Summary of observer biological information on the New Zealand black oreo and smooth oreo fisheries from 1979–80 to 2007–08

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EXECUTIVE SUMMARY

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This report summarises black oreo and smooth oreo biological data (total length/sex ratios/otoliths) from 1979–80 to 2007–08. Data were collected mainly by observers from the Ministry of Fisheries Observer Programme (OP) but some samples came from fishing industry funded groups including the Orange Roughy Management Company (ORMC) before 2003–04 and the Deepwater Group (DWG) from 2005–06. Analyses were carried out for each main oreo fishery and the remaining data were pooled and analysed within each of the main quota management areas. Expected and actual levels of observer coverage for oreos by management area and proportion of oreo catch sampled by observers by fishing area are provided. For both species, annual length data were tabulated to provide number of tows sampled and number of fish measured (usually about 100 fish per sample). For the main black oreo and smooth oreo fisheries mean length by year, scaled by catch weight and a measure of confidence in it were calculated.

The main results were as follows.

In 2007–08:

- The number of samples obtained by the Observer Programme exceeded the planned numbers in OEO 3A/4 (193 achieved, 175 planned) and OEO 6 (322 achieved, 130 planned), and was less than planned in OEO 1 (25 achieved, 45 planned).
- Many black oreo (192) and smooth oreo samples (124) were taken in the Pukaki Rise fishery and this was the best sampled oreo fishery.
- Smooth oreo samples from OEO 4 were maintained at high levels (152) and this remained the second best sampled oreo fishery.
- Compared to recent years more black oreo (32) and smooth oreo (24) samples were taken in OEO 3A but there were fewer samples from Southland (12 and 13 respectively).
- Bounty Plateau smooth oreo samples (14) declined compared to previous years.
- Good numbers of black oreo otoliths were collected only from Pukaki Rise (1335) and smooth oreo otoliths from OEO 4 (1042) and Pukaki Rise (470).

Summary of main trends in observer sampling for the last three years. Major changes in bold.

Black oreo	OEO 3A		OEO 4		Southland		Pukaki Rise	
	% catch	No. of fish	% catch	No. of fish	% catch	No. of fish	% catch	No. of fish
2005–06	46	6 907	3	594	2	19	19	8 024
2006–07	2	730	7	1 378	47	2 779	58	22 407
2007–08	**14**	**1 913**	3	689	**11**	**1 040**	**20**	**15 483**

Smooth oreo	OEO 3A		OEO 4		Southland		Pukaki Rise		Bounty Plateau	
	% catch	No. of fish	% catch	No. of fish	% catch	No. of fish	% catch	No. of fish	% catch	No. of fish
2005–06	35	3 487	10	5 404	3	286	22	2 163	27	5 184
2006–07	4	784	15	8 679	52	2 325	43	13 578	47	3 026
2007–08	**12**	**1 495**	17	10 437	**26**	**997**	**16**	**5 506**	44	1 300

1. INTRODUCTION

This report presents analyses for the following objectives for the Ministry of Fisheries (MFish) funded research project "Oreo stock assessment" (OEO2008/01).

Overall objective

1. To carry out a stock assessment of black oreo (*Allocyttus niger*) and smooth oreo (*Pseudocyttus maculatus*), including estimating biomass and sustainable yields.

Specific objective

3. To analyse length frequency, sex ratio, and reproductive condition data for black oreo and smooth oreo collected by the Observer Programme and other sources during the 2007/08 fishing year for input into stock assessment models.

Biological data collected on commercial fishing vessels by observers funded either by the Ministry of Fisheries (OP) or by the fishing industry (ORMC/DWG) were analysed. No data were available from market sampling programmes. All data are summarised for the fisheries areas described by Coburn & McMillan (2009).

Length data were used in a stock assessment analysis of OEO 3A black oreo by Hicks et al. (2002) and Doonan et al. (2004) who noted strong area and/or depth effects for observer data and each modelled the stock using three subareas. It seems highly likely that depth and area effects are also present for observer-collected black oreo data from other areas, and also for smooth oreo, so analysis of the length data for stock assessment needs to be handled carefully.

This report presents length data from MFish (and predecessors) and industry observers of commercial fishing vessels. Otolith data from MFish observers are summarised. Gonad data are not included (see Hart & McMillan (2009) for some details).

2. DATA COLLECTION

MFish observers are asked to measure length and determine sex from 100–200 fish per tow, i.e., one sample, from at least one tow a day where oreos are targeted, or where oreos are caught as a bycatch to orange roughy fishing. Instructions on the collection of length measurements, reproductive condition, and otolith collection have varied over time. The observer manual (Ministry of Fisheries 1992) section on oreos prioritised four requests. The first two priorities were the recording of oreo catch weight and recording of discarding of oreos. The third priority was collection of length frequency data if time permitted, and the fourth was for gonad staging from at least 100 fish per day; otolith collection was not requested. The updated manual (Ministry of Fisheries 2002) did not request reproductive condition data to be reported but required otoliths to be collected from every tenth fish from the length sample where the catch weight exceeded 1 t. Length samples were required to be taken by each observer each day from oreo catches, and from at least one of the oreo species if orange roughy was the target. Industry observers collected similar data, including fish length, sex, and some reproductive data.

3. METHODS

3.1 Data sources

Observer length data for oreos were collected from several sources. The earliest were collected in 1979 shortly after the New Zealand EEZ was declared when the Fisheries Research Centre (FRC), a

division of the Ministry of Agriculture & Fisheries, placed staff on a few commercial fishing vessels. The FRC data are held in the empress database *obs_lfs* managed by NIWA under contract for MFish.

The Ministry of Agriculture & Fisheries (now MFish) established the Scientific Observer Programme in 1986 (now the Observer Programme) and has collected data since then. The OP data are currently held in the *cod* database managed by NIWA under contract for MFish.

Industry observers managed by the Orange Roughy Management Company (ORMC) collected oreo data from 1998–99 to 2002–03. The ORMC data are held in the *obs_lfs* database. Since 2005–06 industry observers managed by the Deepwater Group (DWG) have collected data. These data are held by the DWG and were made available to NIWA for inclusion in this project.

3.2 Fishery areas and location of sampling

Oreo are managed by quota within quota management areas (QMAs). For these analyses we used data from within a polygon that defined the main contemporary black oreo and smooth oreo fisheries within each QMA. The areas are the same as those used by Coburn & McMillan (2009). The Southland fishery straddled the QMA boundary line between OEO 3A and OEO 1, but other fisheries were defined within each QMA. The fisheries analysed were: Southland, which incorporates the south west corner of OEO 3A; OEO 1 rest which is the remainder of OEO 1; OEO 3A which excludes the Southland fishery; OEO 4 which is the whole of OEO 4; Bounty Plateau in OEO 6; Pukaki Rise in OEO 6; and OEO 6 rest which is the remainder of OEO 6. Tow position data were provided rounded to the nearest 0.1 degree latitude and longitude. Tow positions were jittered by +/- 0.05 degree to avoid overplotting of points (Figure 1).

3.3 Observer coverage

The numbers of annual observer oreo samples that the Ministry of Fisheries planned was obtained from research project tender background documents for 1997–98 to 2007–08 by oreo management area and compared with the actual number of oreo samples taken from those fishing years. The proportion of the oreo samples from OP sources taken from tows that targeted smooth oreo is also calculated.

3.4 Percentage of fishery sampled

The proportion of oreo catch sampled by observers versus the total estimated commercial catch was calculated by fishing area and fishing year. Weight of observer catch from which length samples were taken is divided by the sum of the reported estimated commercial catch extracted from the NIWA Empress database *dw_cdb* for black oreo and smooth oreo and is expressed as a percentage.

3.5 Number of trips, samples, and fish measured

The number of trips, number of tows sampled, and number of fish measured by area and fishing year for each speciesare given.

3.6 Sex ratios

Sex ratio (fraction male) was calculated as the number of males measured, divided by the sum of males and females measured for each species by area and fishing year. Any unsexed fish were ignored in this calculation.

3.7 Mean lengths

For the main black oreo and smooth oreo fisheries a weighted mean length was calculated by fishing year. Lengths were weighted by the associated catch weight of each sample in order to best represent the fishery, i.e., fish lengths from small catches carry little weight. A measure of confidence around the mean was calculated by bootstrap resampling of the data where the resampling was nested, i.e., resampled by tow and by fish within tow. The limits of the confidence interval (c.i.) extend to encompass 95% of the resampled values. For the plots, in order to avoid giving undue visual weight to information based on little data, if there were fewer than 10 samples then the mean is not shown, and if there were fewer than 5 samples the bootstrap c.i. is also not shown.

