

OREOS – OEO 4 BLACK OREO AND SMOOTH OREO

1. FISHERY SUMMARY

This is presented in the Fishery Summary section at the beginning of the Oreos report.

2. BIOLOGY

This is presented in the Biology section at the beginning of the Oreos report.

3. STOCKS AND AREAS

This is presented in the Stocks and Areas section at the beginning of the Oreos report.

4. STOCK ASSESSMENT

4.1 Introduction

There are no new assessment results from 2008 for these oreo stocks.

Black oreo

The assessment was updated in 2000 but not included in this report until 2001. This was the first stock assessments for OEO 4 that included the results from the 1998 acoustic survey.

Assessment of black oreo

The following assumptions were made in the stock assessment analyses carried out to estimate biomasses and yields.

- (a) The acoustic abundance estimates were unbiased absolute values.
- (b) The CPUE analyses provided indices of abundance for either black oreo or smooth oreo in the whole of OEO 4. Most of the oreo commercial catches came from the CPUE study areas. Research trawl surveys indicated that there was little habitat for, and biomass of, black oreo or smooth oreo outside those areas.
- (c) The ranges used for the biological values covered their true values. (Smooth oreo growth was estimated by the model).
- (d) Varying the maximum fishing mortality (F_{MAX}) from 0.5 to 3.5 altered B_0 for smooth oreo in OEO 3A by only about 6% in the 1996 assessment, so only one assumed value (0.9) was used in all the analyses of black oreo and smooth oreo below.
- (e) Recruitment was deterministic and followed a Beverton & Holt relationship with steepness of 0.75.
- (f) Catch overruns were 0% during the period of reported catch.
- (g) The populations of black oreo and smooth oreo in OEO 4 were discrete stocks or production units.
- (h) The catch histories were accurate.

Smooth oreo

The assessment was updated in 2007 with a new acoustic absolute abundance estimate and length data from a survey carried out in 2005. West and east stocks were modelled separately, and updated standardised CPUE, observer (commercial) length data, and catch history for the years from 2001–02 to 2005–06 were all fitted in the model with the new acoustic data.

Assessment of smooth oreo

The following assumptions were made in the stock assessment analyses carried out to estimate biomass and yields.

- (a) The acoustic abundance estimates were unbiased absolute values.
- (b) The CPUE analyses provided indices of abundance for smooth oreo in the whole of OEO 4. Most of the oreo commercial catches came from the CPUE study area. Research trawl surveys indicated that there was little habitat for, and biomass of, smooth oreo outside that area.
- (c) The ranges used for the biological values covered their true values.
- (d) Varying the maximum fishing mortality (F_{MAX}) from 0.5 to 3.5 altered B_0 for smooth oreo in OEO 3A by only about 6% in the 1996 assessment, so only one assumed value (0.9) was used in all the analyses of smooth oreo below.
- (e) Recruitment was deterministic and followed a Beverton & Holt relationship with steepness of 0.75.
- (f) Catch overruns were 0% during the period of reported catch.
- (g) The population of smooth oreo in OEO 4 was a discrete stock or production unit.
- (h) The catch history was accurate.

4.2 Black oreo

Stock assessment

Biomass estimates were made in 2000 using a stock reduction analysis incorporating deterministic recruitment, acoustic absolute abundance estimates from the 1998 survey, relative abundance estimates from new standardised CPUE analyses, relative abundance indices from the south Chatham Rise Tangaroa trawl surveys (1991–93 and 1995), life history parameters from Table 1 of the Biology section at the beginning of the Oreos report, and catch history.

4.2.1 Estimates of fishery parameters and abundance

Absolute abundance estimates from the 1998 acoustic survey

Absolute estimates of abundance were available from an acoustic survey on oreos which was carried out from 26 September to 30 October 1998 on *Tangaroa* (voyage TAN9812). Transects on flat ground were surveyed to a stratified random design and a random sample of seamounts were surveyed with either a random transect (large seamounts) or a systematic “star” transect design. For some seamounts the flat ground nearby was also surveyed to compare the abundance of fish on and near the seamount either by extending the length of the star transects or by extra parallel transects. Acoustic data were collected concurrently for flat and seamounts using both towed and hull mounted transducers. The OEO 4 survey covered 59 transects on the flat and 29 on seamounts. A total of 95 tows were carried out for target identification and to estimate target strength and species composition. In situ and swimbladder samples for target strength data were collected and these have yielded revised estimates of target strength for both black oreo and smooth oreo.

