

**Commercial catch sampling of alfonsino
in QMA 3 in 2002–03**

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Report Title	Commercial catch sampling of alfonsino in QMA 3 in 2002–03
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7. Executive summary

This report describes the first year of a proposed three year commercial catch sampling programme for alfonsino (*Beryx splendens*) in QMA 3 during the 2002–03 fishing year. It fulfils the reporting requirements of Objective 5 of project INS2002/01.

The quota code for “alfonsino” (BYX) includes two species. While most catches are of alfonsino, (*Beryx splendens*), code BYS, the catch of red bream, (*B. decadactylus*), code BYD represents less than 1% of total BYX landings.

The Chatham Rise alfonsino (BYX 3) fishery is of a moderate size (1197 t in 2001–02). It is the second largest alfonsino fishery in New Zealand, after BYX 2, where 1574 t were taken in 2001–02. The BYX 3 fishery generally occurs in spring and summer and most catches are taken by a small target bottom trawl fishery associated with a series of undersea pinnacles situated to the south and east of the Chatham Islands. Alfonsino is a minor bycatch of the middle depth trawl fisheries for hoki, hake, and orange roughy on the Chatham Rise and Mernoo Bank.

In 2002–03, the target fishery was of short duration (January to April), and involved five main vessels. The target number of samples (15) was achieved. One sample was subsequently discarded, as it included alfonsino taken from outside of the sampling area. From the remaining samples, 700 alfonsino were processed for otolith collection and total of 486 fish (178 male, 308 female) fish were aged. This represented a sex ratio of 63% female. The estimated catch-at-age data results indicate the fishery is

dominated by fish aged between 5 and 10 years for male, and between 4 and 11 years for females. The estimated MWCV (mean weighted coefficient of variation for each length and age distribution) across all age classes achieved by the sampling programme of 20.8% was less than the target level of 30%.

This report is based on data from the first year of a three year catch sampling programme. Further data will be required to allow trends in the data to be properly reviewed.

8. Introduction

This report describes the first year of a proposed three-year commercial catch sampling programme for alfonsino (*Beryx splendens*) in QMA 3 during the 2002–03 fishing year. The report summarises the length and age information used to provide age-specific selectivity information, and describes other biological parameters determined from otoliths, length, and sex data sampled from the commercial alfonsino fishery. It fulfils the reporting requirements of Objective 5 of project INS2002/01.

The composite “alfonsino” quota code (BYX) includes two species, alfonsino, (*Beryx splendens*), code BYS; and red bream, (*B. decadactylus*), code BYD. Both species occur widely in tropical and temperate waters, but most BYX landings in New Zealand waters are of *B. splendens* (Annala et al. 2003). Red bream represents a minor bycatch (historically less than 1% of total BYX landings) that mainly occurs in northern waters (BYX 1), and is relatively uncommon in BYX 3 (Annala et al. 2003). In this report, the total reported BYS 3 landings have been assumed to be equivalent to total BYX 3 landings. The quota management areas for alfonsino are given in Figure 1.

The Chatham Rise alfonsino fishery (BYX 3) comprised over 40% of the total national 2001–02 alfonsino landings of 2929 t. Landings in BYX 3 represented the second largest alfonsino fishery in New Zealand at 1197 t, after BYX 2 (total 1574 t in 2001–02). Most BYX 3 landings were associated with a small target bottom trawl fishery that occurred from January to April 2003. This fishery involved five main vessels and was associated with a complex series of underwater structures situated to the south and east of the Chatham Islands (Langley & Walker 2002). Alfonsino were also caught as minor bycatch of midwater trawl fishing for hoki, orange roughy, and hake on the Chatham Rise and Mernoo Bank (Annala et al. 2003).

Other alfonsino fisheries in New Zealand include a target mid-water trawl fishery off the east coast of the North Island (BYX 2), and small target line fisheries in the Bay of Plenty and Northland (BYX 1). Alfonsino is a minor bycatch of other trawl fisheries around New Zealand (Annala et al. 2003).

9. Objectives

The main objective for project INS2002/01 was:

To determine the length and age structure of the commercial catch of selected species in QMA 1, QMA 2 and QMA 3.