3.8 Otolith collection

The number of tows from which MFish observers obtained otolith samples, and the number of otoliths collected, are tabulated by fishing area and fishing year for black oreo and smooth oreo. These data were selected from the *cod* database.

4. RESULTS

4.1 Data sources

The number of tows sampled from each of the four sources (two MFish, two industry) are provided in Table 1 and 2 by area and fishing year for black oreo, and in Table 3 and 4 for smooth oreo.

4.2 Fishery areas and location of sampling

The locations of observed tows that caught black oreo and smooth oreo from 2007–08, and from previous fishing years, are shown in Figures 1 and 2. Figure 1 shows that 2007–08 black oreo samples were mainly from Pukaki Rise and from OEO 3A with only a few samples from OEO 4 and other areas. Past black oreo sampling took place mainly in OEO 3A where the largest fishery occurred until recently. The spatial split between samples taken in the shallow northern part of OEO 3A (smaller fish) and those taken in the deeper southern part (larger fish) is apparent. There were good levels of 2007–08 smooth oreo samples from OEO 4, and Pukaki Rise with some samples from OEO 3A but small numbers from other areas (Figure 2). Past smooth oreo sampling reflects the importance of the large OEO 4 fishery and the former importance of the OEO 3A and Southland fisheries.

4.3 Observer coverage

The number of expected or planned samples compared to the actual OP samples achieved is summarised in Table 5. The targeted oreo coverage is for combined oreo (OEO) by management area rather than separately for black oreo and smooth oreo. Samples taken in the large OEO 3A and OEO 4 oreo fisheries exceeded the number of samples planned for 4 of the 11 years, and were less than, but close to, the target in all other years except 2003–04. The proportion of smooth oreo samples from OEO 3A and OEO 4 varied, but always favoured smooth oreo, often by a large margin, but this is hardly surprising because OEO 4 has the largest smooth oreo fishery in the EEZ. In OEO 1, target coverage was met in 3 years and nearly met in one other of the 11 year series. In OEO 6, target coverage was met in only one year, 2006–07, when a substantial 500 samples were reported compared to the 130 planned. In OEO 1 the sample proportion favoured smooth oreo since 1999–2000. In OEO 6 the sample proportion favoured smooth oreo in 7 of the 11 year series, but the proportion of black oreo samples has increased in the last three years, probably reflecting changes in catch on Pukaki Rise and Bounty Plateau.

4.4 Percentage of fishery sampled

Black oreo

The proportion of catch sampled by observers versus the total estimated commercial catch by fishing area and year is presented in Table 6.

Southland. Sampling was minor before the mid 1990s and sporadic since then, but over the last 10 years sampling averaged 12% of the catch.
OEO 1 rest. This was first sampled in 1992–93 but coverage since was sporadic. An annual maximum of 33% of the catch was sampled in 1996–97 but sampling averaged 10% of catch over the last 10 years.
OEO 3A. Sampling started in 1979–80 and was patchy through to the late 1990s. Sampling averaged 18% of the catch over the last 10 years.
OEO 4. Sampling was highest in the early 1990s with a maximum of 26% of catch sampled in 1991–92. Sampling averaged 6% of the catch over the last 10 years.
Bounty Plateau. Sampling was minor until recently and is highly variable.
Pukaki Rise. This was first sampled in 1996–97, but sampling averaged 18% of the catch over the last 10 years.
OEO 6 rest. Sampled infrequently since the mid 1990s.

Smooth oreo

The proportion of catch sampled by observers versus the total estimated commercial catch by fishing area and year is presented in Table 7.

Southland. This was first sampled in 1986–87 but sampling was minor until the late 1990s. Over the last 10 years sampling averaged 19% of the catch.
OEO 1 rest. This was first sampled in 1991–92 but sampling averaged 24% of the catch over the last 10 years.
OEO 3A. This was first sampled in 1979–80 but sampling was patchy until the 1990s. Sampling averaged 16% of the catch over the last 10 years.
OEO 4. This was first sampled in 1986–87 and over the last 10 years sampling averaged 11% of the catch.
Bounty Plateau. This was first sampled in 1994–95 and over the last 10 years sampling averaged 24% of the catch.
Pukaki Rise. This was first sampled in 1996–97 and over the last 10 years sampling averaged 18% of the catch.
OEO 6 rest. This was first sampled in 1993–94 and over the last 10 years sampling averaged 18% of the catch.

4.5 Number of trips, samples, and fish measured

Black oreo

Southland

Samples were from few trips (1–8) in any year (Table 8). The number of samples peaked at 35 in 2001–02: samples were infrequently collected (with a mean of 12.3) over the last 10 years (Table 9). A total of 14 235 fish were measured with large numbers in 2001–02 (3650) and 2006–07 (2779) (Table 10).

OEO 1 rest
Samples were mostly from few trips (1–14) in any year (see Table 8). The number of samples was a maximum of 34 in 1998–99 with a mean of 12.1 over the last 10 years (see Table 9). A total of 18 275 fish was measured with larger numbers in 1996–97 (3327) and 1998–99 (3090) (see Table 10).

OEO 3A
The number of trips varied, with a maximum of 12 in 2000–01 (see Table 8). The number of samples was a maximum of 137 in 2000–01 with mean of 45.1 over the last 10 years (see Table 9). A total of 70 431 fish was measured with larger numbers in 1999–2000 (12 355) and 2000–01 (13 771) (see Table 10).

OEO 4
Samples were typically from up to 10 trips in a year (see Table 8). The number of samples was a maximum of 68 in 1993–94 and averaged 21.7 over the last 10 years (see Table 9). A total of 36 333 fish was measured (see Table 10).

Bounty Plateau
Only 20 samples were collected and the fishery appears to be mainly for smooth oreo (see Table 9).

Pukaki Rise
Samples were collected from 3–14 trips per year (see Table 8). On average, over the last 10 years, 73 samples were collected annually. Recent sampling is particularly high with 267 in 2006–07 and 192 in 2007–08 (see Table 9). A total of 67 298 fish was measured, with about 68% of these from the last three years (see Table 10).

OEO 6 rest
There were only a few trips sampled (see Table 8) and on average 5.5 samples were taken annually over the last 10 years (see Table 9). A total of 2939 fish was measured (see Table 10).

Smooth oreo

Southland
This was first sampled in 1986–87, but it was infrequently sampled subsequently with most of the work in the four years from 1998–99 to 2001–02 (Table 11). During the last 10 years an average of 25.6 samples was taken annually (Table 12). A total of 25 691 fish were measured (Table 13).

OEO 1 rest
Samples were mostly from few trips (1–11) in any year although in 1998–99 22 trips were sampled (see Table 11). Samples per year averaged 30.6 in the last 10 years (see Table 12). A total of 28 995 fish was measured (see Table 13).

OEO 3A
Sampling in the last 10 years was from multiple (2–13) trips per year (see Table 11). Over the last 10 years an average of 35 samples was taken annually (see Table 12). A total of 47 287 fish was measured with larger numbers in 1999–2000 (8083) and 2000–01 (10 103) (see Table 13).

OEO 4
Sampling in the last 10 years was from an average of 10 trips per year (see Table 11). Over the last ten years an average of 96 samples per year was taken (see Table 12). A total of 134 875 fish was measured mostly in the last 20 years (see Table 13).

Bounty Plateau
Sampling in the last 10 years was from an average of 4.7 trips per year (see Table 11). Over the last 10 years an average of 23 samples per year was taken (see Table 12). A total of 25 150 fish was measured (see Table 13).

Pukaki Rise
Sampling in the last 10 years was from an average of 7.1 trips per year (see Table 11). Over the last ten years an average of 65.3 samples per year was taken (see Table 12). A total of 50 467 fish was measured (see Table 13).

OEO 6 rest
Sampling in the last 10 years was from an average of 4.6 trips per year (see Table 11). Over the last ten years an average of 25.8 samples per year was taken (see Table 12). A total of 26 135 fish was measured (see Table 13).

4.6 Sex ratios

Black oreo (Table 14)
Southland. Sex ratios are fairly even and show no clear temporal trend.
OEO 1 rest. Sex ratios slightly favour females but show no clear temporal trend.
OEO 3A. Sex ratios slightly favour females but show no clear temporal trend.
OEO 4. Sex ratios slightly favour females but show no clear temporal trend.
Bounty Plateau. Sex ratios are fairly even and show no clear temporal trend.
Pukaki Rise. Sex ratios favour females.
OEO 6 rest. Sex ratios are approximately even with no temporal trend (Table 14).

Smooth oreo (Table 15)
Southland. Sex ratio is approximately even.
OEO 1 rest. Sex ratio appeared even.
OEO 3A. Sex ratio is even with no clear temporal trend.
OEO 4. Sex ratio is approximately even with no clear temporal trend.
Bounty Plateau. Sex ratio is approximately even.
Pukaki Rise. Sex ratio is approximately even.
OEO 6 rest. Sex ratio is approximately even.