Acoustic abundance estimates for recruit black oreo from seamounts and flat for the whole of OEO 4 are in Table 1. About 59% of the black oreo abundance came from the background mark-type. This mark-type is not normally fished by the commercial fleet and this implies that the abundance estimate did not cover the fish normally taken by the fishery. In addition the scaling factor to convert the acoustic area estimate to the trawl survey area estimate was 4.3, i.e., the acoustic survey area only had about 23% of the abundance. The magnitude of this ratio suggests that the size of the area surveyed was borderline for providing a reliable abundance estimate.

Table 1: OEO 4 recruit black oreo seamount, flat, and total acoustic abundance estimates (t) and recruit CV (%) based on knife-edge recruitment (23 years).

	Abundance (t)	CV (%)
Seamount	127	91
Flat	13 800	56
Total	13 900	55

Relative abundance estimates from standardised CPUE analyses

The CPUE analysis method was the same as that used for analyses of standardised CPUE for black oreo in OEO 3A and involved regression based methods where the zero catch tow and the positive catch tow data were analysed separately to produce positive catch and zero catch indices. For target fishing a combined index (positive catch and zero catch indices) was calculated. Only the positive catch index was calculated for analysis of bycatch data because the zero catch index was only important for target fishing. The mean CVs for the combined and positive indices (all years) were estimated using a jackknife technique. Data were divided into those from target fishing or from catch taken as bycatch during target fishing for other species, e.g., orange roughy; pre- and post-global positioning system (GPS) time periods, 1979–80 to 1988–89 and 1992–93 to 1998–99 respectively.

Two (of four) potential analyses were chosen where data were adequate and because target was preferred over bycatch analyses (Table 2).

Table 2: OEO 4 black oreo standardised CPUE analyses. Overall CVs of 66 and 104% were calculated for the target and bycatch series respectively.

	Index	CV
(a) Target pre-GPS combined index and jackknife CV (%)		
1980–81	2.80	122.0
1981–82	2.72	94.8
1982–83	1.02	68.1
1983–84	1.00	0.0
1984–85	0.64	60.8
1985–86	0.46	127.0
1986–87	0.41	63.4
(b) Bycatch post-GPS positive index and jackknife CV (%)		
1992–93	1.32	39.2
1993–94	1.31	75.4
1994–95	1.00	0.0
1995–96	0.63	88.1
1996–97	0.95	45.9
1997–98	0.63	39.2
1998–99	0.37	332.0

Relative abundance estimates from trawl surveys

The estimates, and their CVs, from the four standard *Tangaroa* south Chatham Rise trawl surveys were treated as relative abundance indices (Table 3).

Table 3: OEO 4 black oreo research survey abundance estimates (t). N is the number of stations. Estimates were made using knife-edge recruitment set at 33 cm TL. Previously knife-edge recruitment was set at 27 cm and estimates of abundance based on that value are also provided for comparison.

	Mean abundance		CV (%)	N
	27 cm	33 cm		
1991	34 407	13 065	40	105
1992	29 948	12 839	46	122
1993	20 953	6 515	30	124
1995	29 305	9 238	30	153

4.2.2 Biomass estimates

The stock assessment of OEO 4 black oreo was considered unreliable and was not accepted because:

1. The acoustic abundance estimate is uncertain. The acoustic survey was aimed at smooth oreo and consequently the black oreo areas in OEO 4 received only minimal coverage. The estimate of recruit abundance is low and is largely based on background abundance, where the acoustic method performed poorly, rather than from black oreo schools. The poor coverage of black oreo areas by the acoustic survey was compensated by multiplying the acoustic survey area abundance by a scaling factor of 4.3 (based on research surveys) to make the estimate equivalent to the trawl survey area and then by a further 1.06 to estimate a total abundance for OEO 4. In addition only small acoustic abundance estimates were made from the seamounts, which suggests that either black oreo abundance on seamounts was low or the estimate was biased low.

OREOS (OEO4)

2. The CPUE abundance estimates are uncertain. There is only a small fishery for black oreo in OEO 4 (about 1100 t per year from 1989–90 to 1998–99) with target fishing largely confined to the west end during the late 1980s and early 1990s.

No estimates of biomass are reported because they were considered unreliable.