The specific objective for alfonsino in 2002–03 (Objective 5) was:

To conduct sampling in fish processing sheds and determine the length and age composition of the commercial catch of alfonsino (*Beryx splendens*) in BYX 3 during 2002–03. The target coefficient of variation (MWCV) for the catch at age across all age classes was 30 %.

10. Methods

10.1 Sample size

Little is known about the age structure of alfonsino in BYX 3, consequently there were no available BYX 3 data from which to infer the optimal number and size of samples needed to achieve the target c.v. Gemfish and alfonsino in QMA 2 have a similar number of year classes in their age distribution, and from an analysis of 7 years of gemfish catch sampling data (D. Gilbert, NIWA, pers. comm. 2002), on average 11 landings (range 9–15) and a sample of 410 otoliths (range 290–500) were required to achieve a target MWCV of 30%. Furthermore, 15 landings were sampled in the 1998–2000 BYX 2 catch sampling programme and target MWCV's of less than 30% were obtained (McMillan et al. 2000, Blackwell et al. 2001). Following those results, a sample size of 15 landings and 750 otoliths was used for the 2002–03 BYX 3 catch sampling programme.

10.2 Developing sampling strata

Review of landings data between 1999 and 2002 (NIWA, unpublished data) indicated the fishery was of short duration (October to April), but the period of heaviest fishing varied between the first and second quarters. The target fishery involved only 5 vessels in the review period.

Vessel category and season were used to define sampling strata. Sampling effort was allocated in relation to the expected seasonal distribution of the commercial catch. This is similar to the stratification method previously used for catch sampling programmes for the SNA 2, SNA 7 and several middle depth FMA 2 species (Blackwell & Gilbert 2002, McMillan et al. 2000).

Three strata were established (Table 1). The fishery was divided into two seasonal strata, Spring/summer (October–March), and Autumn (April–July). Vessels were divided into two strata. The 4 high-catch trawlers were placed into one stratum (“BT1”), which was estimated to account for 71% of catch between 1999 and 2002, and remaining vessels were placed in a second stratum (“OTHER”). It was not practical to make these strata of equal sizes because the catch is taken by relatively

few vessels. As fishing effort was expected to be low outside of the target fishing period, the Autumn stratum included all vessels (“ALL”).

The target numbers of landings to be sampled (Table 1) were made proportional to the anticipated catch by weight in each stratum, to minimise the mean weighted c.v.s of the proportions-at-age (D. Gilbert, NIWA, pers. comm. 2003). Port of landing was not included in the definition of the strata as that depended primarily on quota holdings and marketing.

10.3 Catch sampling of alfonsino

Otoliths from each 1 cm length class for each sex, were selected proportionally to their occurrence in the scaled length-frequency distributions for each sex, with the constraint that at least one otolith from each length class was selected. In addition, all otoliths from fish in the extreme right hand tail of the scaled length-frequency (constituting about 2% of that distribution) were fully selected. This method provided MWCVs for numbers-at-age similar to that obtained from proportional sampling, and was considered better than uniform sampling for the older age classes (A. Dunn, NIWA, pers. comm. 2002).

Age estimates were obtained by examining the otoliths whole, immersed in paraffin oil on a dark background with reflected light, following the procedures of Massey & Horn (1990). A nominal birthday date of 1 January was set, and fish were aged based on the number of complete rings present, so a 1+ fish sampled in 2003 was considered as part of the 2002 year class (P. Horn, pers. comm. 2003). This otolith reading protocol has been validated for alfonsino using a marginal increment analysis that included most of the age classes present in the catch (Massey & Horn 1990).

10.4 Estimation of length and age structure

Proportion-at-length estimates

Proportion-at-length estimates scaled to the commercial catch by stratum were produced for alfonsino using purpose-written software “Catch-at-age” developed by NIWA (Bull & Dunn 2002). “Catch-at-age” scales fish lengths from each landing up to the landing weight, then up to the total stratum catch, to yield estimated scaled length frequency distributions for each sex. The values of the parameters used for the length weight relationship for BYX 2 were $\hat{a} = 0.00002564$ and $\hat{b} = 2.9704$ for both males and females from Chatham Rise trawl survey (Stevens & Livingston 2003).