4.7 Mean length

Black oreo
OEO 3A. Mean length was highly variable until the late 1990s but appears to have increased slightly in the last 11 years (Figure 3).
OEO 4. Mean length appears to have declined since 2000–01 (Figure 4).
Pukaki Rise. Mean length appears variable with a possible decline in the few years (Figure 5).

Smooth oreo
OEO 3A. Mean length showed little change over the last 10 years (Figure 6).
OEO 4. Mean length appears to have declined up to about 1999–2000, but appears to show little change in the last eight years (Figure 7).
Bounty Plateau. Mean length has a downward trend (Figure 8).
Pukaki Rise. Mean length shows no clear trend and c.i. is high in several years in spite of large sample sizes (Figure 9).
Southland. Mean length values are variable but appear to have declined since 2000–01 (Figure 10).

4.8 Otolith collection

Black oreo

Otoliths were very intermittently collected since 1991–92 (Tables 16 and 17), but this is not surprising as otoliths have been requested only since 2002. In 2007–08 1625 otoliths were collected, mostly from Pukaki Rise. A total of 7687 otoliths have been archived from observer sources from all years.

Smooth oreo

Otoliths were intermittently collected since 1991–92 (Table 18 and 19). Most were collected from 2002–03 onward when otoliths were added to the requests in the observer manual. A total of 1929 smooth oreo otoliths was collected in 2007–08, mostly from OEO 4 and Pukaki Rise. A total of 12 432 smooth oreo otoliths have been archived from observer sources.

5. SUMMARY

This report provides an overview and summary of the available oreo fisheries observer data, collected both from government and industry sources, plus a simple analysis of sex ratios and mean length derived from these data. The sex ratio is typically close to 50% for smooth oreo, while black oreo females seem to outnumber males for unknown reasons.

Over the last 10 years 6–18% of the black oreo catch was sampled annually for the six main fisheries (not including Bounty Plateau). For the same years, 11–24% of the smooth oreo catch was sampled annually for the seven main fisheries. This probably represents an adequate level of sampling and is a marked improvement on the previous decade when only the OEO 4 black oreo and OEO 4 smooth oreo fisheries achieved sampling of about 10% of the total catch. Unstandardised mean length data need to be treated with caution, but trends in mean length were identified in several areas as follows.

Black oreo mean length trends

- OEO 3A – steady or slight increase from 1997–98 to 2007–08
- OEO 4 – downward trend from 2000–01 to 2007–08
- Pukaki Rise – variable with a possible decline in the recent years

Smooth oreo mean length trends

- OEO 3A – steady from 1999–2000 to 2007–08
- OEO 4 – declined to about 1999–2000, but little change in the last eight years
- Bounty Plateau – downward 1998–99 to 2007–08
- Southland – declining since 2000–01

Observer length data were used extensively for previous oreo stock assessment analyses. For example, black oreo in OEO 3A, where depth was identified as an important covariable and incorporated in the modelling (Doonan el al. 2004), and for smooth oreo in Southland where industry-sourced data proved inconsistent with the MFish data and were excluded from the final model (Coburn el al. 2008).

These data are a valuable resource with the potential to increase our knowledge of oreo population dynamics, in particular size structure. But careful analysis, beyond the scope of this report, is required to fully utilise these data.

6. ACKNOWLEDGMENTS

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7. REFERENCES

Coburn, R.P.; McMillan, P.J. (2009). Descriptions of the black oreo and smooth oreo fisheries in OEO 1, 3A, 4, and 6 for the 1977–78 to the 2007–08 fishing years. *New Zealand Fisheries Assessment Report 2009/54*. 82 p.

Coburn, R.P.; Doonan, I.J.; McMillan, P.J. (2008). A stock assessment of smooth oreo in Southland (part of OEO 1 & OEO 3A). *New Zealand Fisheries Assessment Report 2008/37*. 43 p.

Doonan, I.J.; Coburn, R.P.; McMillan, P.J.; Hart, A.C. (2004). Assessment of OEO 3A black oreo for 2002–03. New *Zealand Fisheries Assessment Report 2004/52*. 54 p.

Hart, A.C.; McMillan, P.J. (2009). A summary of observer biological information on the New Zealand black oreo and smooth oreo fisheries from 1979–80 to 2006–07. *New Zealand Fisheries Assessment Report 2009/51*. 41 p.

Hicks, A.C.; Doonan, I.J.; McMillan, P.J.; Coburn, R.P.; Hart, A.C. (2002). Assessment of OEO 3A black oreo for 2002–03. *New Zealand Fisheries Assessment Report 2002/63*. 58 p.

Ministry of Fisheries (1992). Biological data collection by scientific observers, information and requests. 100 p. (Unpublished report held in NIWA library, Wellington.).

Ministry of Fisheries (2002). Ministry of Fisheries observer programme biological data collection manual. 72 p. (Unpublished report held in NIWA library, Wellington.).

Table 1: The number of black oreo samples from government sources by area and fishing year. Samples in 1979–80 are from FRC. Data from other years are from OP. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	49	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	–	–	8	–	–	–	–
1987–88	–	–	9	–	–	–	–
1988–89	1	–	43	8	–	–	–
1989–90	–	–	19	–	–	–	–
1990–91	–	–	15	25	–	–	–
1991–92	–	1	11	63	–	–	–
1992–93	–	9	–	38	–	–	–
1993–94	6	22	26	68	–	–	–
1994–95	2	4	7	43	–	–	–
1995–96	7	2	8	7	–	–	–
1996–97	2	31	4	3	–	7	2
1997–98	8	10	20	8	–	26	–
1998–99	–	3	6	3	–	8	11
1999–00	17	25	116	8	–	10	5
2000–01	–	–	137	16	1	15	–
2001–02	28	5	42	22	–	4	4
2002–03	1	5	28	49	1	14	3
2003–04	4	–	12	24	–	22	1
2004–05	5	3	12	28	4	29	1
2005–06	1	–	48	15	7	27	–
2006–07	22	2	11	33	4	256	–
2007–08	7	2	26	15	–	176	4

Table 2: The number of black oreo samples from industry sources by area and fishing year. Samples before 2003–04 are from ORMC. Data from other years are DWG. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1998–99	12	31	–	–	2	62	8
1999–00	3	2	–	–	–	3	–
2000–01	6	15	–	–	–	21	1
2001–02	7	2	–	–	–	10	5
2002–03	–	–	–	–	–	2	–
2003–04	–	–	–	–	–	–	–
2004–05	–	–	–	–	–	–	–
2005–06	–	7	4	1	1	49	–
2006–07	5	–	3	2	–	11	–
2007–08	5	7	6	1	–	16	1

Table 3: The number of smooth oreo samples from government sources by area and fishing year. Samples in 1979–80 are from FRC. Data from other years are OP. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	35	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	1	–	4	7	–	–	–
1987–88	–	–	10	–	–	–	–
1988–89	2	–	15	34	–	–	–
1989–90	–	–	–	5	–	–	–
1990–91	1	–	28	51	–	–	–
1991–92	1	1	9	82	6	–	–
1992–93	–	8	–	39	–	–	–
1993–94	4	8	28	130	–	–	1
1994–95	3	2	8	107	4	–	6
1995–96	5	3	2	37	4	–	–
1996–97	4	8	3	51	–	1	4
1997–98	3	9	14	51	1	15	34
1998–99	–	10	8	65	–	9	19
1999–00	33	62	88	39	17	36	23
2000–01	4	22	108	93	13	17	1
2001–02	46	10	23	63	7	22	34
2002–03	8	18	25	135	12	12	20
2003–04	14	6	5	81	4	19	9
2004–05	13	12	12	120	39	30	8
2005–06	3	20	41	77	40	20	–
2006–07	28	16	10	111	34	205	2
2007–08	10	6	19	133	10	121	11

Table 4: The number of smooth oreo samples from industry sources by area and fishing year. Samples before 2003–04 are from ORMC. Data from other years are DWG. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1998–99	25	51	–	8	37	64	37
1999–00	3	2	–	–	–	5	–
2000–01	28	52	–	10	4	37	36
2001–02	35	15	1	–	4	42	22
2002–03	1	–	–	–	–	4	–
2003–04	–	–	–	–	–	–	–
2004–05	–	–	–	–	–	–	–
2005–06	–	–	–	–	–	–	–
2006–07	2	3	5	8	5	7	–
2007–08	3	1	5	19	4	3	10

Table 5: The planned number of observer samples for oreos for the fishing years 1997–98 to 2007–08, by oreo management area, and the number of actual oreo samples, and the proportion of the actual samples that were from smooth oreo. *, compiled from Ministry of Fisheries research project tender background documents.

