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Commercial catch sampling of alfonsino, bluenose, gemfish and rubyfish in QMA 2 in 1999–2000

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Report Title		Commercial catch sampling of alfonsino, bluenose, gemfish and rubyfish in QMA 2 in 1999–2000
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7. Executive summary

This report describes the sampling programme carried out on commercial landings of alfonsino, bluenose, gemfish and rubyfish for length/sex and age in QMA 2 during the 1999–00 fishing year, and fulfils the reporting requirements of specific Objectives 1 and 2 of Project INS1999/01.

Objective 1 – sampling for length/sex and age
The target numbers of landings sampled were achieved for alfonsino (18 completed of 15 planned), bluenose (32 completed of 32 planned), and gemfish (15 completed of 15 planned). For rubyfish, only 18 of the 32 target samples were obtained, because of the small number of landings made, and the relatively small size of many landings.

Target numbers of otolith samples were achieved for all species. For alfonsino 1222 fish were measured and 545 otoliths were read (target 500). For bluenose 1670 were measured and 750 otoliths (target 800) from 1999–00 and 765 otoliths from 1998–99 (target 800) were prepared for reading. For gemfish 722 were measured and 506 otoliths were read (target 500). For rubyfish 861 were measured and 819 otoliths were read (target 800). Age estimates were made for alfonsino (3–19 years), gemfish (3–19 years), and rubyfish (6–84 years). No bluenose ageing was carried out pending the results of a project (INS2000/02) on validating age for that species. Proportion-at-age estimates had mean weighted c.v. estimates across all age classes of 20.2% (target 20%) for alfonsino,

30.7% (target 20%) for gemfish, and 32.3% (target 20%) for rubyfish. Proportion-at-length estimates only were made for bluenose and appear to be consistent with previous fishing years.

Objective 2 – gemfish gonad condition
Gonad stages of fish sampled from 15 landings taken in QMA 2 during October 1999 to February 2000 were analysed. Most of the male and female gonads examined were in a resting or early development stage suggesting that the QMA 2 fishery is based on pre-spawning fish.

8. Objectives

The objectives for project INS199901 were:

1. To determine the length and age structure of the commercial catch of alfonsino (*Beryx splendens*), gemfish (*Rexea solandri*), bluenose (*Hyperoglyphe antarctica*), and rubyfish (*Plagiogeneion rubiginosum*) in QMA 2.

Specific objectives for 1999/2000 were:

1. To conduct sampling in fish sheds and determine the length and age composition of the commercial catch of alfonsino in BYX 2, gemfish in SKI 2, bluenose in BNS 2, and rubyfish in QMA 2 during the 1999/2000 fishing year. The target coefficient of variation (c.v.) for the catch at age is 20 % (mean weighted c.v. across all age classes).

2. To conduct sampling in fish sheds and determine the gonad condition of gemfish taken in SKI 2 target trawl fisheries during 1999/2000.

9. Methods

OBJECTIVE 1:

To conduct sampling in fish sheds and determine the length and age composition of the commercial catch of alfonsino in BYX 2, gemfish in SKI 2, bluenose in BNS 2, and rubyfish in QMA 2 during the 1999/2000 fishing year. The target coefficient of variation (c.v.) for the catch at age is 20% (mean weighted c.v. across all age classes).

Methods to carry out this objective were similar to the methods used to sample and determine the length and age composition of the same four species in QMA 2 in 1998–99, project INS9801 (McMillan *et al.* 2000). The main difference was that in the current project 'random age' methods were used which involved taking otoliths, length, sex, and gonad stage from each of up to 50 fish sampled at random from a catch. For INS9801 a subset of up to 50 otoliths were taken from 200 fish sampled at

random for length, sex, and gonad stage. There were two key activities for this objective:

9.1 Catch sample alfonsino, bluenose, gemfish and rubyfish in QMA 2

Developing sampling strata

The same vessels generally fished for all four species so sampling strata were developed together for the four fishstocks to avoid an excessively complex sampling regime. An analysis was carried out at the start of sampling to apportion the sampling effort throughout the year in relation to the expected seasonal distribution of the commercial catch, based on the most recently available complete catch data (June 1996 to May 1999). A set of ten high catch trawlers (T1) that together accounted for around two thirds of this catch data were identified for alfonsino, gemfish, and rubyfish. All other vessels fishing using all methods were collectively grouped as a single stratum (OTH). Separate bluenose strata were defined where the 10 high catch trawlers were included in the T1 stratum but all other (not T1) trawlers were included in stratum T2 and the remaining vessels catching bluenose by non-trawl (i.e., line fishing) methods were included in stratum OTH. This stratum was required because a substantial proportion of bluenose catch was taken by line in past years.

From the catch data, October to December was identified as the peak quarter for the alfonsino, bluenose and rubyfish fisheries, whilst gemfish landings in QMA 2 generally occurred between October and May. The two factors of vessel and season were then used to define strata for each fishery. Within each fishery the aim was to make the strata about equal in size, i.e., so that the expected catch was about the same. The target number of landings was made proportional to the square of the anticipated catch in each stratum, to approximately minimise the variance of the estimated proportion-at-age (D.J. Gilbert, NIWA, Wellington, pers. comm.). A minimum of three landings per stratum was set, so that estimates of variance could be made within each stratum. Port of landing was not included in the definition of the strata as that depended primarily on quota holdings and marketing.

Sampling of the commercial catch

Alfonsino

The sampling aimed to collect 15 samples and about 500 otoliths. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The planned number of samples required to achieve the mean weighted c.v. across all age classes of 20% was assumed from the results of 7 years of gemfish sampling and age determination (D.J. Gilbert, NIWA, Wellington, pers. comm.). Alfonsino appear to have a similar age structure (Horn & Massey) to gemfish so it was assumed that a similar sampling regime would be required to achieve the target c.v.