Otolith selection, ageing and proportion-at-age estimates

Estimated scaled age frequency distributions were derived using “Catch-at-age” (Bull & Dunn 2002). The precision was measured by the mean weighted c.v. (MWCV), which was calculated as the average of the c.v.s for the individual length or age classes weighted by the proportion of fish in each class. Bootstrapping was used to calculate the MWCVs, i.e., fish were resampled within each landing, landings were resampled within each stratum, and otoliths were simply randomly resampled. Estimates were based on a total of 300 bootstrap samples.

11. Results

11.1 Sampling strata

The 15 samples were allocated among the three strata (Table 1): 9 samples in BT1 for October to March; 3 samples in OTH for October to March; and 3 samples to ALL for April to September.

11.2 Sampling of the commercial catch

The estimated catch from BYX 3 was determined from an extract provided by Ministry of Fisheries in November 2003 (NIWA, unpublished data). Of the estimated catch of 1078 t landed during 2002–03, 76% (824 t) was taken between October and March (Table 1). Of this total, 77% (634 t) was taken by BT1 vessels, and the remainder was taken as bycatch of other fishing activity.

While 15 samples were collected, one sample was discarded because it contained fish from the BYX 2 fishstock. The remaining 14 samples collected to the end of June 2003 include samples from the ports of Napier, Wellington, Nelson, and Dunedin. The total weight of BYX 3 sampled (378 t) represented 35% of the total catch. During 2002–03, most target fishing occurred after January 2003 and the 9 samples collected from the “MAIN” stratum vessels during January–March represented 48% of the catch in this period.

Few samples were available from non-target fishing (OTHER), as alfonsino bycatch is commonly part-processed to the “headed and gutted” state at-sea. As little target fishing occurred after April 2003, the target number of otoliths collected per sample was increased from 50 to 60 for all samples collected in the second quarter.

A total of 700 fish were included in the catch at age analysis, and 486 otoliths were selected for catch at age determination.

11.3 Estimation of length and age structure

Proportion-at-length estimates

The numbers-at-length for alfonsino were scaled to represent the total reported commercial catch from the 2002–03 fishing year (Table 2). These data do not show strong polymodality, but are suggestive of modes at 36, and 38 cm for males, and at 33, 37, 40, and 44 cm for females (Figure 2).

Otolith selection, ageing and proportion-at-age estimates

Of the 486 fish aged, 63% were female (178 male, 308 female). An age-length key was constructed, and scatter plots of length and age by sex is given in Figure A1. These data were applied to the scaled length-frequency to produce estimates of numbers-at-age, given in Table 3. The MWCV over all age classes was 20.8% (Table 4), which is less than the target value of 30%. The estimated scaled numbers-at-age

(Figure 3) indicate the fishery is dominated by fish aged between 5 and 10 years for males and between 4 and 11 years for females.

Comparison of scaled length frequencies from the commercial fishery and trawl survey data (Figure 4) indicate alfonsino sampled from the commercial catch were generally larger (range 26–49 cm) than data from comparable trawl surveys. Alfonsino caught during the 2002 Chatham Rise trawl survey in depths of 600–800 m east of Longitude 180° ranged from 16–40 cm. These data were collected in strata 2b, 3, 5, 9, 10a, 10b, 11a, 11b, 11c, 11d, 12, and 13 of the Chatham Rise (see Stevens & Livingston 2003).

12. Conclusions

This report describes the first year of the BYX 3 catch sampling programme in 2002–03. The target fishery during the 2002–03 fishing year was of short duration, and most of the catch was taken between January and March. This meant that the target number of samples was not reached, although the overall MWCV of 20.8% achieved by the sampling programme was below the target of 30%.

The BYX 3 commercial fishery appears numerically dominated by fish aged between 5 and 11 years (5–10 years for males, and 4–11 years for females). Alfonsino begin to recruit into the fishery at age 3, with maximum observed ages of 13 years for males and 16 years for females.