	OEO 3A/OEO 4			OEO 1			OEO 6		
	Expected*	Actual	% SSO	Expected*	Actual	% SSO	Expected*	Actual	% SSO
1997–98	100	91	69	60	30	40	140	76	66
1998–99	100	80	89	60	55	16	140	116	24
1999–00	100	251	51	60	139	68	140	83	81
2000–01	100	354	57	60	46	54	100	65	43
2001–02	190	149	57	60	97	59	100	81	72
2002–03	190	235	67	60	32	81	100	64	69
2003–04	190	118	69	60	19	95	100	54	57
2004–05	190	167	76	60	33	76	100	99	68
2005–06	190	178	65	60	23	96	100	90	63
2006–07	175	163	74	45	60	63	130	500	47
2007–08	175	193	88	45	25	64	130	322	44

Table 6: All fishing areas, black oreo. Summary of weight of catch sampled for black oreo length measurement by fishing area relative to the estimated catch of black oreo taken from the fishing area. The figures are percentages, rounded to the nearest percent. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	3	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	0	–	–	–	–
1986–87	–	–	3	–	–	–	–
1987–88	–	–	2	–	–	–	–
1988–89	1	–	9	3	–	–	–
1989–90	–	–	7	–	–	–	–
1990–91	–	–	1	9	–	–	–
1991–92	–	0	7	26	–	–	–
1992–93	–	2	–	18	–	–	–
1993–94	2	3	2	14	–	–	–
1994–95	1	6	1	16	–	–	–
1995–96	3	1	1	2	–	–	–
1996–97	0	33	1	1	–	2	19
1997–98	5	8	3	1	–	7	–
1998–99	6	23	0	4	2	33	23
1999–00	9	9	18	5	–	3	3
2000–01	6	15	36	7	0	18	1
2001–02	23	5	14	8	–	9	25
2002–03	0	6	34	6	39	6	1
2003–04	3	–	4	3	–	6	1
2004–05	9	2	11	13	3	9	0
2005–06	2	13	46	3	7	19	–
2006–07	47	11	2	7	86	58	–
2007–08	11	7	14	3	–	20	53

Table 7: All fishing areas, smooth oreo. Summary of weight of catch sampled for smooth oreo length measurement by fishing area relative to the estimated catch of smooth oreo taken from the fishing area. The figures are percentages, rounded to the nearest percent. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	3	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	0	–	–	–	–
1986–87	8	–	2	2	–	–	–
1987–88	–	–	1	–	–	–	–
1988–89	32	–	1	6	–	–	–
1989–90	–	–	–	1	–	–	–
1990–91	0	–	4	10	–	–	–
1991–92	0	0	2	12	–	–	–
1992–93	–	3	–	5	–	–	–
1993–94	0	0	1	13	–	–	2
1994–95	3	0	2	15	6	–	15
1995–96	1	2	0	13	1	–	–
1996–97	3	6	1	13	–	0	3
1997–98	1	8	2	6	1	4	46
1998–99	7	24	4	10	27	25	25
1999–00	14	24	14	9	22	18	12
2000–01	23	9	30	10	36	17	17
2001–02	28	17	16	8	7	24	38
2002–03	7	3	29	8	14	7	13
2003–04	15	4	4	9	1	5	6
2004–05	18	11	7	14	14	8	14
2005–06	3	24	35	10	27	22	–
2006–07	52	106	4	15	47	43	9
2007–08	26	15	12	17	44	16	26

Table 8: All fishing areas, black oreo. The number of trips where length samples were taken by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	3	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	–	–	1	–	–	–	–
1987–88	–	–	2	–	–	–	–
1988–89	1	–	5	5	–	–	–
1989–90	–	–	3	–	–	–	–
1990–91	–	–	1	6	–	–	–
1991–92	–	1	2	6	–	–	–
1992–93	–	1	–	5	–	–	–
1993–94	2	5	6	11	–	–	–
1994–95	2	2	4	6	–	–	–
1995–96	2	1	4	4	–	–	–
1996–97	1	4	1	3	–	3	1
1997–98	2	4	6	4	–	3	–
1998–99	7	14	2	2	1	13	7
1999–00	8	9	11	3	–	5	3
2000–01	2	3	12	5	1	7	1
2001–02	7	3	8	4	–	7	5
2002–03	1	1	6	6	1	4	2
2003–04	1	–	4	5	–	5	1
2004–05	2	1	4	6	3	3	1
2005–06	1	2	7	8	3	9	–
2006–07	4	2	7	8	2	14	–
2007–08	3	2	9	9	–	6	2

Table 9: All fishing areas, black oreo. The number of tows where length samples were taken by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	49	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	–	–	8	–	–	–	–
1987–88	–	–	9	–	–	–	–
1988–89	1	–	43	8	–	–	–
1989–90	–	–	19	–	–	–	–
1990–91	–	–	15	25	–	–	–
1991–92	–	1	11	63	–	–	–
1992–93	–	9	–	38	–	–	–
1993–94	6	22	26	68	–	–	–
1994–95	2	4	7	43	–	–	–
1995–96	7	2	8	7	–	–	–
1996–97	2	31	4	3	–	7	2
1997–98	8	10	20	8	–	26	–
1998–99	12	34	6	3	2	70	19
1999–00	20	27	116	8	–	13	5
2000–01	6	15	137	16	1	36	1
2001–02	35	7	42	22	–	14	9
2002–03	1	5	28	49	1	16	3
2003–04	4	–	12	24	–	22	1
2004–05	5	3	12	28	4	29	1
2005–06	1	7	52	16	8	76	–
2006–07	27	2	14	35	4	267	–
2007–08	12	9	32	16	–	192	5

Table 10: All fishing areas, black oreo. The number of fish measured by observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	5572	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	103	–	–	–	–
1986–87	–	–	978	–	–	–	–
1987–88	–	–	1 284	–	–	–	–
1988–89	100	–	5 284	849	–	–	–
1989–90	–	–	2 288	–	–	–	–
1990–91	–	–	1 541	2 756	–	–	–
1991–92	–	118	1 155	6 038	–	–	–
1992–93	–	932	–	4 412	–	–	–
1993–94	466	2 399	2 485	5 542	–	–	–
1994–95	123	335	805	4 645	–	–	–
1995–96	793	228	866	731	–	–	–
1996–97	211	3 327	504	281	–	784	218
1997–98	878	1 149	1 863	608	–	2 447	–
1998–99	1 265	3 090	825	526	200	6 611	993
1999–00	1 843	2 397	12 355	921	–	1 223	382
2000–01	599	1 510	13 771	643	1	3 039	71
2001–02	3 650	552	4 033	1 301	–	1 304	692
2002–03	25	447	2 720	1 490	25	1 333	57
2003–04	192	–	1 278	525	–	1 841	20
2004–05	252	136	1 171	2 404	73	2 802	6
2005–06	19	701	6 907	594	166	8 024	–
2006–07	2 779	120	730	1 378	86	22 407	–
2007–08	1 040	834	1 913	689	–	15 483	500

Table 11: All fishing areas, smooth oreo. The number of trips where length samples were taken by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	3	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	1	–	2	2	–	–	–
1987–88	–	–	3	–	–	–	–
1988–89	1	–	3	7	–	–	–
1989–90	–	–	–	3	–	–	–
1990–91	1	–	1	7	–	–	–
1991–92	1	1	2	6	1	–	–
1992–93	–	1	–	5	–	–	–
1993–94	2	4	8	12	–	–	1
1994–95	1	1	3	15	2	–	1
1995–96	2	3	2	5	1	–	–
1996–97	1	4	1	4	–	1	1
1997–98	2	4	3	6	1	2	5
1998–99	11	22	3	7	8	12	14
1999–00	9	11	13	6	3	6	5
2000–01	7	10	11	11	7	9	7
2001–02	15	9	6	7	3	9	7
2002–03	3	7	3	10	3	4	3
2003–04	2	4	2	10	3	5	1
2004–05	2	1	3	9	6	5	1
2005–06	1	2	7	12	2	4	–
2006–07	5	9	4	13	8	12	1
2007–08	3	4	6	15	6	5	2

