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Manatū Ahu Matua

Estimates of age frequency for black oreo from 2014 on southwest Chatham Rise (OEO 3A)

New Zealand Fisheries Assessment Report 2017/59

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Table of Contents

EXECUTIVE SUMMARY

Doonan, I.J.; McMillan, P.J.; Ó Maolagáin, C. (2017). Estimates of age frequency for black oreo from 2014 on southwest Chatham Rise (OEO 3A).

***New Zealand Fisheries Assessment Report 2017/59*. 16 p.**

Otoliths (n=600) sampled mainly from the 2014 acoustic survey mark identification tows in management area OEO 3A were prepared and read by one reader. Otoliths were selected from each of two areas, i.e., Area 1 (primarily unfished) and Area 2&3 (the main fishery area). The split was 300 otoliths from each area. Age data were scaled up to the square-root of black oreo survey catch within mark-types-area-strata and then by acoustic abundance in each mark-type to derive an age frequency for Area 1 and Area 2&3. Otoliths from fourtows in a 2011 acoustic survey were used where otolith samples by mark-type from the 2014 survey were inadequate. The current study confirms the results found in a previous ageing study that used data from 1997 to 2006, i.e., age distributions were similar in Area 1 and Area 2&3, and mean length at age was lower in Area 1 relative to that in Area 2&3. The mean ages increased by 6 years for Area 1 and by 2 years for Area 2&3 in 2014 compared to the 1997 to 2006 age distributions

1. INTRODUCTION

This work is part of the Ministry for Primary Industries (MPI) project MID201501, with an overall objective 'To age samples of middle depth and deepwater species from commercial fisheries and resource surveys as input data to the stock assessments for those species'. It addresses part of objective 1: To "determine catch-at-age for commercial catches and resource surveys of specified middle depth and deepwater fishstocks". The intention was to age 600 black oreo from Fishstock OEO 3A from the 2014–15 fishing year, to produce an age-frequency distribution.

Age estimates of black oreo in OEO 3A are required for stock assessment. A previous OEO 3A black oreo study investigated the proportions of mature fish abundance from the unfished area (Area 1), and the fished area (Area 2&3) (Figure 1), and produced age frequency distributions for these areas (Doonan et al. 2016a). The age data were derived from 1000 prepared otoliths from the acoustic surveys in 1997, 2002 and 2006. Subsequent acoustic surveys were conducted in 2011 (Doonan et al. 2014) and 2014 (Doonan at al. 2016b). The work reported here is an analysis of 600 aged otoliths from fish sampled in the 2014 survey, providing another set of age frequencies for black oreo in Area 1 and Area 2&3. Note that the age frequency estimated in this work has been combined over Area 2 and Area 3 since the aim is to delineate the mainly unfished Area 1, which has had a relatively large mature abundance in previous assessments, from the fished Area 2&3.

2. METHODS

2.1 Selection of otoliths from the 2014 acoustic survey tow samples

Acoustic survey methodology

The 2014 black oreo acoustic survey in OEO 3A used a conventional stratified random approach (Jolly & Hampton 1990) over eight strata divided into three spatial areas (Figure 1). An abundance estimate was estimated for each of the three areas used in the stock assessment model (Hicks et al. 2002). The same strata were used in both the 2011 (Doonan et al. 2014) and 2014 (Doonan et al. 2016b) surveys, and six mark-types were recognised (Table 1).

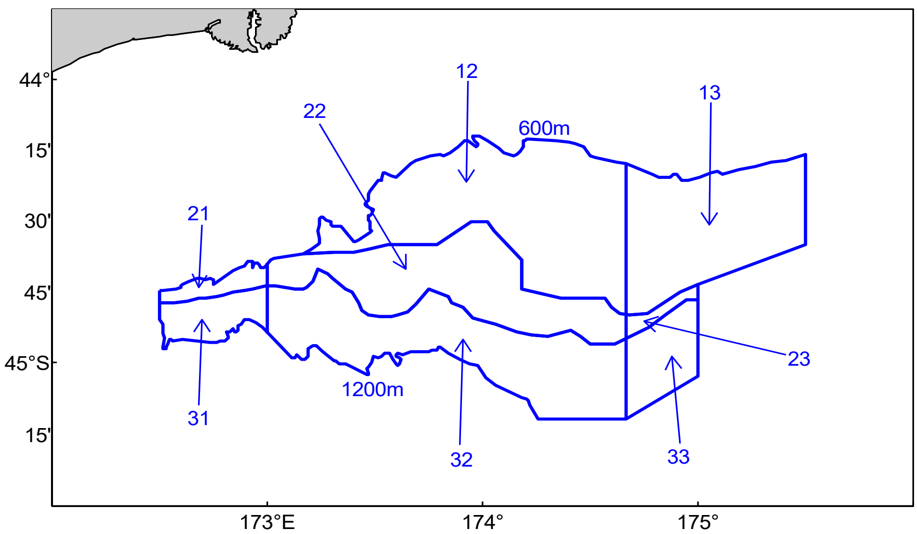

Figure 1: The 2014 (and 2011) acoustic abundance survey area with stratum boundaries and stratum numbers. Area 1 is composed of strata 12 and 13; Area 2 is composed of strata 21, 22, and 23; and Area 3 is composed of strata 31, 32, and 33. The boundary between Area 2 and 3 separates the mean lengths from early commercial catch at a contour of 32.5 cm (Smith et al. 2006).