Alfonsino sampled from the commercial fishery in 2002–03 were larger than alfonsino sampled by the Chatham Rise hoki trawl survey in 2002, although these data may be influenced by different gear selectivities among vessels, particularly for smaller fish. The estimated scaled length frequencies of alfonsino sampled by the Chatham Rise hoki trawl survey series were also variable between 1991 and 1996, particularly in the proportion of catch in the 30–40 cm range which represents a significant proportion of the commercial catch (Langley & Walker (2002). Insufficient data are available from the Scientific Observer Programme for BYX 3 target fishing to provide valid comparisons with current data.

Further sampling in subsequent years of this programme will allow these trends to be more properly reviewed.

13. Publications

Nil

14. Data Storage

All data are stored on MFish databases administered by NIWA (*market* and *age*).

15. Acknowledgements

We would like to thank all NIWA staff involved in the catch sampling programme, and the fishing company staff who provided access to fish and landings data for the sampling programme. Thanks also to Peter Horn and Michael Manning, NIWA, who provided comments on an earlier version of this report.

16. References

- Annala, J.H.; Sullivan, K.J.; O'Brien, C.J.; Smith, N.W. McL.; Grayling, S.M. (2003). Report from the Fishery Assessment Plenary, May 2003: stock assessments and yield estimates. Science Group, Ministry of Fisheries, Wellington. 616 p.
- Blackwell, R.G.; McMillan, P.J.; Horn, P.L.; Paul, L.J. (2001). Commercial catch sampling of alfonsino, bluenose, gemfish and rubyfish in QMA 2 in 1999–2000. Final Research Report for Ministry of Fisheries Research Project INS1999/01. 25 p.
- Blackwell, R.G.; Gilbert, D.G. (2002). Age composition of commercial snapper landings in Tasman Bay/Golden Bay (SNA 7), 2000–01. *New Zealand Fisheries Assessment Report 2002/49*. 17 p.
- Bull, B.; Dunn, A. (2002). Catch-at-age: User Manual v1.06.2002/09/12. NIWA Internal Report 114. 23 p. (Unpublished report held in NIWA Library, Wellington).
- Langley, A. L.; Walker, N. (2002). Characterisation of the alfonsino (*Beryx splendens*) fishery in BYX 3. *New Zealand Fisheries Assessment Report 2002/29*. 49 p.
- Massey, B.R.; Horn, P.L. (1990). Growth and age structure of alfonsino (*Beryx splendens*) from the lower east coast, North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 24: 121–136.
- McMillan, P.J.; Blackwell, R.G.; Paul, L.J. (2000). Catch sampling for length/sex and age of alfonsino, bluenose, gemfish and rubyfish in QMA 2 during the 1998–99 fishing year. Final Research Report for Ministry of Fisheries Research Project INS9801. Objectives 1 & 2. 13 p.
- Stevens, D.W.; Livingston, M.E. (2003). Trawl survey of hoki and middle depth species on the Chatham Rise, January 2002 (TAN0201). *New Zealand Fisheries Assessment Report 2003/19*. 57 p.

Table 1: Sampling strata, planned and actual number of landings sampled, landed commercial catch, and total number of landings in BYX 3 during the 2002–03 fishing year.

Vessel type	Stratum			Total
	BT	OTHER	ALL	
Months	Oct–Mar	Oct–Mar	Apr–Sep	
Target sampled landings	9	3	3	15
Actual sampled landings	9	2	3	14
Sampled catch (t)	302	4	72	378
Landed catch (t)	634	190	254	1 078
Number of landings (n)	31	169	103	303

Table 2: Estimated scaled numbers-at-length and coefficients of variation (c.v.) from commercial catches in BYX 3 for the 2002–03 fishing year by sex.