Table 12: All fishing areas, smooth oreo. The number of tows where length samples were taken by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	35	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	1	–	–	–	–
1986–87	1	–	4	7	–	–	–
1987–88	–	–	10	–	–	–	–
1988–89	2	–	15	34	–	–	–
1989–90	–	–	–	5	–	–	–
1990–91	1	–	28	51	–	–	–
1991–92	1	1	9	82	6	–	–
1992–93	–	8	–	39	–	–	–
1993–94	4	8	28	130	–	–	1
1994–95	3	2	8	107	4	–	6
1995–96	5	3	2	37	4	–	–
1996–97	4	8	3	51	–	1	4
1997–98	3	9	14	51	1	15	34
1998–99	25	61	8	73	37	73	56
1999–00	36	64	88	39	17	41	23
2000–01	32	74	108	103	17	54	37
2001–02	81	25	24	63	11	64	56
2002–03	9	18	25	135	12	16	20
2003–04	14	6	5	81	4	19	9
2004–05	13	12	12	120	39	30	8
2005–06	3	20	41	77	40	20	–
2006–07	30	19	15	119	39	212	2
2007–08	13	7	24	152	14	124	21

Table 13: All fishing areas, smooth oreo. The number of fish measured by observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	3900	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	106	–	–	–	–
1986–87	119	–	387	992	–	–	–
1987–88	–	–	1 300	–	–	–	–
1988–89	189	–	1 540	3 262	–	–	–
1989–90	–	–	–	555	–	–	–
1990–91	130	–	3 029	6 806	–	–	–
1991–92	103	100	919	7 603	516	–	–
1992–93	–	869	–	4 313	–	–	–
1993–94	399	882	1 722	13 402	–	–	110
1994–95	139	17	778	9 803	427	–	603
1995–96	554	276	207	4 544	352	–	–
1996–97	438	812	365	5 628	–	40	427
1997–98	403	1 144	1 826	4 971	91	1 535	3 223
1998–99	2 730	6 046	1 064	9 434	3 691	6 747	4 955
1999–00	3 479	5 570	8 083	4 025	2 045	4 470	2 335
2000–01	2 982	5 718	10 103	8 223	1 274	4 482	3 518
2001–02	7 358	2 043	3 292	5 098	865	6 230	5 490
2002–03	820	620	1 667	6 225	1 055	1 634	1 883
2003–04	1 297	177	346	5 419	370	1 619	552
2004–05	943	755	881	10 052	4 954	2 463	1 081
2005–06	286	1 911	3 487	5 404	5 184	2 163	–
2006–07	2 325	1 640	784	8 679	3 026	13 578	40
2007–08	997	415	1 495	10 437	1 300	5 506	1 918

Table 14: All fishing areas, black oreo. Sex ratios (percentage male) from length samples by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	47	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	56	–	–	–	–
1986–87	–	–	47	–	–	–	–
1987–88	–	–	41	–	–	–	–
1988–89	53	–	48	47	–	–	–
1989–90	–	–	50	–	–	–	–
1990–91	–	–	43	52	–	–	–
1991–92	–	53	43	45	–	–	–
1992–93	–	48	–	41	–	–	–
1993–94	47	39	50	46	–	–	–
1994–95	45	39	45	48	–	–	–
1995–96	48	58	37	36	–	–	–
1996–97	55	50	42	52	–	47	45
1997–98	50	45	44	47	–	49	–
1998–99	37	44	50	49	53	47	51
1999–00	50	45	47	45	–	49	49
2000–01	39	46	47	50	50	47	47
2001–02	45	48	49	47	–	48	48
2002–03	54	49	44	48	44	41	47
2003–04	51	–	55	46	–	44	59
2004–05	34	32	43	45	47	45	58
2005–06	51	45	51	47	52	46	–
2006–07	45	30	50	49	56	47	–
2007–08	49	50	45	51	–	49	45

Table 15: All fishing areas, smooth oreo. Sex ratios (percentage male) from length samples by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1979–80	–	–	48	–	–	–	–
1980–81	–	–	–	–	–	–	–
1981–82	–	–	–	–	–	–	–
1982–83	–	–	–	–	–	–	–
1983–84	–	–	–	–	–	–	–
1984–85	–	–	–	–	–	–	–
1985–86	–	–	34	–	–	–	–
1986–87	29	–	48	50	–	–	–
1987–88	–	–	54	–	–	–	–
1988–89	57	–	55	53	–	–	–
1989–90	–	–	–	52	–	–	–
1990–91	54	–	46	46	–	–	–
1991–92	40	–	53	48	50	–	–
1992–93	–	50	–	50	–	–	–
1993–94	52	46	51	50	–	–	50
1994–95	51	51	50	50	58	–	44
1995–96	53	54	35	53	53	–	–
1996–97	54	52	53	48	–	–	53
1997–98	44	43	43	54	43	50	48
1998–99	49	53	50	49	49	48	50
1999–00	52	47	49	48	53	50	46
2000–01	49	49	51	50	48	47	49
2001–02	49	44	53	48	51	47	49
2002–03	47	50	52	49	50	53	50
2003–04	49	36	51	50	36	49	50
2004–05	42	49	46	50	48	45	44
2005–06	50	49	45	51	48	52	–
2006–07	48	45	56	49	48	49	36
2007–08	54	53	48	44	56	50	53

Table 16: All fishing areas, black oreo. The number of tows where otoliths were collected by OP Observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1991–92	–	–	–	9	–	–	–
1992–93	–	9	–	11	–	–	–
1993–94	–	–	–	4	–	–	–
1994–95	1	1	–	1	–	–	–
1995–96	–	–	–	3	–	–	–
1996–97	–	–	–	–	–	–	–
1997–98	–	2	–	–	–	6	–
1998–99	–	1	–	–	–	–	–
1999–00	–	–	–	–	–	–	–
2000–01	–	–	–	–	–	–	–
2001–02	2	–	–	–	–	–	1
2002–03	1	4	21	26	–	13	3
2003–04	4	–	11	5	–	17	–
2004–05	5	1	10	25	1	25	1
2005–06	1	–	44	9	2	25	–
2006–07	22	2	10	31	4	210	–
2007–08	7	–	20	14	–	169	2

Table 17: All fishing areas, black oreo. The number of otoliths collected by OP observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1991–92	–	–	–	137	–	–	–
1992–93	–	174	–	104	–	–	–
1993–94	–	–	–	58	–	–	–
1994–95	10	18	–	20	–	–	–
1995–96	–	–	–	60	–	–	–
1996–97	–	–	–	–	–	–	–
1997–98	–	10	–	–	–	30	–
1998–99	–	25	–	–	–	–	–
1999–00	–	–	–	–	–	–	–
2000–01	–	–	–	–	–	–	–
2001–02	19	–	–	–	–	–	4
2002–03	5	48	292	174	–	130	21
2003–04	24	–	123	37	–	146	–
2004–05	25	10	148	224	10	258	6
2005–06	5	–	677	61	10	305	–
2006–07	220	15	60	183	21	2 155	–
2007–08	54	–	128	85	–	1 335	23

Table 18: All fishing areas, smooth oreo. The number of tows where otoliths were collected by OP Observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1991–92	1	–	–	9	5	–	–
1992–93	–	8	–	12	–	–	–
1993–94	–	–	–	15	–	–	–
1994–95	1	2	–	9	1	–	–
1995–96	–	1	1	8	3	–	–
1996–97	–	1	–	–	–	–	–
1997–98	1	1	–	–	–	5	21
1998–99	–	–	–	–	–	–	–
1999–00	–	–	–	–	–	–	–
2000–01	–	–	1	–	–	–	–
2001–02	5	3	–	–	–	–	1
2002–03	8	10	22	84	10	11	18
2003–04	14	5	2	45	3	13	6
2004–05	9	2	8	91	37	23	6
2005–06	2	4	34	58	38	15	–
2006–07	27	15	10	104	31	140	2
2007–08	10	6	19	119	9	103	9

Table 19: All fishing areas, smooth oreo. The number of otoliths collected by OP observers by fishing year. –, no data.