Survey design and abundance estimation details are provided by Doonan et al. (2016b). The overall approach to the survey was to measure acoustic backscatter together with information from trawl tows to estimate the size structure of the black oreo samples and the mix of species present in acoustic marks. The catches from each successful tow were sorted by species, and the weight of each species was recorded. For each tow, a staged length frequency (total length (mm, TL), sex, and gonad stage) was recorded for a random sample of 200 black oreo (and smooth oreo). Up to 60 individuals of black oreo and smooth oreo, (and sometimes other quota species) were selected at random from each tow for a more detailed biological analysis which included measuring fish length, weight, sex, macroscopic gonad stage and weight, and otolith extraction. Length and weight measurements were made for samples of up to 100 of all by-catch species from each tow.

Acoustic backscatter from black oreo alone was calculated by accounting for backscatter from other species present via their target strengths and fraction in the tow catch composition. Black oreo acoustic abundance was then estimated from the black oreo backscatter and mean weight. The industry vessel FV *San Waitaki* carried out all the acoustic work (using a hull-mounted transducer) and the trawl sampling. To better characterize species composition and increase the precision of the abundance estimates, backscatter was classified into six different mark-types (Table 1) and species composition was estimated for each mark-type.

Table 1: Classification of echogram marks into black oreo mark-types.

Mark-type	Description
SHORT	Discrete marks < 500 m long
LONG	Discrete marks > 500 m long
LAYEROFF	Layers off the bottom
LAYER	Layers on the bottom
BACK	Background < 1000 m deep
BACKDEEP	Background > 1000 m deep

Table 2 shows how catch rates differed between mark-types for the two main species caught in the survey, black oreo (BOE) and smooth oreo (SSO), and the other species combined for tows targeting each mark-type. Relatively high BOE catch rates were observed in the LONG and SHORT mark-types. The species composition for the LONG and SHORT mark-types were nearly 100% oreo (both species), whilst the other mark-types contained some black oreo with a mixture of other species and very little smooth oreo. This broad pattern was seen in past acoustic OEO 3A surveys, although details differ slightly between surveys.

Table 2: Mean tow catch rates (kg/n.mile) for black oreo, smooth oreo, and all other species combined for each mark-type from the 2011 and 2014 surveys, and the number of unique species in the catch data by mark-type (see http://marlin.niwa.co.nz **for species code definitions).**

Mark-type	Number of species	Number of tows	Catch rates (kg/n.mile)						
			BOE	SSO	All others				
					Total	Highest species		Next highest	
						Catch data from the 2014 survey			
SHORT	21	13	2 080	4 718	141	ETB	67	HJO	18
LONG	18	5	9 212	2 098	242	ETB	149	HOK	43
LAYEROFF	16	5	189	0	229	JAV	60	GSP	59
LAYER	15	3	74	0	303	JAV	105	HOK	77
BACK	24	7	320	3	144	GSP	30	JAV	22
BACKDEEP	8	1	0	0	181	SSM	81	MCA	66
						Catch data from the 2011 survey			
SHORT	15	3	2 853	1 941	126	ETB	65	HJO	30
LONG	18	3	4 585	4 517	161	ETB	98	HOK	21
LAYEROFF	21	7	205	155	73	HOK	21	JAV	14
LAYER	24	6	466	15	147	HJO	25	BJA	23
BACK	21	2	90	25	140	HOK	63	ETB	35
BACKDEEP	14	2	0	0	113	SSM	46	MCA	28

Otoliths selected for the age estimate analysis

Black oreo otoliths were selected from the total 2014 survey set to provide a representative sample of the black oreo population size range (as a proxy for age) from Area 1 and Area 2&3. To get an adequate estimate of error, otoliths were required from several tows in each mark-type and area. For some acoustic mark-types, however, too few otoliths were available from the 2014 survey. Consequently, otoliths from four of the 2011 acoustic survey tows (stations 4, 34, 35) were included. Selection of otoliths was undertaken before the final black oreo abundance was available. A review of the assigned mark-types for the final abundance estimate excluded three tows from which otoliths were prepared and read, and included some other tows which did not contribute any otoliths to the analysis. The three tows excluded from the abundance were assigned mark-types for the age analysis and the number tows used, by mark type, for otolith selection is shown in Table 3.

The number of otoliths selected from each tow was weighted by the square-root of the black oreo catch for each tow within the mark-type and area, and this was then weighted by the area mark-type abundance. There were 300 otoliths selected from each of Area 1 and Area 2&3, giving a total of 600 otoliths for the analysis.

Table 3: Numbers of tows (by acoustic mark-type) from which otoliths were selected for the age analysis. "2014" are tows used in the acoustic abundance estimation; "Ex 2014" are tows selected in the preliminary analysis for age but subsequently excluded from the acoustic abundance analysis; "2011" are tows from the 2011 survey used to provide sufficient otoliths for the age analysis. "Abd." is the proportion of abundance within a mark-type for that area group (%).