Length (cm)	Male		Female	
	Numbers	c.v. (%)	Numbers	c.v. (%)
26	1 469	137.49	0	-
27	0	-	1 451	136.47
28	1 420	141.49	2 920	101.48
29	2 920	90.89	7 335	60.01
30	15 912	49.33	16 282	55.94
31	9 736	57.79	8 501	68.58
32	19 447	48.62	20 009	38.33
33	24 116	38.37	18 758	43.13
34	32 015	38.01	22 193	38.47
35	34 393	39.08	16 571	41.71
36	45 741	28.11	33 241	33.9
37	31 986	30.2	69 283	25.82
38	44 941	29.19	54 818	22.38
39	29 348	37.61	52 630	26.58
40	23 366	42.65	60 875	25.31
41	5 703	90.01	43 368	28.09
42	7 387	83.62	33 801	35.55
43	3 922	93.39	9 460	60.48
44	710	111.21	17 850	43.73
45	1 420	99.34	13 382	38.46
46	0	0	7 149	60.55
47	710	114.32	6 374	74.34
48	0	-	5 681	77.56
49	0	-	4 954	74.05
50	0	-	2 130	97.28
51	0	-	0	-
52	0	-	0	-

Table 3: Estimated scaled numbers-at-age and coefficients of variation (c.v.) from commercial catches of BYX 3 for the 2002–03 fishing year by sex.

Age (yr)	Male		Female	
	Numbers	c.v. (%)	Numbers	c.v. (%)
1	0	227.89	0	240.83
2	1 469	181.71	0	-
3	1 420	176.4	2 911	120.97
4	14 890	47.19	30 808	34.58
5	36 328	33.68	36 163	30.03
6	42 414	28.51	37 922	30.5
7	70 660	22.42	46 485	27.7
8	74 510	19.78	80 603	18.74
9	35 658	27.03	113 400	16.32
10	37 040	31.49	70 539	18.36
11	12 528	52.99	52 857	21.32
12	4 403	118.42	21 863	34.08
13	5 342	70.04	17 305	39.66
14	0	-	9 426	61.54
15	0	-	7 910	71.54
16	0	-	826	140.71
17	0	257.21	0	364.64

Table 4: Mean weighted coefficient of variation (MWCV) for age frequencies from commercial catches of BYX 3 for the 2002–03 fishing year by sex and both sexes combined.

Sex	MWCV (%)
Male	30.9
Female	25.4
Combined	20.8

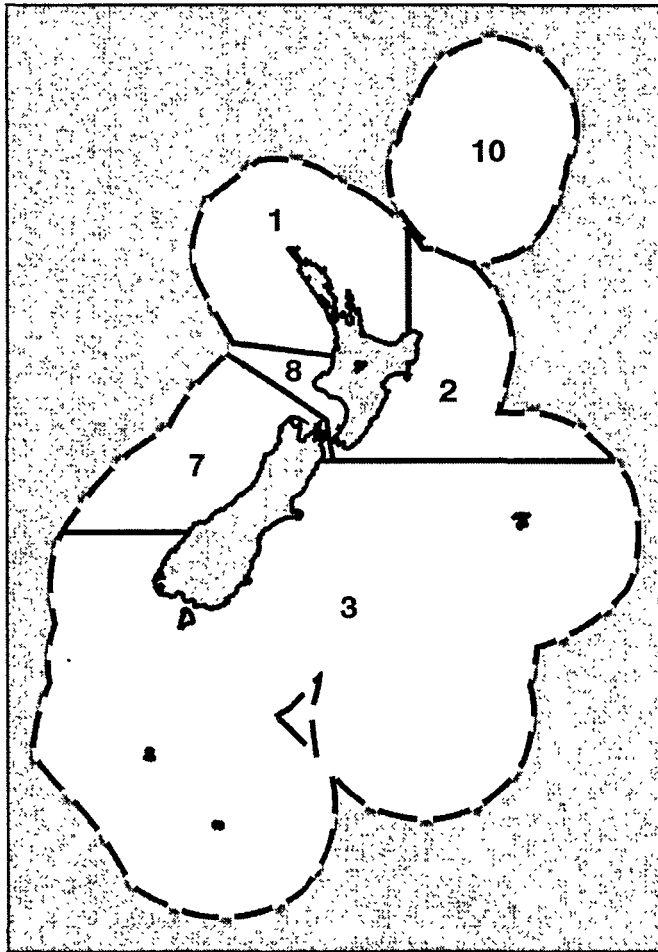


Figure 1: Quota managements areas (QMAs) for alfonsino (after Annala et al. 2003)