	Southland	OEO 1 rest	OEO 3A	OEO 4	Bounty Plateau	Pukaki Rise	OEO 6 rest
1991–92	20	–	–	126	90	–	–
1992–93	–	158	–	113	–	–	–
1993–94	–	–	–	351	–	–	–
1994–95	20	15	–	139	20	–	–
1995–96	–	7	20	160	60	–	–
1996–97	–	6	–	–	–	–	–
1997–98	5	5	–	–	–	25	438
1998–99	–	–	–	–	–	–	–
1999–00	–	–	–	–	–	–	–
2000–01	–	–	2	–	–	–	–
2001–02	35	20	–	–	–	–	1
2002–03	76	75	229	616	117	107	198
2003–04	132	33	20	481	40	132	90
2004–05	100	20	108	924	437	202	89
2005–06	20	17	379	586	505	190	–
2006–07	225	146	43	862	267	1 191	10
2007–08	70	37	120	1 042	90	470	100

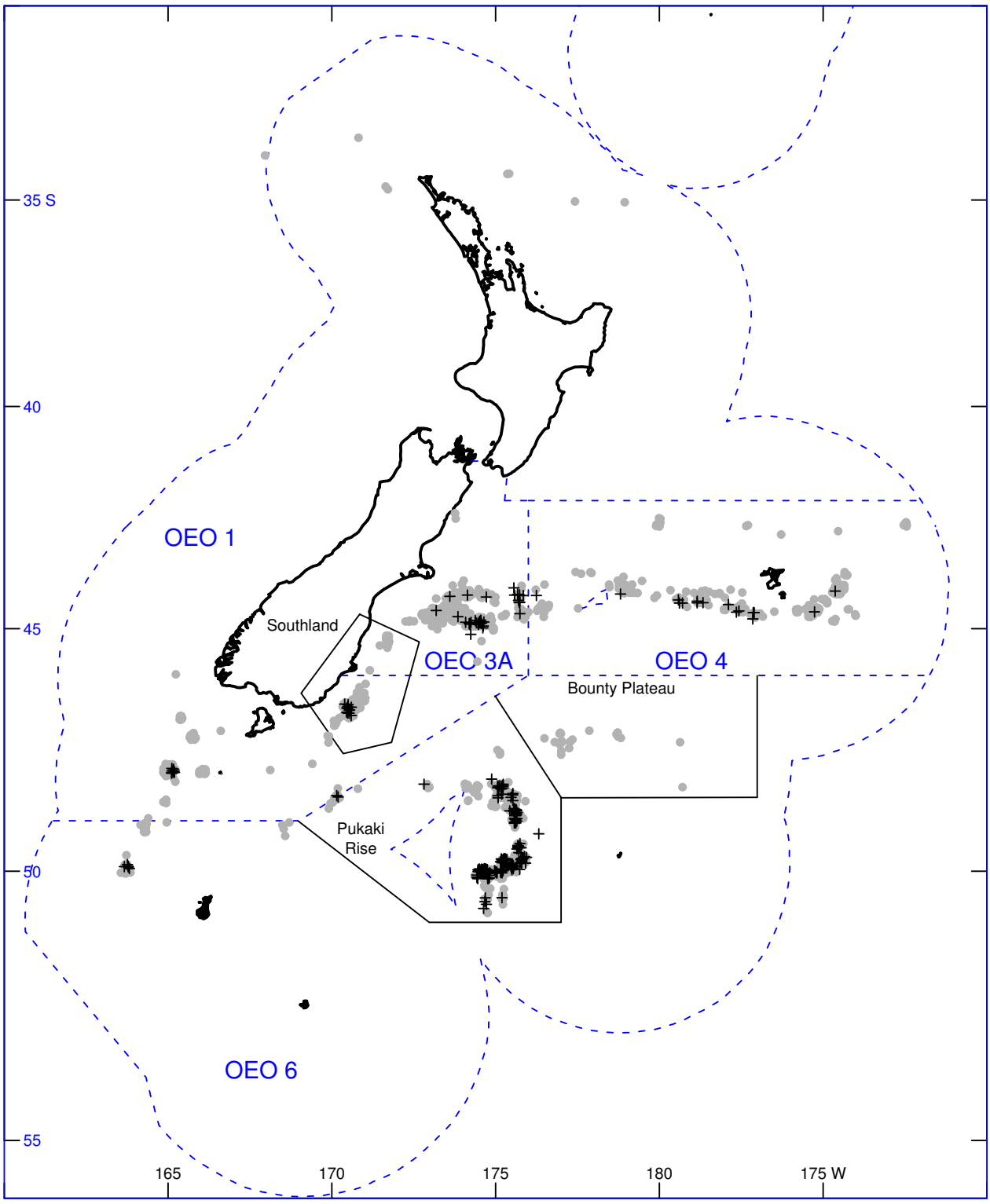

Figure 1: Oreo QMAs and fishing areas referred to in the report and all black oreo tow positions for the fishing years 1979–1980 to 2007–08 from which observer length data were taken. Tow positions are the grey dots, except 2007–08 which are black crosses. Positions were jittered by +/– 0.05 degree.

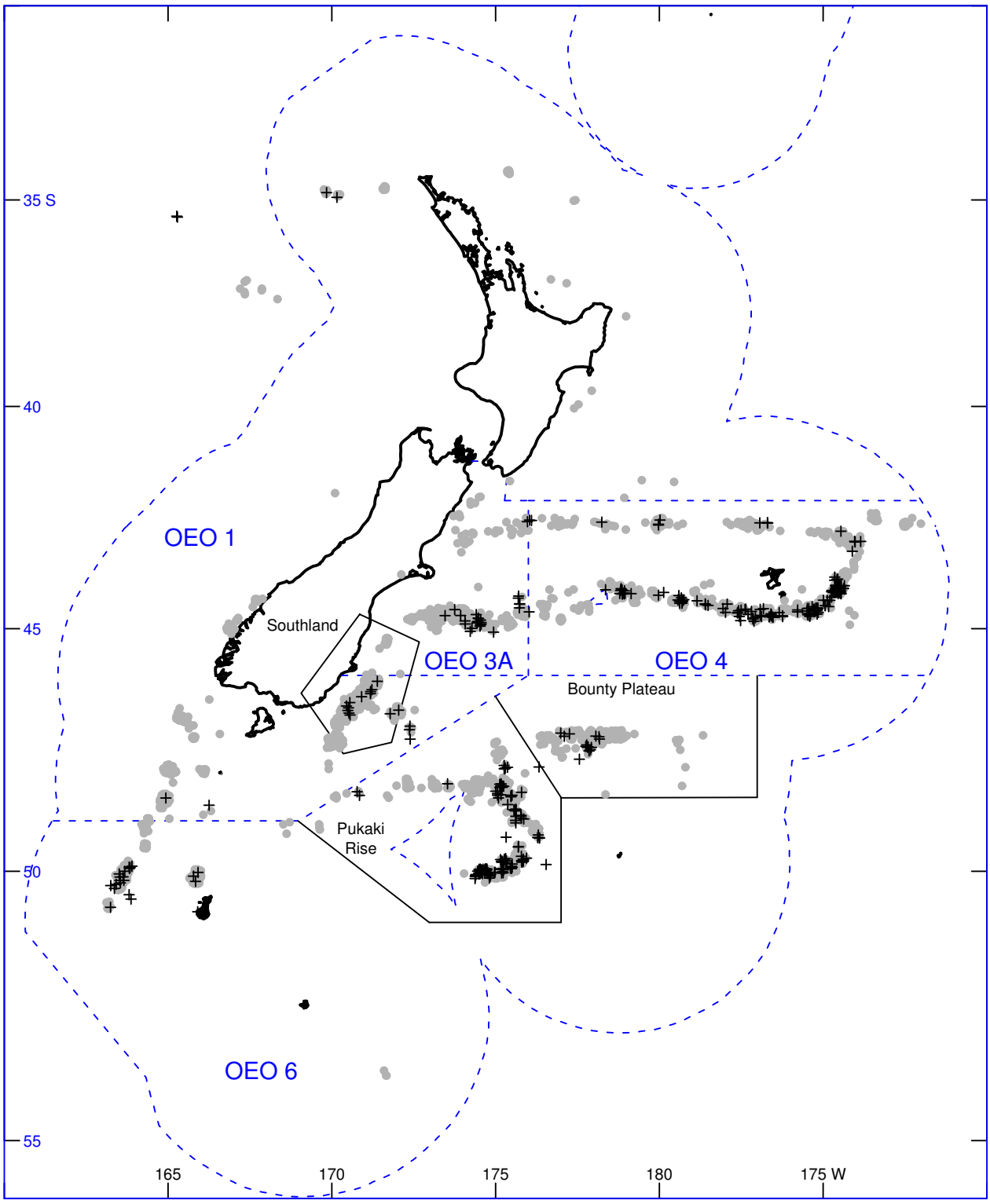

Figure 2: Oreo QMAs and fishing areas referred to in the report and all smooth oreo tow positions for fishing years 1979–1980 to 2007–08 from which observer length data were taken. Tow positions are the grey dots, except 2007–08 which are black crosses. Positions were jittered by +/– 0.05 degree.