	Area 1					Area 2&3				
Mark-type	2014	Ex 2014	2011	Total	Abd.	2014	Ex 2014	2011	Total	Abd.
BACK	5	1		6	23	1		1	2	53
BACKDEEP				0	0	1		1	2	0
LAYER	3			3	3				0	9
LAYEROFF	5			5	70				0	1
LONG				0	2	5		1	6	26
SHORT			1	1	1	8	2		10	12

2.2 Age determination of black oreo

Background

NIWA has previously completed three studies that estimated black oreo age using zone counts in otoliths, plus a fourth study which estimated age using the bomb chronometer method of radiocarbon ageing (Neil et al 2008). The method measures levels of radiocarbon that was introduced into the environment from nuclear weapons testing in the Pacific Ocean in the 1950s to 1970s.

The first study used 227 readable otolith thin sections from samples taken during random trawl surveys on the Chatham Rise from 1988 to 1994 (Doonan et al. 1995). Two readers used a protocol set of 21 (16 readable) sections to help them consistently interpret the observed zones in the larger sample. Estimated between-reader variability was high, with a CV on the age estimates of up to about 15% for fish less than 20 years old, which declined to about 7% for fish of about 80 years (Doonan et al. 1995). A maximum unvalidated age of 153 years was estimated for a 45.5 cm TL female fish (Doonan et al. 1995).

The second study used 266 readable otolith thin sections from samples taken during a random trawl survey on the Puysegur Bank area in 1992 (TAN9208). The same two readers as in the work described above used the protocol set to help them consistently interpret the observed zones. Estimated average between-reader variability (CV on the age estimates) was 8.3%. A maximum unvalidated age of 142 years was estimated for a 42.3 cm TL female fish (McMillan et al. 1997). The Puysegur age estimates were used to estimate natural mortality from a lightly fished black oreo population (Doonan et al. 1997).

The third study used black oreo otoliths sampled from acoustic survey mark identification tows in OEO 3A and aimed to test the prediction that there was a large proportion of mature fish in the predominantly unfished area (Area 1) of OEO 3A. About 1000 otoliths were prepared and read by two readers. A revised protocol set of 46 readable otoliths was developed from the original 1995 age study. Ageing was problematical; there was a small between-reader bias and the precision of age estimates had a CV of 15% (Doonan et al. 2016a).

The fourth study measured radiocarbon (^{14}C) levels in otolith core micro-samples from 16 large, previously-aged (by zone-count) black oreo (Neil et al. 2008). A thin section from one otolith of the pair was re-read to confirm the original count, and thick sections from the other otolith were micro-milled to remove material for the analysis. The radiocarbon results corroborated otolith zone age estimates for black oreo to about 40 years, with marginal support for much older derived ages given the implied annual formation of zones and the relatively regular pattern of zones formed in the otoliths of larger (i.e. older) fish. By inference, it is probable that ages in excess of 100 years are achieved by this species.

Preparation and reading of black oreo otoliths
In the current study, one of each pair of otoliths from a fish was chosen for sectioning, with neither the left nor right otolith consistently chosen. The main selection criterion was a clean and complete otolith that was not 'crystalline' (i.e., comprised partially or completely of vaterite). Each otolith was marked with a dorso-ventral line through the primordium along the section (reading) axis. Three otoliths were oriented in a mould with all the reading axes lined up, embedded in resin (Araldite K142), cured at about 50°C for a minimum of 4 hours and left to completely harden overnight. After curing, a thin section 250 ± 20 μm wide was taken through the three otoliths along the marked axis line using a high precision Struers Secotom sectioning saw. The sections were cleaned in detergent and water to remove any residual particulates, then air-dried before being mounted on a glass microscope slide with epoxy resin under a glass cover slip. One reader, who had read the otoliths for the previous studies, read all the otoliths. The protocol set of 46 readable otoliths was used to calibrate otolith zone interpretation prior to reading the unread otoliths. No re-reading or within-reader estimates were made.

Readability categories (5-stage scale defined below) were assigned for each otolith section read.

1. Otolith structure is exceptionally clear with unambiguous zones. This is very rare for black oreo (and smooth oreo) for sections prepared with the techniques described above. It is unknown if better readability can be achieved with different preparation methods. This readability scale is potentially possible for very young fish where there are fewer than 6 inner zones.
2. A complete zone count from primordium to edge can be made relatively easily. Repeat counts of the best preparations in this category gave differences of fewer than 5 zones for large/old fish.
3. A complete zone count can be made with some difficulty. Parts of the section are ambiguous, e.g., there may be split zones or the zones at the edge may be faint. There may be small (up to 10) zone count differences for repeat counts for large/old fish.
4. A zone count is possible with extreme difficulty and the count is probably unreliable.
5. The section is unreadable due to a failed preparation, or unreadable structure (e.g., no readable zones visible in outer region), or the section had clearly missed the primordium.

2.3 Estimating the age frequency

The analysis method was adapted from that used by Doonan et al. (2012) for Challenger Plateau orange roughy. An age frequency was formed from each tow and these frequencies were used in a weighted average with weights equal to the square-root of the black oreo catch within the mark-type and area. The area (Area 1 or Area 2&3) age frequency was the weighted average of the mark-type-area age frequencies with weights equal to the acoustic abundance estimate. CV was estimated by bootstrapping the tows within each mark-type-area group and also using a parametric bootstrap of the abundance estimates used in the mark-type-area weightings. The abundance estimate distribution was assumed to be lognormal with mean and CV estimated from the 2014 acoustic survey estimate.

