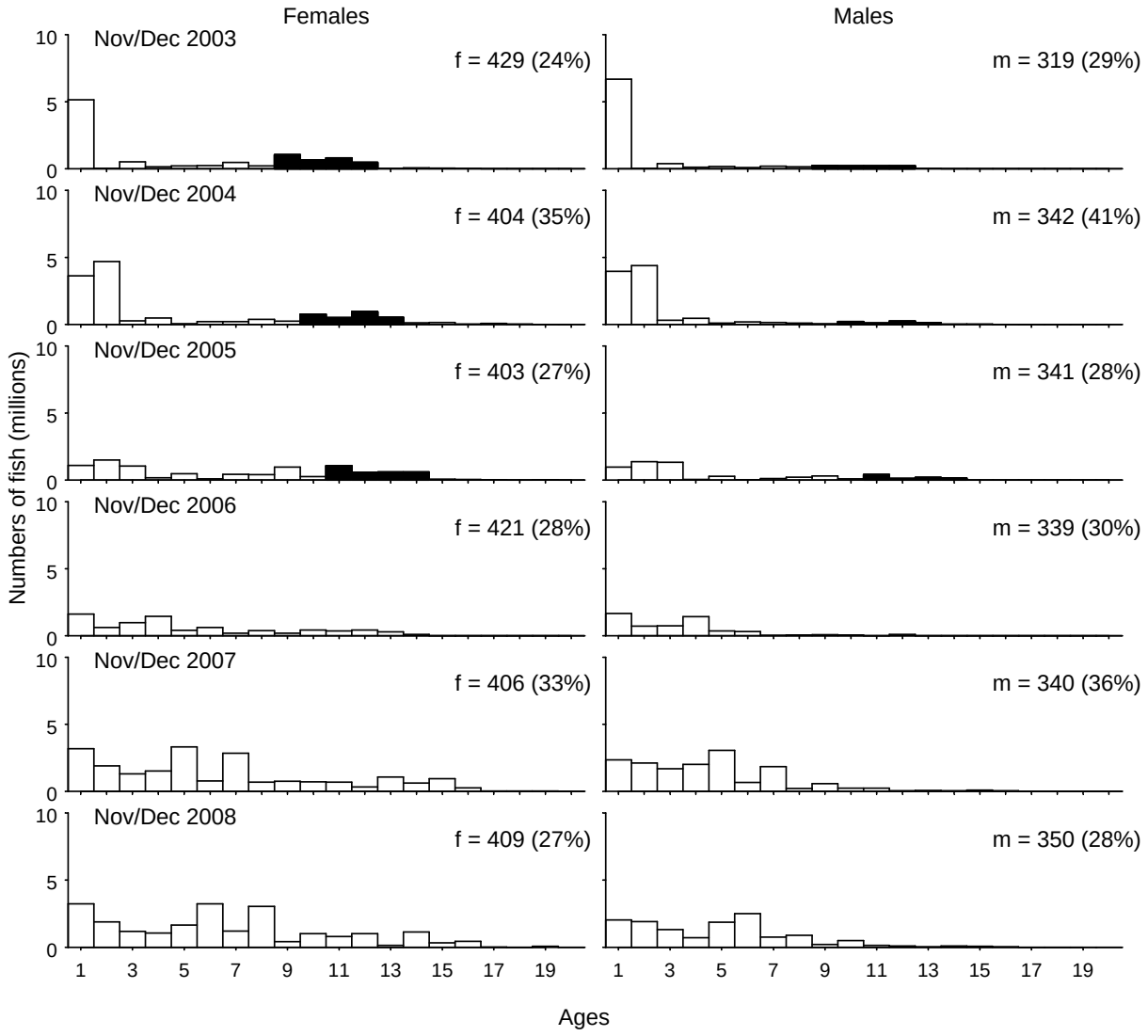

Figure 32: continued.