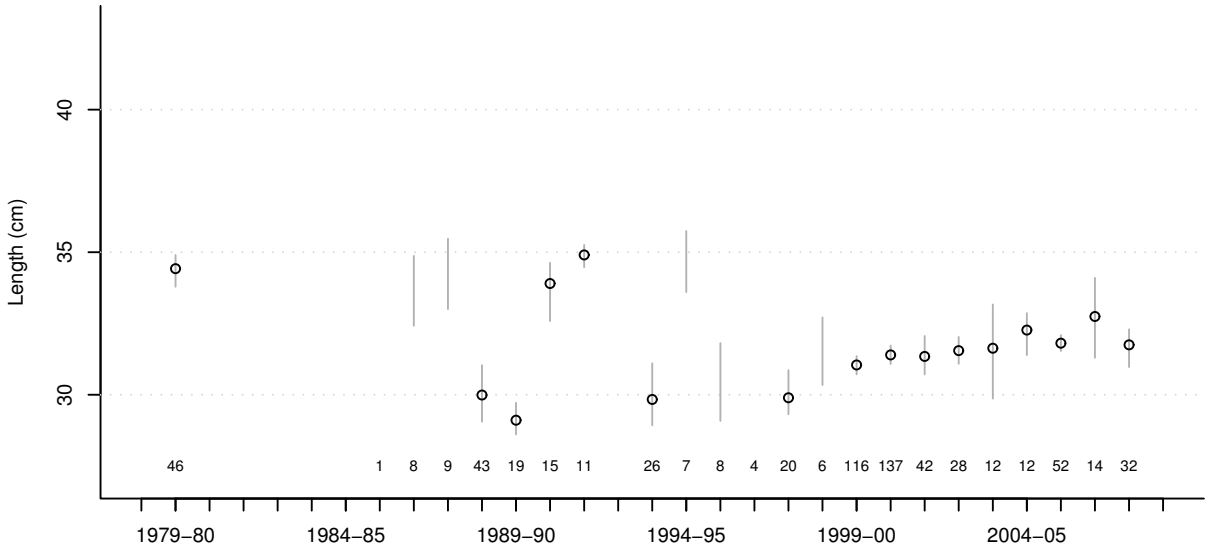

Figure 3: Catch weighted mean length (o) by fishing year for black oreo in OEO 3A, with associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

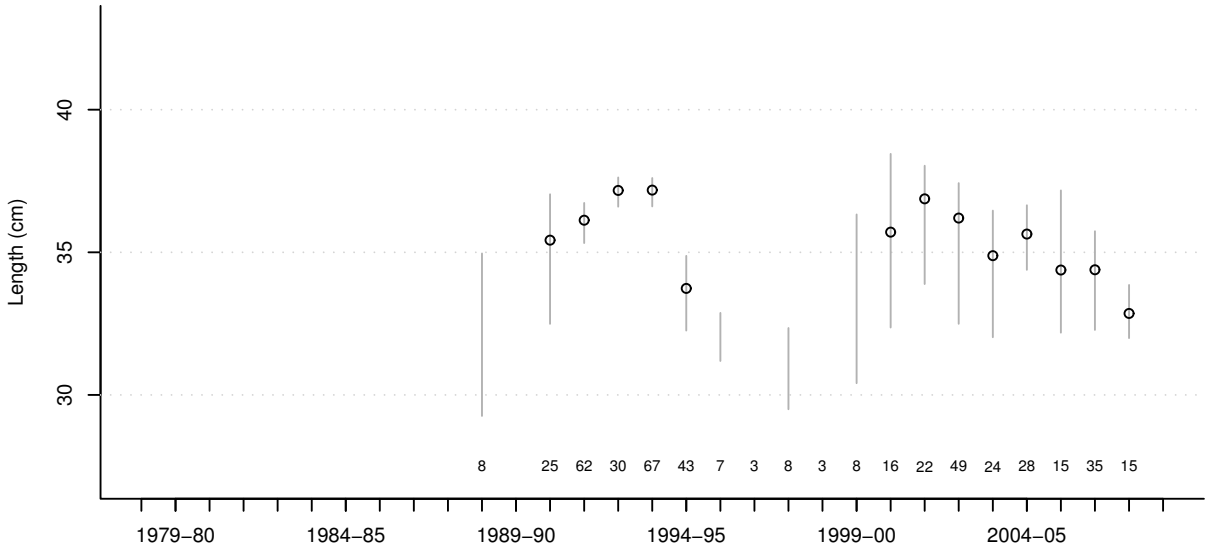

Figure 4: Catch weighted mean length (o) by fishing year for black oreo in OEO 4, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

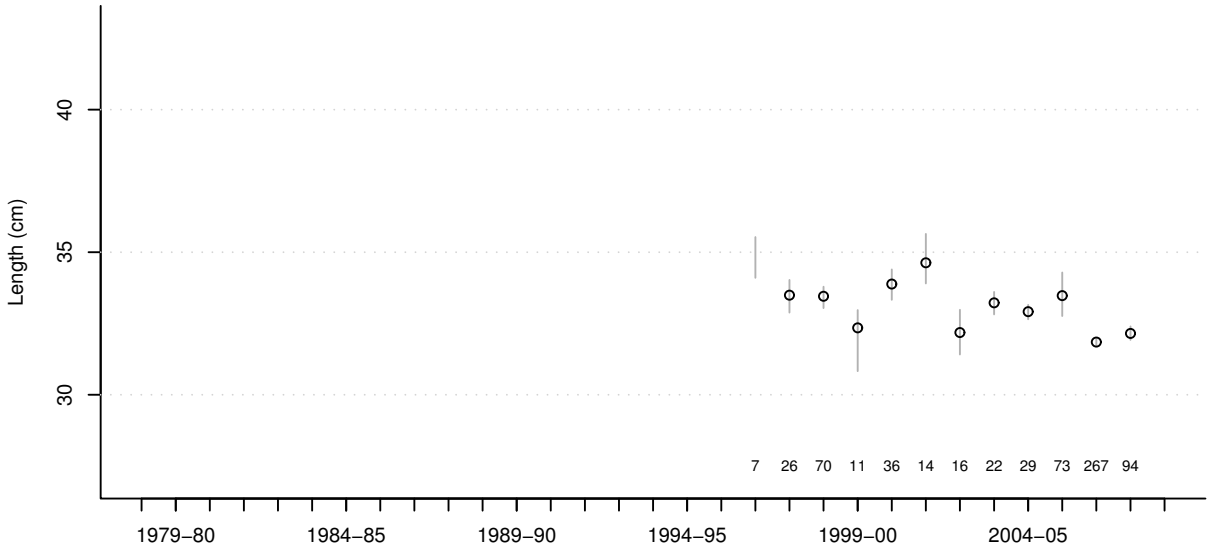

Figure 5: Catch weighted mean length (o) by fishing year for black oreo in Pukaki Rise, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

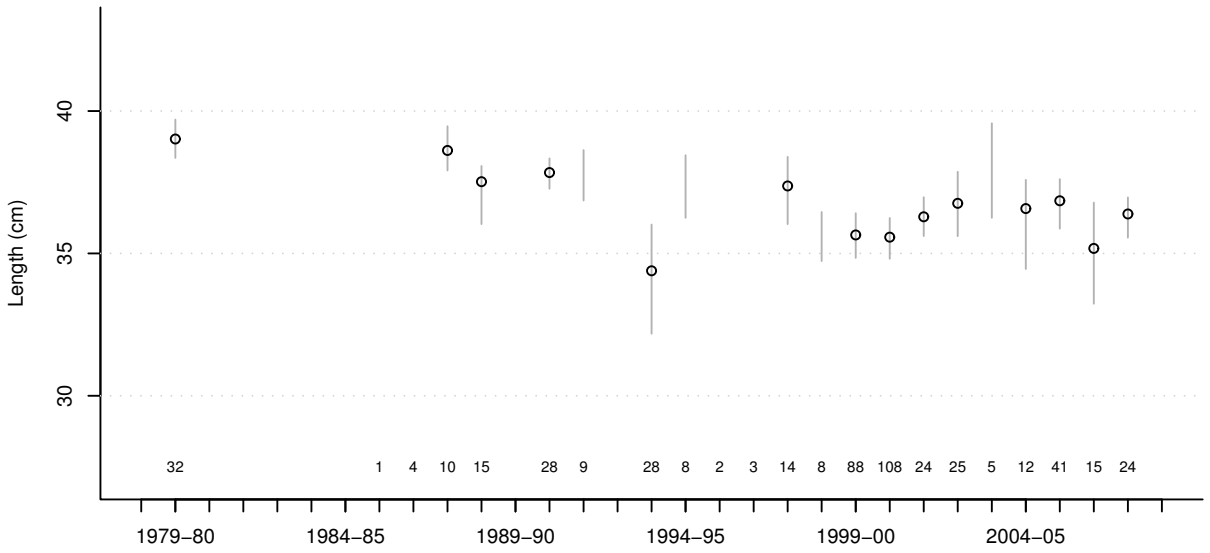

Figure 6: Catch weighted mean length (o) by fishing year for smooth oreo in OEO 3A, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