4.2.3 Estimation of Maximum Constant Yield (MCY)

MCY was estimated using the equation, $MCY = c * Y_{AV}$ (Method 4). There was no trend in the annual catches, nominal CPUE, or effort from 1982–83 to 1987–88 so that period was used to calculate the MCY estimate (1200 t).

4.2.4 Estimation of Current Annual Yield (CAY)

CAY cannot be estimated because of the lack of current biomass estimates.

4.3 Smooth oreo

Stock assessment

Bayesian procedures were used in the assessment to estimate the uncertainties in model estimates of current biomass and in future projections for all model runs. These procedures were conducted with the following steps:

1. Model parameters were estimated using maximum likelihood and the prior probabilities;
2. Samples from the joint posterior distribution of parameters were generated with the Monte Carlo Markov Chain procedure (MCMC) using the Hastings-Metropolis algorithm;
3. A marginal posterior distribution was found for each quantity of interest by integrating the product of the likelihood and the priors over all model parameters; the posterior distribution was described by its median, 5th and 95th percentiles for parameters of interest.

The area was split at 178° 20' W into a west and an east fishery based on an analysis of commercial catch, standardised CPUE, and research trawl and acoustic results. Oreo catch data showed marked changes in fishing patterns over time. This involved a progression of high catches over time starting in the west and moving east and appeared to represent successive exploitation of new areas. Areas in the west previously exploited did not later sustain high catches. The target species and the type of fishing changed over time with smooth oreo the target species in the west on flat, dropoff, and seamounts from the late 1970s, with a gradual change to target fishing for orange roughy on seamounts in the east from the late 1980s.

Biomass and yield estimates for smooth oreo were made using a CASAL age-structured population model with Bayesian estimation, incorporating deterministic recruitment, life history parameters (Table 1 of the Biology section at the beginning of the Oreos report), and catch history. Estimated model parameters and priors are presented in Table 4. Data fitted in the analysis were the 1998, 2001, and 2005 acoustic survey abundance estimates (Table 6), standardised combined CPUE indices (a, b, & c, Table 8), observer length data (Table 7), and the 2001 and 2005 acoustic survey length data.

Table 4: Estimated parameters and priors of the CASAL assessment model. U, uniform distribution. –, no value or not applicable.

Parameter	Both	Number	Prior
Virgin biomass	Estimated	2	$\ln B_0 \sim U[0, \ln(350\,000)]$
West catchability coefficient [pre-GPS CPUE]	Estimated	1	$U[0, 1]$
East catchability coefficient [post-GPS CPUE]	Estimated	1	$U[0, 1]$
West catchability coefficient [post-GPS CPUE]	Estimated	1	$U[0, 1]$
<u>Age-based selectivity: commercial fishery:</u>			
Age at 50% selected (east & west)	Estimated	2	$U[1, 50]$
Extra years to 95% selected (east & west)	Estimated	2	$U[0, 1]$

Table 4 (Continued):Age-based selectivity: acoustic survey:

Age at 50% selected (east & west)	Estimated	2	U[1, 50]
Extra years to 95% selected (east & west)	Estimated	2	U[0,1]

Process errors

Acoustic length data (east)	Estimated	1	U[0,1.5]
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The model assumed two independent stocks, one in the west and the other confined to the east with no migration from the east to the west area and a fixed M (0.063). Selectivities were modelled as effectively knife-edged with separate functions for the east and west areas but with no differences between males and females (for both the observer and acoustic survey data). The knife-edge cutoff was obtained by restricting the selectivity parameter where 50–95% of ages were selected to be between 0 and 1 in a logistic function. Acoustic length data were fitted to the model using a log-normal likelihood with process errors, and a robustified binomial distribution was used for the observer length data. Process error for the CPUE series was set to a CV of 0.20.

Three cases (runs) are reported. The Base case used all the data including the three acoustic survey abundance estimates and survey length data, observer length data, and three standardised CPUE index series. The CPUE case used the same data as the base case except that it excluded the acoustic survey abundance and length data. The Acoustic case used the same data as the base case except that it excluded the three CPUE index series.

Bayesian estimates were based on the median of a 2 million long MCMC sampled at each 1000th value, with the first 10% excluded.

4.3.1 Estimates of fishery parameters and abundance

Catch history

A catch history for OEO 4 split into east and west areas was developed by scaling the estimated catch to the QMS values. The west fishery was larger from 1978–79 to 1986–87 but east was more important from 1987–88 onwards, Table 5.