Kernel smoothing was used to give more stable results. It used one parameter, *width*, which is approximately the moving window width in which averaging is calculated. The R function `density` was used with analysis *width* set to 10 (R Development Core Team, 2010).

2.4 Comparison of growth

For each area group, Area 1 and Area 2&3, smoothed growth curves were fitted and plotted. The smoothed growth curves were compared visually to two others, one using 1997 through to 2006 data (Doonan et al. 2016a) and another that was used in the previous stock assessments (Doonan et al. 2009).

3. RESULTS

3.1 Otoliths

A summary of the readability scores for the 600 prepared otoliths (Table 4) shows that 24% of the sections were either unreadable or had counts classified as unreliable (i.e., readability 4).

Table 4: Summary of readability scores for the 600 black oreo otolith sections. See Section 2.2 above for description of the readability categories.

Readability	Number	Proportion (%)
1	0	0
2	88	15
3	370	62
4	109	18
5	33	6

3.2 Growth comparison

Figure 2 shows the estimated black oreo growth curves (Lowess curves) from the current study, and, for comparison, the growth curve used in the last stock assessment of OEO 3A black oreo for 2006–07 (Doonan et al. 2009). The growth curve in Area 1 matches the stock assessment growth curve reasonably well up to about age 35 years, but after that age the assessment curve diverges from the Area 1 curve to produce higher estimated length at age. It is also apparent that for Area 2&3, relative to Area 1, initial growth is faster and the mean length at age 30 years is about 2.8 cm larger.

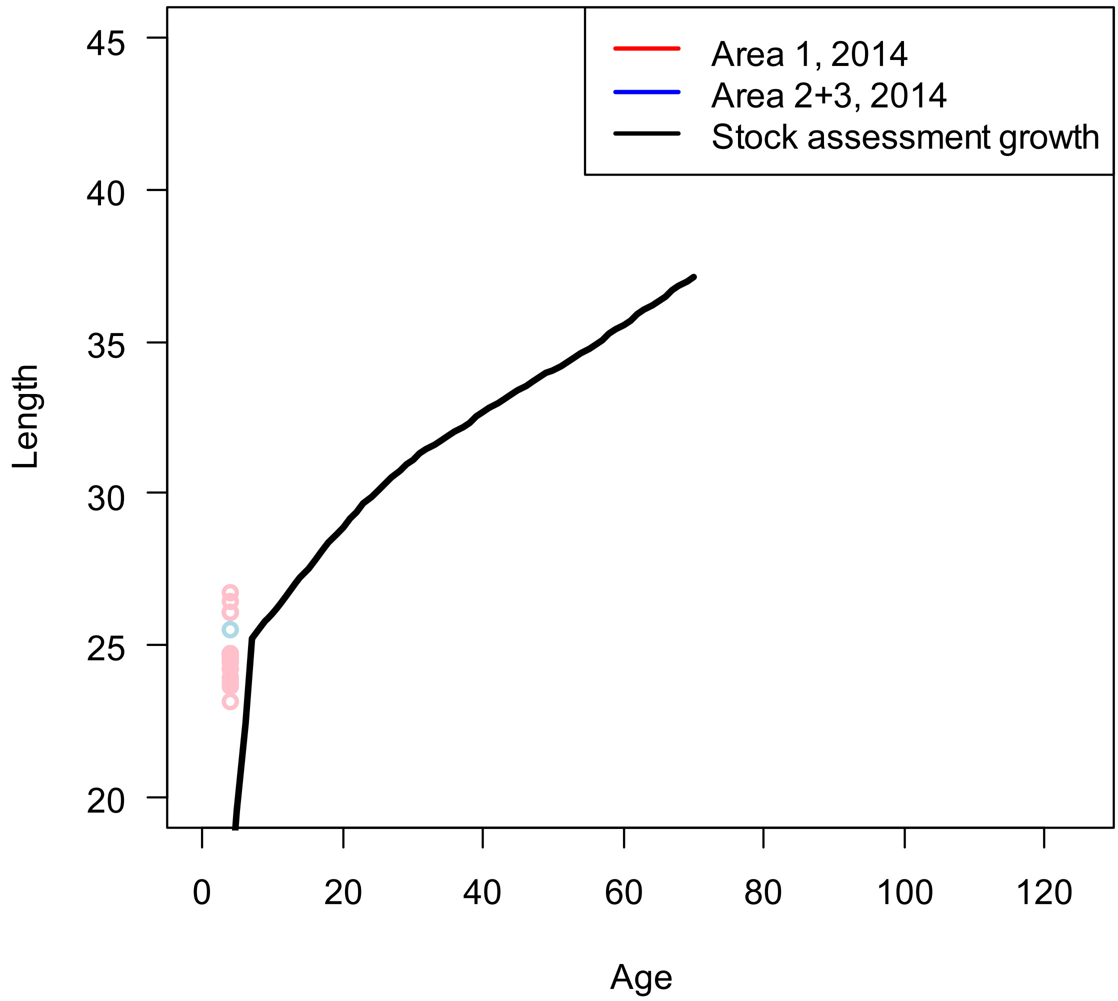

Figure 2: Growth curves fitted to the new 2014 age data (red and blue curves) compared to the growth curve used in the Doonan et al. (2009) stock assessment model (black curve). Area 1, red circles; Area 2&3, blue circles. Age in years. Length is total length (cm).