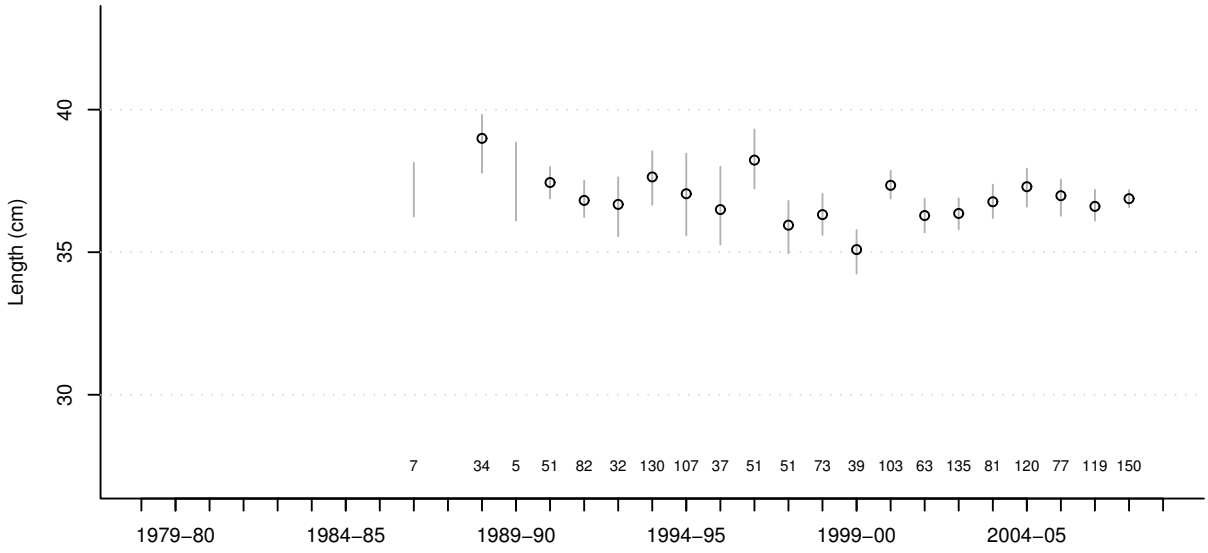

Figure 7: Catch weighted mean length (o) by fishing year for smooth oreo in OEO 4, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

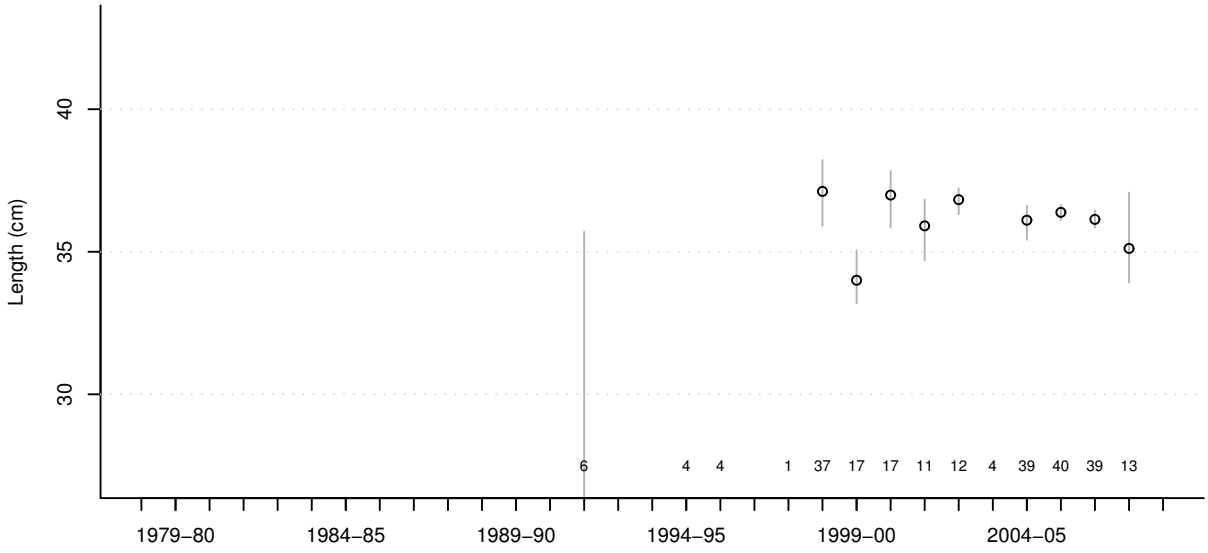

Figure 8: Catch weighted mean length by fishing year for smooth oreo in Bounty Plateau, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

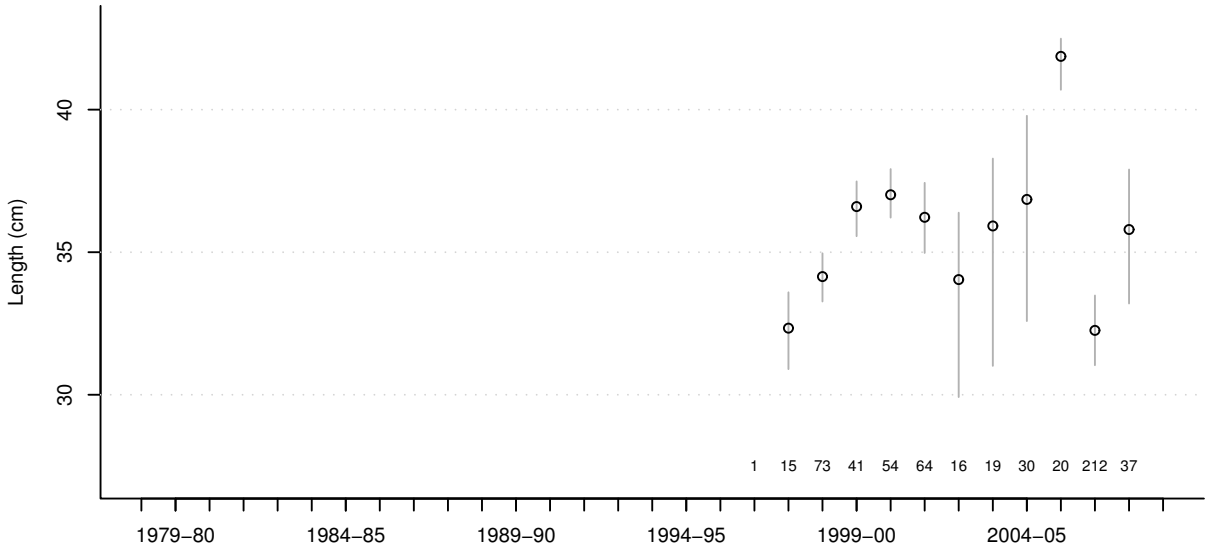

Figure 9: Catch weighted mean length by fishing year for smooth oreo in Pukaki Rise, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.

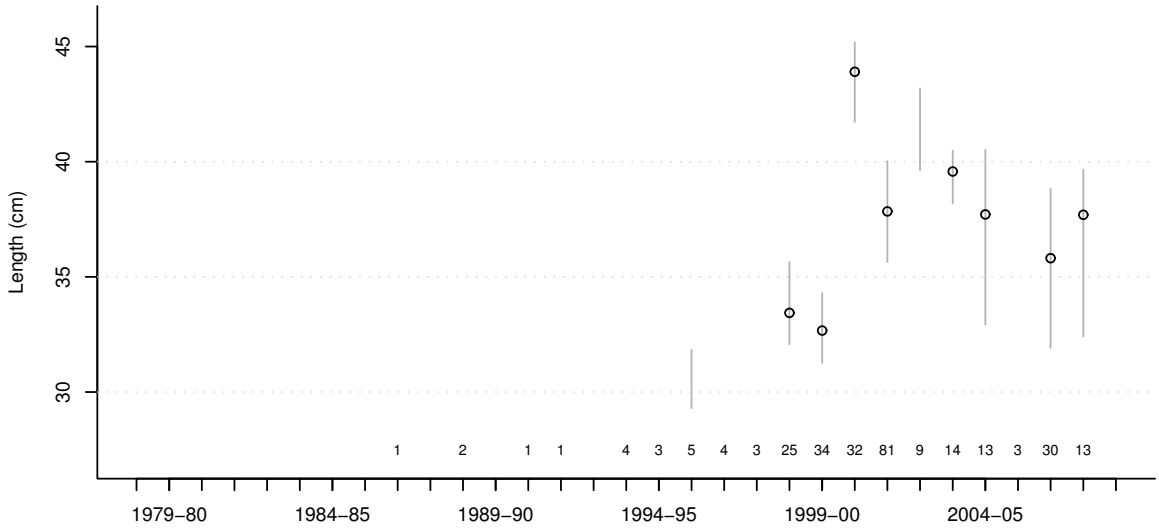

Figure 10: Catch weighted mean length by fishing year for smooth oreo in Southland, with the associated bootstrap c.i. (95%) shown with vertical bars. The number of samples is shown above the x–axis.