Table 5: Catch history for OEO 4 smooth oreo (t)

Year	OEO 4	West	East	Year	OEO 4	West	East
1978–79	1 351	1 351	0	1992–93	5 918	1 420	4 498
1979–80	114	114	0	1993–94	6 287	1 069	5 218
1980–81	1 436	1 436	0	1994–95	6 961	1 392	5 568
1981–82	3 465	3 430	35	1995–96	6 364	2 227	4 137
1982–83	3 757	3 757	0	1996–97	6 339	1 712	4 627
1983–84	5 817	5 759	58	1997–98	6 159	1 848	4 311
1984–85	4 736	4 547	189	1998–99	6 025	1 749	4 283
1985–86	4 922	4 380	541	1999–00	6 366	1 670	4 696
1986–87	5 670	4 196	1 474	2000–01	6 484	1 720	4 764
1987–88	7 771	2 642	5 129	2001–02	4 284	1 436	2 848
1988–89	7 225	2 457	4 769	2002–03	4 459	1 332	3 127
1989–90	6 788	1 154	5 634	2003–04	5 653	1 519	4 134
1990–91	6 028	1 808	4 220	2004–05	6 451	1 818	4 633
1991–92	5 504	1 211	4 293	2005–06	5 946	1 302	4 644

Absolute abundance estimates from the 1998, 2001, and 2005 acoustic surveys

Absolute estimates of abundance were available from three acoustic surveys:

- (i) 26 September to 30 October 1998 on *Tangaroa* (voyage TAN9812);
- (ii) 16 October to 14 November 2001 using *Tangaroa* for acoustic work (voyage TAN0117) and *Amaltal Explorer* (voyage AEX0101) for trawling; and
- (iii) 3–22 November 2005 using *Tangaroa* for acoustic work (voyage TAN0514) and 3–20 November 2005 using *San Waitaki* (SWA0501) for mark identification trawling.

Acoustic abundance estimates for total smooth oreo from seamounts and flat for the whole of OEO 4 are in Table 6. The 1998 and 2001 estimates for the mixed species mark-types were adjusted to match the larger contribution for non-smooth oreo species in these mark types from the trawl net used in 2005. The assessment used the estimates for the east and west areas separately.

Table 6: Estimated absolute abundance (t) from acoustic surveys in 1998, 2001, and 2005 by east, west and for the combined area. CVs are in brackets (%).

	1998	2001	2005
West	22 600 (52)	43 000 (35)	32 200 (31)
East	127 000 (37)	183 000 (22)	91 800 (30)
Total	146 600 (33)	218 165 (22)	115 500 (28)

One of the major uncertainties in the assessment is from the large contribution to the total acoustic abundance estimate from smooth oreo estimated to be in the layers (about 72% of the total abundance for the 1998 survey, 47% for the 2001 survey, and about 45% for the 2005 survey). The contribution of large (greater than 31 cm) smooth oreo to the total backscatter in these layers was typically less than 10% of the total abundance, with the remainder composed of a number of associated bycatch species and smaller smooth oreo in 1998 and 2001. The layer acoustic abundance could be biased because the contribution made by the suite of other fish species present in the layers may be mis-specified, thus adding to the overall uncertainty in the biomass estimates from the assessment. The contribution of large smooth oreo to the total backscatter in the schools was typically greater than 75% in 1998 and 2001. Therefore, the acoustic smooth oreo abundance estimates from the schools were considered to be better estimated than the equivalent acoustic estimates from the layers.

Observer length frequencies

Observer length data were extracted from the observer database. These data were stratified by season (October-March and April-September) and into west and east parts. The length frequencies were combined over strata by the proportion of catch in each stratum.

The assessment included data for all years where there were more than 5 tows for the year for both strata combined, more than 30 fish were measured in each stratum, and there were data for both females and males in the stratum (Table 7).

Table 7: Observer length frequencies for the west and east areas: number of tows with length data by season strata, and whether the data for each year were used in the stock assessment. †, updated data.