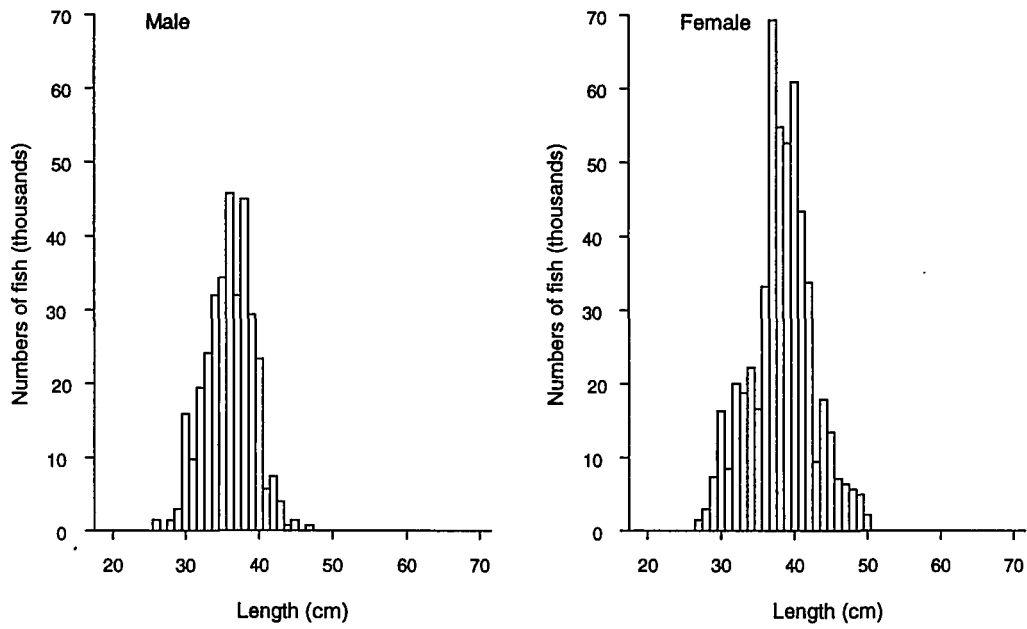


Figure 2: Estimated scaled numbers-at-length by sex from commercial catches of BYX 3, 2002-03.

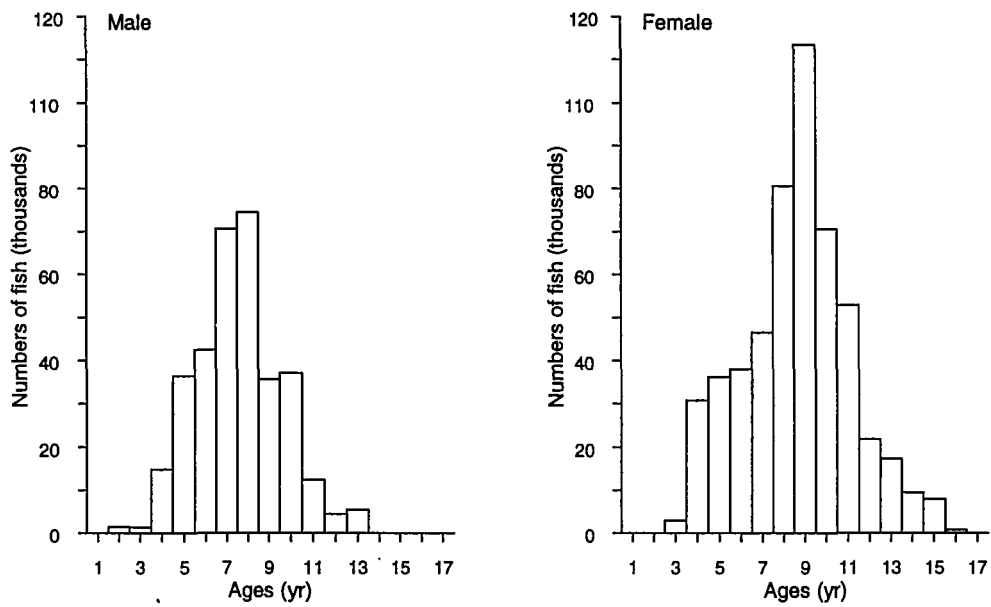


Figure 3: Estimated scaled numbers-at-age by sex from commercial catches of BYX 3, 2002-03.