3.2 Age frequency distributions

The minimum estimated age was 4 years for both areas, and the maximum was 98 years for Area 1, and 125 years for Area 2&3 (Figure 2). Appendix A provides details of the analysis and Appendix B provides the estimated age frequencies and CVs for both areas.

The smoothed age frequency distributions from each area are compared in Figure 3. The distributions both show a mode at 5 years and also strong modes at about 25 years (Area 2&3) and 30 years (Area 1). The main mode at about 25 years lies within the 95% point-wise confidence intervals (CI) for the other area (Figure 4). Overall, the age frequency distributions are similar for Area 1 and Area 2&3. The mean age was 31 years (standard error 3.2 years) for Area 1 and 25 years (s.e. 6.0) for Area 2&3; these means were not significantly different at the 5% level (t-test).

The age frequencies were poorly estimated with Mean Weighted CV (MWCV) of 70+% for both areas. Variation attributable to mark-type abundance was insignificant. Almost all variation was due to the between-tow variation of ages within a mark-type-area.

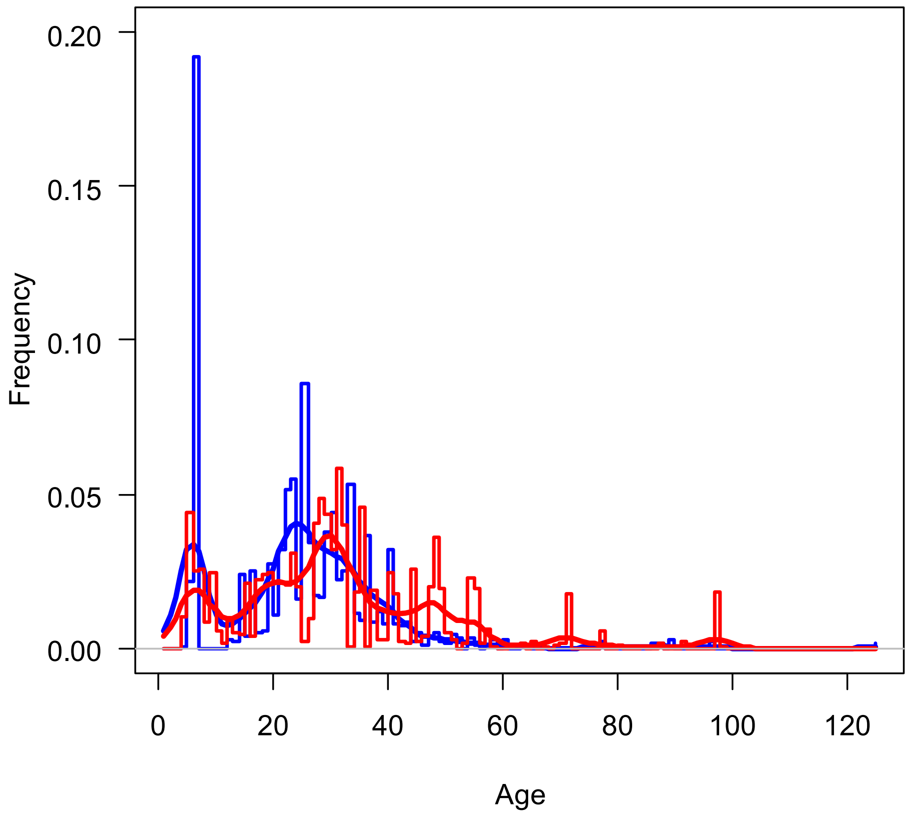

Figure 3: Smoothed age frequency distributions (curve) and the raw frequencies (histogram) for Area 1 (red) and Area 2&3 (blue). Age in years.