Year	West			East		
	Oct-Mar	Apr-Sep	Used	Oct-Mar	Apr-Sep	Used
1987	2	1		0	0	
1989	10	5	Y	1	0	
1990	4	0		0	0	
1991	16	0		26	4	Y
1992	6	0		45	8	Y
1993	0	0		22	16	Y
1994	1	0		64	33	Y
1995	1	0		42	30	Y
1996	9	10	Y	6	6	Y
1997	11	0		28	3	Y
1998	2	9	Y	20	9	Y
1999	0	7		30	21	Y
2000	3	15	Y	14	0	
2001	8	14	Y	44	5	Y
2002†	0	3		24	16	Y
2003†	3	4	Y	28	6	Y
2004†	1	6		27	3	Y
2005†	3	3		18	46	Y
2006†	3	14	Y	3	14	Y

Acoustic survey length frequencies

Length data collected during the 2001 and 2005 acoustic survey were used to generate population length frequencies for the east and west areas separately. Each frequency was estimated using the length data from trawls in each mark-type sub-stratum weighted by the catch rates and the proportion of acoustic abundance in the sub-stratum. These frequencies were normalised over both male and female frequencies so that the sum of the frequencies over both sexes summed to 1. The data for the two areas separately were used in the assessment.

Relative abundance estimates from standardised CPUE analyses

The CPUE analysis method was the same as that described above (Section 4.2) for OEO 4 black oreo except that a revised method was used to convert the index values to a canonical form by dividing each value by the geometric mean of the index series following the suggestion of Francis (1999) and resulted in the index value for the reference year being a value other than 1. Annual CVs for the combined indices were estimated using a jackknife technique (Doonan *et al.* 1995a) but the method was revised by using the canonical index values to calculate the jackknife CV values and resulted in the reference year CV having a value other than 0. The target SSO pre-GPS series (Table 8 a) used data from the both east and west areas but most of the data were from the west. The assessment used east and west indices (Table 8 a, b, & d).

Table 8: OEO 4 smooth oreo time series of combined and positive catch abundance indices from standardised CPUE analyses used in the assessment.

Year	Combined index	Jackknife CV
(a) Target SSO pre-GPS (east + west but mainly west data)		
1981–82	1.40	15
1982–83	1.36	19
1983–84	1.04	21
1984–85	0.84	20
1985–86	1.00	44
1986–87	0.99	28
1987–88	0.89	20
1988–89	0.68	22
(b) Target OEO/SSO post-GPS (west)		
1992–93	0.50	29
1995–96	0.53	53
1996–97	0.99	17
1997–98	0.80	74
1998–99	0.82	19
1999–00	1.12	30
2000–01	1.04	13
2001–02	1.07	54
2002–03	1.38	54
2003–04	1.40	8
2004–05	1.65	31
2005–06	1.47	38
(c) Bycatch post-GPS (east)		
Year	Positive catch index	Jackknife CV
1992–93	1.56	33
1993–94	1.29	27
1994–95	1.18	16
1995–96	0.96	57
1996–97	1.52	18
1997–98	0.96	28
1998–99	1.03	22
1999–00	1.10	71
2000–01	0.93	8
2001–02	0.83	10
2002–03	0.92	21
2003–04	1.00	31
2004–05	0.64	34
2005–06	0.57	24

4.3.2 Biomass estimates

The estimates of biomass from the Base case (Figure 1) and the Acoustic case (Figure 2) are very similar. The mature virgin biomass estimates from the CPUE case have a long tail on the right hand side of the distribution and the current biomass estimates are wide 90% confidence bounds (Figure 3).

All estimated parameters for the three cases achieved MCMC convergence. Biomass point estimates are in Table 9. For the base case the median estimate of current mature biomass was 57% B_0 .