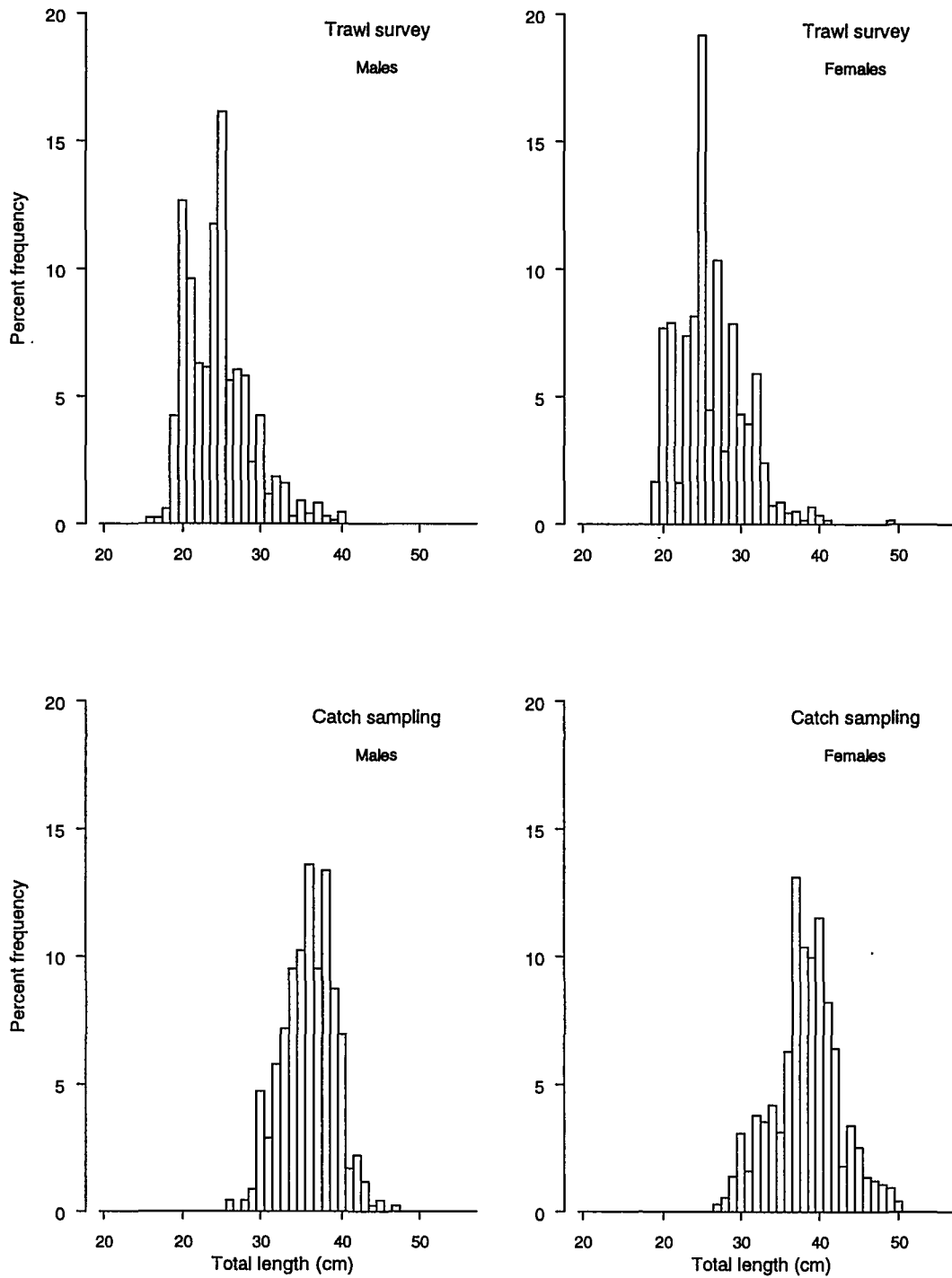


Figure 4: Comparison of BYX 3 estimated scaled length frequencies from eastern strata of the January 2003 Chatham Rise middle depths hoki survey and BYX 3 sampled from the commercial catch, 2002–03.