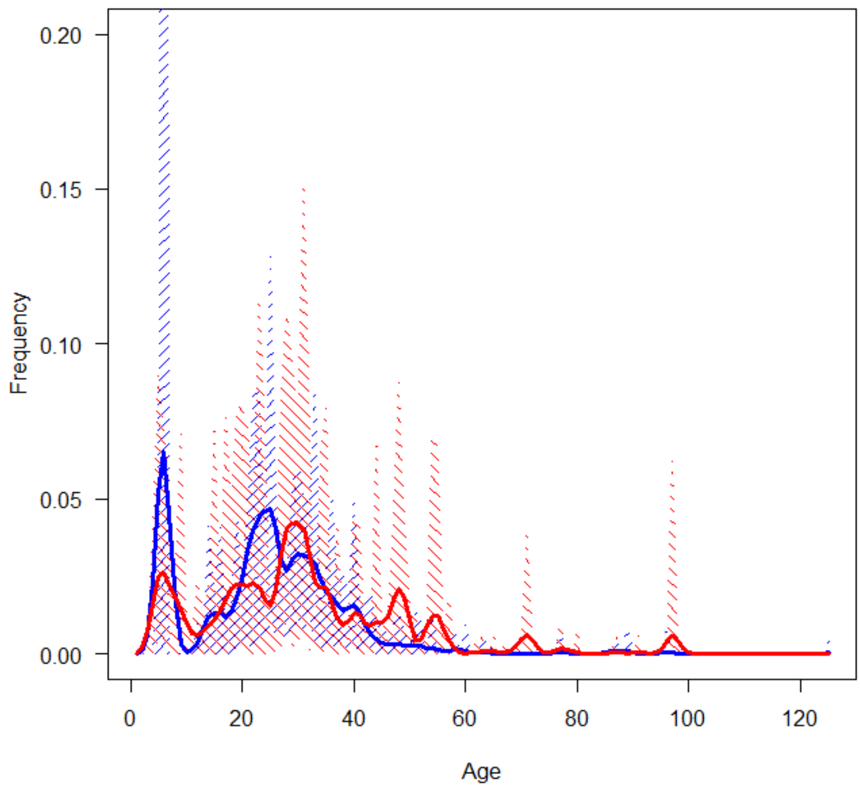

Figure 4: Comparison of age frequency distributions for Area 1 (red) and Area 2&3 (blue) with point-wise 95% confidence intervals (slanted lines). Age in years.

4. DISCUSSION

The current work produced results similar to those from the previous ageing study that used data from 1997 to 2006 (Doonan et al. 2016a), and so reinforces the conclusions from that study, i.e.:

- Age distributions are similar in Areas 1 and 2&3.
- Mean length at age is lower in Area 1 relative to Area 2&3.

The age distributions from Areas 1 and 2&3 in 2014 were similar to each other, but both are quite different to those developed by Doonan et al. (2016a) using 1997–2006 data (Figure 5). Between the two time periods there was an increase in the distribution modes by about 13 years in Area 1 and about 5–10 years in Area 2&3. The mean ages were higher in 2014 (relative to 1997–2006) by 6 years for Area 1 (2014 mean was 31 years and for 1997-06, it was 25 years) and by 2 years for Area 2&3 (2014 mean was 24 years and for 1997–06, it was 22 years), but if ages 1 to 10 are excluded to remove the influence of the large peak at age 6 in 2014, the Area 2&3 difference increases to 5 years.

The growth curves from the current study (smoothed lowess lines) are similar to those derived previously by Doonan et al. (2016a) using the 1997–2006 data (Figure 6). Age at length is lower in Area 1 than Area 2&3. The differences in mean length at age 30 is 2.8 cm for the current study and 1.8 cm for the earlier one.

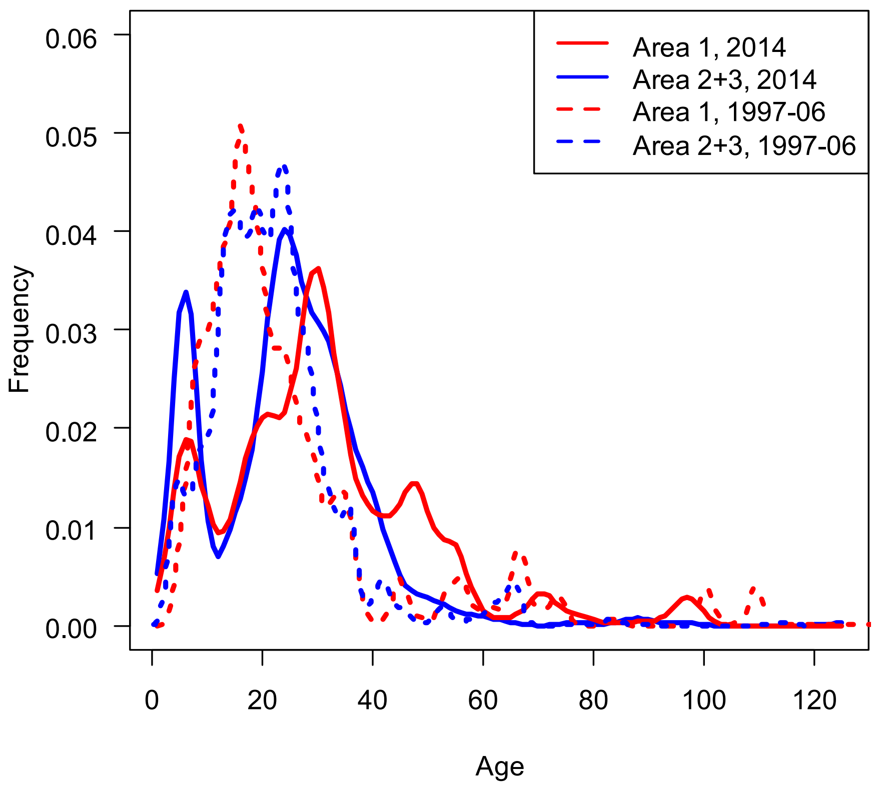

Figure 5: Comparison of age frequency distributions for Area 1 and Area 2&3 from the current study with those from the previous study using data from 1997 to 2006. Age in years.