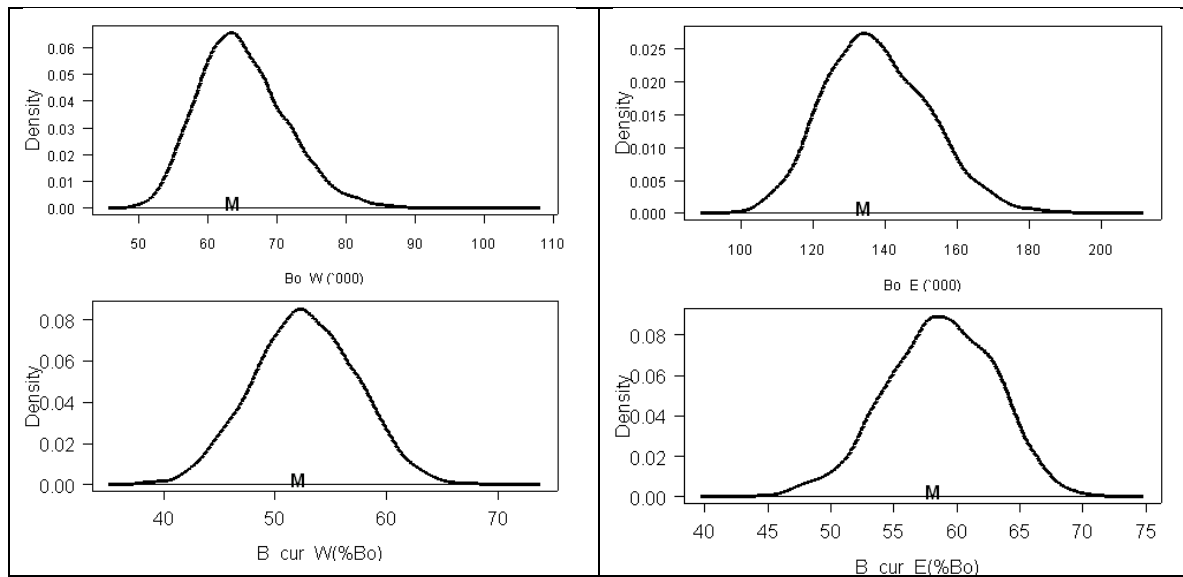


Figure 1: Bayesian posterior distribution of mature biomass estimates for the OEO 4 smooth oreo Base case. Based on 2000 Monte Carlo Markov Chain runs. Upper panels are west (B_0 W) and east (B_0 E) virgin biomass (t) and lower panels are west (B_{cur} W(% B_0)) and east (B_{cur} E(% B_0)) current biomass as a percentage of virgin biomass. M is the MPD point estimate.

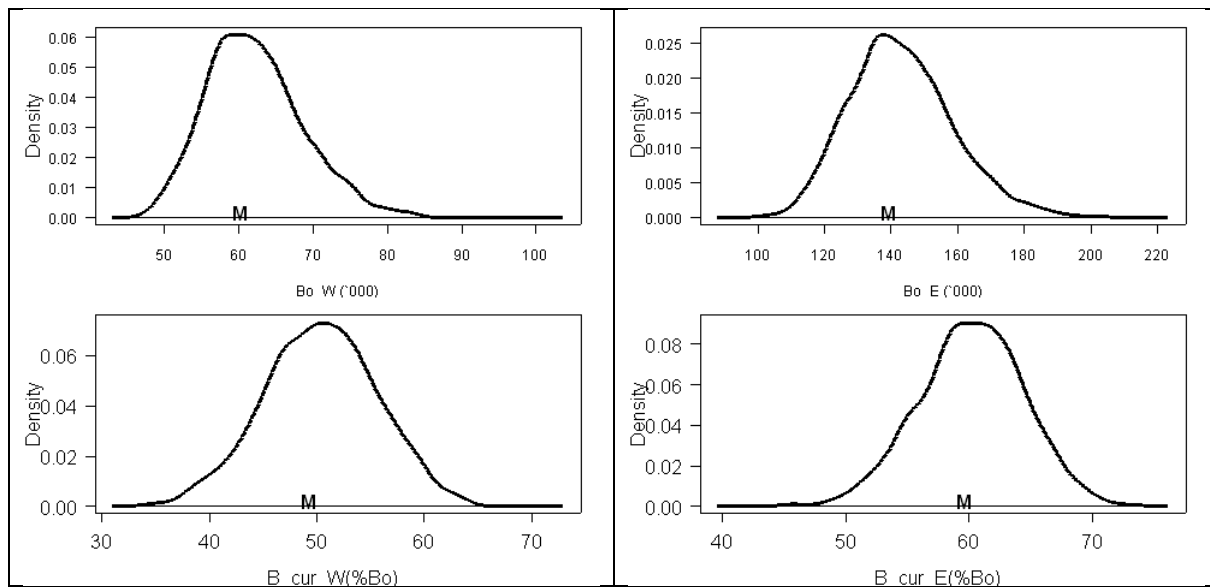


Figure 2: Bayesian posterior distribution of mature virgin biomass (t) estimates for the OEO 4 smooth oreo Acoustic case. Based on 2000 Monte Carlo Markov Chain runs. Upper panels are west (B_0 W) and east (B_0 E) virgin biomass (t) and lower panels are west (B_{cur} W(% B_0)) and east (B_{cur} E(% B_0)) current biomass as a percentage of virgin biomass. M is the MPD point estimate.