Appendix A

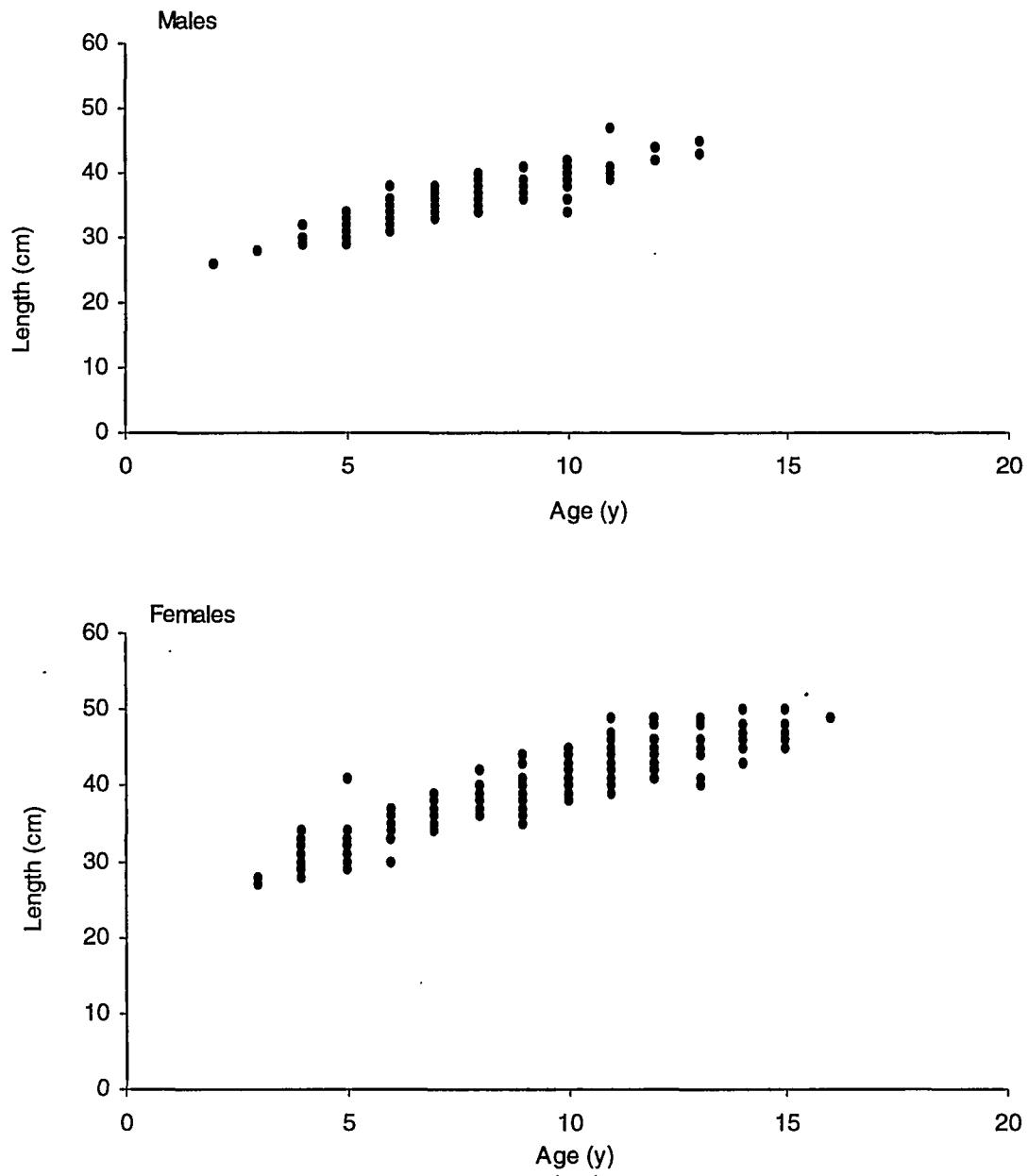


Figure A1: Length and estimated age for BYX 3 sampled from the commercial fishery, 2002–03.