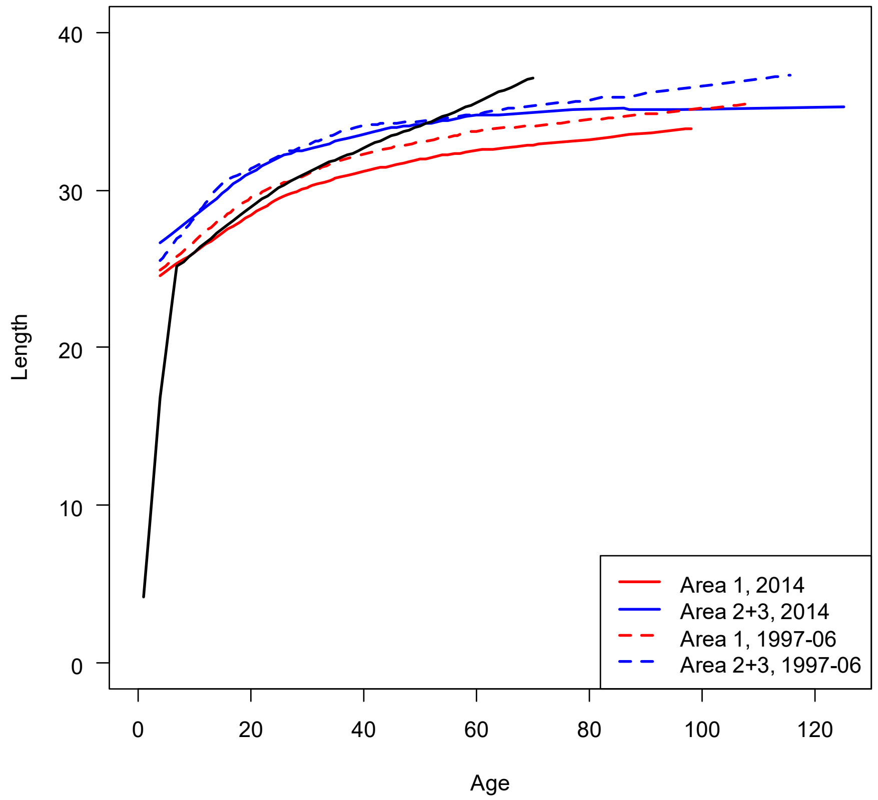

Figure 6: Comparison of growth for Area 1 and Area 2&3 from the current study with that from the previous study using data from 1997 to 2006. Black curve is the growth used in stock assessments. Age in years. Length is total length (cm).

The MWCV for age frequencies from previous deepwater studies (including orange roughy) were generally much lower than the values reported here. Examples for orange rough are 30% on Volcano (ORH 7A) from data collected in 2014 (Doonan et al. (2015), 24% from data collected on the 1994 trawl survey on the northwest Chatham Rise, 25% from a Challenger trawl survey in 1989, and 18 to 40% for 2013 data from acoustic surveys of the three plumes in the north Chatham Rise (Doonan et al. 2014). Examples for smooth oreo from acoustic surveys are 36% for the 1998 age frequency and 45% for the 2005 age frequency (Doonan et al. 2008). However, some estimates do occasionally have high MWCV, e.g., the Challenger orange roughy trawl surveys in 2006 and 2008 (105% and 57%) (Doonan et al. 2014).

5. ACKNOWLEDGMENTS

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APPENDIX A: STATION SCALING FACTORS

Table A1.1: Station scaling factors for tows used in age frequency estimates for Area 1. Coded station numbers are station number for the 2002 survey, station number + 100 for the 2006 survey, and station number times 100 for the 1995 survey.

Survey year	Station number	Mark-type	Scale factor	Recorded catch (kg)
2002	17	LAYEROFF	8.910	180
2002	16	LAYEROFF	1.044	2
2002	19	LAYEROFF	1.124	2
2002	18	BACK	15.415	401
2006	110	LAYER	0.343	8
2006	111	LAYER	4.800	2 121
2006	112	LAYER	7.439	3 108
2006	113	LAYER	2.846	596
2006	114	LAYEROFF	1.487	4
2006	115	LAYER	0.899	102
2006	116	LAYER	4.078	2 152
2006	117	LAYEROFF	1.941	8
2006	118	LAYEROFF	23.716	1 644
2006	120	LAYER	2.107	524
2006	121	LAYEROFF	11.347	354
2006	122	LAYEROFF	1.616	8
2006	119	LAYEROFF	4.184	46
1995	1000	BACK	3.288	36
1995	1900	BACK	3.415	39

Table A1.2: Station weights for tows used in age frequency for Area 2&3. Coded station numbers are station number for 2002, station number + 100 for 2006, and station number times 100 for 1995.

Survey year	Station number	Mark-type	Scale factor	Recorded catch (kg)
2002	2	LONG	2.677	287
2002	3	SHORT	3.448	2 270
2002	5	SHORT	0.987	319
2002	11	LONG	4.138	1 424
2002	12	LONG	6.712	3 063
2002	13	SHORT	4.953	7 450
2002	15	LAYER	6.179	646
2002	20	BACK	15.35	121
2002	21	LAYEROFF	8.043	918
2006	101	SHORT	0.107	4
2006	102	SHORT	1.584	528
2006	103	LONG	2.398	277
2006	104	LONG	5.890	3 182
2006	105	LAYER	8.985	1 119
2006	106	LONG	5.876	2 341
2006	108	SHORT	0.328	14
2006	107	SHORT	2.343	619
1995	100	BACK	7.503	57
1995	400	BACK	3.170	10
1995	1400	BACK	3.445	11
1995	16000	BACK	3.481	12
1995	600	LAYER	1.742	147
1995	700	LAYER	0.663	21

APPENDIX B: BLACK OREO AGE FREQUENCIES BY AREA (OEO 3A)