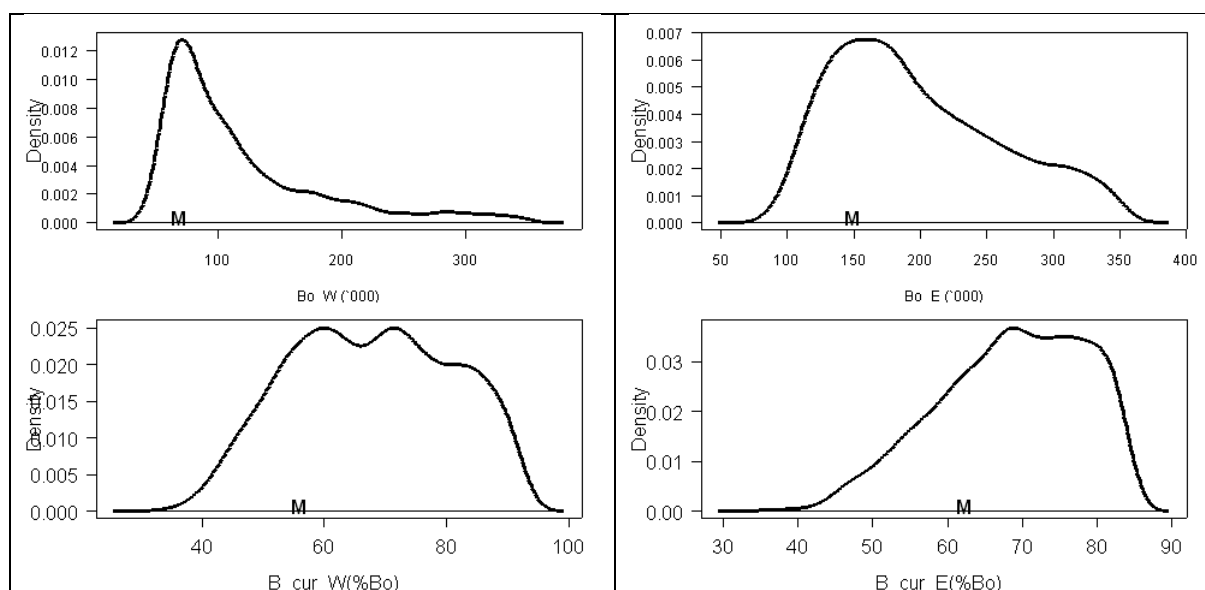


Figure 3: Bayesian posterior distribution of mature virgin biomass (t) estimates for the OEO 4 smooth oreo CPUE case. Based on 2000 Monte Carlo Markov Chain runs. Upper panels are west (B_0 W) and east (B_0 E) virgin biomass (t) and lower panels are west ($B_{\text{cur}} W(\%B_0)$) and east ($B_{\text{cur}} E(\%B_0)$) current biomass as a percentage of virgin biomass. M is the MPD point estimate.

Table 9 Mature biomass, estimates for OEO 4 smooth oreo. –, not estimated or na.

	Median	CV	90% C.I.
(a) Base case			
B_0 (t)	202 000	8	178 000–231 000
B_{current} (t)	115 000	14	91 600–144 000
B_{current} ($\%B_0$)	57	6	51.3–62.4
(b) Acoustic case			
B_0 (t)	204 000	8	180 000–235 000
B_{current} (t)	118 000	15	92 900–148 000
B_{current} ($\%B_0$)	58	6	52–63
(c) CPUE case			
B_0 (t)	300 000	29	194 000–491 000
B_{current} (t)	214 000	40	107 000–405 000
B_{current} ($\%B_0$)	71	12	55–82

4.3.3 Estimation of Maximum Constant Yield (MCY)

No estimates of MCY are available.

4.4.4 Estimation of Current Annual Yield (CAY)

No estimates of CAY are available.

4.3.5 Estimation of Current Surplus Production (CSP)

No estimates of CSP are available.

4.3.6 Other factors that may modify assessment results

The WG considered that there were a number of other factors that should be considered in relation to the stock assessment results presented here:

- This assessment still has the uncertainties that were identified in the 2003 assessment analysis. The main uncertainty is that substantial proportions of the abundance in each survey are attributed to layer marks which are generally not fished by the commercial fishery. That uncertainty results from apportioning the observed acoustic backscatter to the range of different species caught by bottom trawl in layer marks. The acoustic surveys probably do a

good job of estimating the abundance of school or high density marks which were observed by trawling to comprise mostly smooth oreo.

- The 2007 assessment was an update of the 2003 NIWA assessment and gave a similar overall result to the previous assessment for the base case, i.e., 55% (45–61) in 2003 and 57% (51–62) of mature B_0 (90% CI) in 2007. But the 2007 assessment differed from the previous assessment because the increasing trend in the west post-GPS standardised CPUE did not fit the model, and seemed in conflict with the declining trend in the east bycatch post-GPS standardised CPUE series.
- The assessment estimated the current stock size at 57 (51–62) % of the mature virgin level. The CV of 6% is unrealistic and only indicates that there is enough data to achieve a precise estimate for each case, which does not represent the true level of uncertainty in the stock assessment. Some of the additional uncertainty is apparent when looking across the three cases. There are a number of structural assumptions in the model that result in the true uncertainty of the model biomass estimates being underestimated. These include the assumption that the acoustic biomass estimates for smooth oreo are absolute (scaling coefficient = 1) and that there was no variability in recruitment (deterministic recruitment was used).
- There are also a number of factors that are outside the model and the analyses that add uncertainty to the model estimates of biomass. These include the large smooth oreo acoustic abundance estimated to be in layers (mentioned above) which are not normally fished by the commercial fleet, sensitivity of the acoustic biomass estimate to the low value of the target strength of smooth oreo, and uncertainty in the estimates of M and growth rates.
- The 2003 NIWA assessment estimated M within the model to achieve fits for both the length and abundance data. This indicated inconsistencies between the data and the model structure. The 2007 analysis showed that fitting the right hand side of the observer length frequency distribution gave poor fits to the model and that the profile of those data are inconsistent with other data, e.g., M , average recruitment, or growth. The 2007 analysis therefore fitted only the left hand side of the observer length frequency distribution to estimate selectivity. Fitting the right hand side would require estimates of recruit deviates to provide a quality fit to the model.
- This assessment suggests that there is no immediate sustainability issue for OEO 4 smooth oreo. But the decline in the standardised CPUE for the East bycatch post-GPS, assumed to index the larger east fishery, from 1.56 in 1992–93 to 0.57 in 2005–06 suggests that future monitoring of the stock would be wise. This decline is in contrast to the West target post-GPS fishery which shows increasing CPUE.
- Anecdotal evidence of large catches of small smooth oreo in the research trawl survey in 1990 suggests the possibility of a pulse of recruitment in the late 1980s, while the lack of large catches of small smooth oreo from recent acoustic surveys, e.g., 2005, suggests the possibility of poor recent recruitment.

5. STATUS OF THE STOCKS

There are no new assessment results from 2008 for these oreo stocks.

Black oreo

The stock assessment of OEO 4 black oreo was considered unreliable and was not accepted. However, abundance indices from standardised CPUE analysis suggests that there was a decline in the stock through the 1980s and 1990s. It is not known if recent catch levels or the current TACC are sustainable or if they are at levels that will allow the stock to move towards a size that will support the maximum sustainable yield.

Smooth oreo

The OEO 4 smooth oreo stock assessment was updated in 2007. Three final runs are reported for the stock.

The model estimates of mid-year mature biomass in 2005–06 was 57% (51–62) of mature B_0 and suggests that there is not an immediate sustainability issue with this stock. However, there are considerable uncertainties associated with this assessment described in section 4.3.6 above. The main uncertainty is that substantial proportions of the abundance in each acoustic survey are attributed to layer marks which are generally not fished by the commercial fishery. Also, standardised CPUE in the larger east fishery has declined in recent years.

OEO 4: Summary of yield estimates (t) and estimated catch (t) for the most recent fishing year. Estimated catch was scaled to the reported oreo landings for each fishstock using the reported estimated catch of black or smooth oreo from Tables 2 and 3 of the Fishery Summary section at the beginning of the Oreos report. Reported landings and TACCs for both oreo species combined are in Table 2 of the Fishery Summary section at the beginning of the Oreos report. –, not available.

Species	CAY	Long-term MCY	2006–07 estimated catch
Black oreo	–	1200	882
Smooth oreo	–	–	5946

6. FOR FURTHER INFORMATION

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