	Area 1		Area 2&3	
Age	Frequency	CV[ξ]	Frequency	CV[ξ]
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0.01033	1.01493	0.00016	1.29904
5	0.04409	0.45814	0.02145	1.02613
6	0.02495	0.76563	0.19208	1.02795
7	0.02569	0.60673	0	0
8	0.00853	0.69708	0	0
9	0.02445	0.81023	0	0
10	0.0054	0.73952	0	0
11	0.00149	1.245	0	0
12	0.00882	0.70019	0.00251	1.20396
13	0.00524	0.74274	0.0023	1.01577
14	0.00463	1.03424	0.02393	0.88556
15	0.02081	0.8843	0.00384	0.90241
16	0.00379	1.08467	0.02496	0.85734
17	0.02194	0.93049	0.00488	0.62512
18	0.02363	0.65132	0.00573	0.61433
19	0.02455	0.83759	0.02761	0.76361
20	0.02109	0.91895	0.01076	0.50787
21	0.02095	0.88786	0.03184	0.63156
22	0.02023	0.77472	0.0512	0.78835
23	0.03093	1.04335	0.05505	0.75048
24	0.01967	0.98434	0.01609	0.53618
25	0.00188	0.94508	0.08561	0.70189
26	0.00975	0.63918	0.03452	0.55639
27	0.04081	0.50436	0.01729	0.34878
28	0.04883	0.51593	0.01656	0.38038
29	0.04327	0.70485	0.03739	0.52722
30	0.03191	0.64928	0.04377	0.44454
31	0.05853	0.70133	0.02191	0.55002
32	0.03973	0.50561	0.02487	0.34384
33	0.0003	1.49619	0.05292	0.75316
34	0.01818	1.0518	0.01101	0.4648
35	0.04559	0.4703	0.00919	0.57856
36	0.00036	1.34918	0.03669	0.56002
37	0.01881	0.8368	0.00845	0.70414
38	0.00272	0.94338	0.01158	0.45358
39	0.00289	0.68333	0.00782	0.52105
40	0.02455	0.63928	0.03221	0.59875
41	0.01774	0.90152	0.00782	0.51372

	Area 1		Area 2&3	
Age	Frequency	CV[ξ]	Frequency	CV[ξ]
42	0.00217	0.82359	0.00711	0.52829
43	0.00148	1.13208	0.00852	0.50328
44	0.0257	0.76709	0.00226	0.78524
45	0.0022	0.9768	0.00489	0.70731
46	0.0036	0.60391	0.00094	1.21483
47	0.01998	0.78335	0.00371	0.61736
48	0.03584	0.64588	0.00499	0.6974
49	0.01909	0.81775	0.00197	0.83199
50	0.00478	0.73667	0.00134	1.12028
51	0.00272	0.96384	0.0046	0.71207
52	0	0	0.00324	0.84043
53	0.00158	1.07818	0	0
54	0.0227	0.8661	0.00342	0.89064
55	0.01946	0.98611	0.00092	1.16884
56	0.00136	0.96384	0	0
57	0.00587	0.85504	0.00092	1.16884
58	0.00059	1.31767	0.00252	0.79172
59	0	0	0	0
60	0	0	0.00247	1.11635
61	0.0003	1.49619	0	0
62	0.00077	1.26071	0	0
63	0.00158	1.07818	0.00117	1.13822
64	0	0	0.0008	1.18368
65	0.00194	0.90323	0	0
66	0	0	0	0
67	0.00059	1.31767	0	0
68	0	0	0	0
69	0.00089	1.03531	0	0
70	0.00158	1.07818	0	0
71	0.01774	0.90152	0	0
72	0	0	0	0
73	0	0	0	0
74	0	0	0	0
75	0	0	0	0
76	0	0	0	0
77	0.00533	0.6924	0.00183	1.14304
78	0	0	0	0
79	0	0	0	0
80	0.00118	1.31767	0	0
81	0	0	0	0
82	0	0	0	0
83	0	0	0	0
84	0.0003	1.49619	0	0
85	0	0	0	0

	Area 1		Area 2&3	
Age	Frequency	CV[ξ]	Frequency	CV[ξ]
86	0	0	0.00135	1.05493
87	0.00158	1.07818	0.00135	1.05493
88	0	0	0	0
89	0	0	0.00247	1.11635
90	0	0	0	0
91	0.00188	0.94508	0	0
92	0	0	0	0
93	0	0	0	0
94	0	0	0	0
95	0	0	0	0
96	0	0	0.00183	1.14304
97	0.01788	1.06762	0	0
98	0.0003	1.49619	0	0
99	0	0	0	0
100	0	0	0	0
101	0	0	0	0
102	0	0	0	0
103	0	0	0	0
104	0	0	0	0
105	0	0	0	0
106	0	0	0	0
107	0	0	0	0
108	0	0	0	0
109	0	0	0	0
110	0	0	0	0
111	0	0	0	0
112	0	0	0	0
113	0	0	0	0
114	0	0	0	0
115	0	0	0	0
116	0	0	0	0
117	0	0	0	0
118	0	0	0	0
119	0	0	0	0
120	0	0	0	0
121	0	0	0	0
122	0	0	0	0
123	0	0	0	0
124	0	0	0	0
125	0	0	0.00135	1.05493

[ξ] CV of 0 means it is undefined.