Bluenose
The sampling aimed to collect 32 samples and about 800 otoliths. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The planned number of samples required to achieve the mean weighted c.v. across all age (length) classes of 20% was based on previous bluenose sampling and age determination (Blackwell 1999).

Gemfish
The sampling aimed to collect 15 samples and about 500 otoliths. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The planned number of samples required to achieve the mean weighted c.v. across all age classes of 20% was assumed from the results of 7 years of gemfish sampling and age determination (D.J. Gilbert, NIWA, Wellington, pers. comm.).

Rubyfish
The sampling aimed to collect 32 samples and about 800 otoliths. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The planned number of samples required to achieve the mean weighted c.v. across all age (length) classes of 20% was based on previous bluenose sampling and age determination (Blackwell 1999). Rubyfish appear to be a long-lived, slow growing species and therefore was assumed to have a similar age structure to that of bluenose. It was assumed that a similar sampling regime would be required to achieve the target c.v.

9.2 Estimate the length and age of alfonsino, bluenose, gemfish and rubyfish from catch samples

Proportion-at-length estimates

Proportion-at-length and proportion-at-age estimates scaled to the commercial catch by stratum were produced for each species, using the 'Catch.at.age' software developed by NIWA (B. Bull, NIWA, pers. comm.) The software scaled the length frequency of fish from each landing up to the landing weight, and these were then summed over landings in each stratum and then scaled up to the total stratum catch, to yield a scaled length frequency of the commercial catch in 1999–00.

Otolith selection, ageing and proportion-at-age estimates

Alfonsino, rubyfish and gemfish
For these species, an age-length key was constructed from otolith data and applied to the length frequency to yield an age frequency. The precision of each length or age frequency was measured by the mean weighted c.v., 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. C.v.s were calculated by bootstrapping, i.e., fish were resampled within each landing, landings were resampled within each stratum, and otoliths were simply randomly resampled.

A length-frequency distribution, scaled to represent the total landed catch, was produced, as described above. Otoliths (from each sex separately) from each 1 cm length class were selected proportionally to their occurrence in the scaled length-frequency, with the constraint that at least one otolith from each length class was selected. In addition, for alfonsino and gemfish all otoliths from fish in the extreme right hand tail of the scaled length-frequency (constituting about 2% of that distribution) were fully selected. Alfonsino were aged from readings of whole, untreated otoliths as described by Massey & Horn (1990). Gemfish were aged as described by Horn & Hurst (1999). Rubyfish were aged as described by Paul *et al.* (2000).

Bluenose
Work to determine the age composition for samples collected in 1998–99 and 1999–00 was postponed (letter from the Ministry of Fisheries dated 25 August 2000) until results of project INS2000/02 "Validating ageing techniques for rubyfish and bluenose" became available. Otoliths from 1998–99 (765) and 1999–00 (750) were selected (using the method below), and prepared for reading using the method of Horn (1988), but no reading was carried out. Otoliths were selected using a length-frequency distribution, scaled to represent the total landed catch. Otoliths (from each sex separately) from each 1 cm length class were selected proportionally to their occurrence in the scaled length-frequency, with the constraint that at least one otolith from each length class was selected.

OBJECTIVE 2:

To conduct sampling in fish sheds and determine the gonad condition of gemfish taken in SKI 2 target trawl fisheries during 1999/2000.

There was one key activity:

9.3. Determine gemfish gonad condition from samples taken in fish sheds from QMA 2 in 1999–00.

Gonad condition was determined using a 5-point macroscopic scale defined in Appendix 1 and was recorded during the sampling for otoliths described in Objective 1. Each of the 15 samples comprised up to 50 fish that were randomly selected and measured to the nearest centimetre below fork length, sexed, and the gonad development was recorded.

10. Results

OBJECTIVE 1:

10.1 Catch sample alfonsino, bluenose, gemfish and rubyfish in QMA 2

Developing sampling strata
The strata for each species and the target number of landings to be sampled from this analysis are given in Tables 1–4.

Sampling of the commercial catch
Catch sampling was carried out at the ports of Napier, Nelson, and Wellington.

Alfonsino
Eighteen landings from BYX 2 (Table 1), comprising a total of 227 t, were sampled between 30 October 1999 and 15 February 2000. Little fishing occurred after February as most vessels were engaged in orange roughy or hoki fishing. In 16 of the samples, 50 fish were randomly selected from each sampled catch, and were then measured, sexed, and had their otoliths removed. In 2 samples, approximately 210 fish were measured and sexed, and 50 of these had their otoliths collected. A total of 1222 fish were measured; 556 males and 666 females (i.e., 45% males in the sampled catch). The commercial catch landed and number of landings by stratum is given in Table 1.

Bluenose
Thirty-two landings from BNS 2 (Table 2), comprising a total weight of 272 t were sampled between 29 October 1999 and 6 September 2000. A total of 1670 bluenose were measured; 873 males and 797 females (i.e., 52% males in the sampled catch). The proposed sampling regime was generally followed, although over-sampling was required in the T2 strata, due to a reduction in target line fishing during 1999–00. The commercial catch landed and number of landings by stratum is given in Table 2. The strata catch totals were derived from estimated catches, as that was the only way to get catch by method (i.e., large trawlers, small trawlers, line), and consequently the sum of estimated catches (1010 t) is less than the sum of QMR reported catches for BNS 2 (1136 t for 1999–00).

Gemfish
Fifteen landings from SKI 2 (Table 3), comprising a total of 161 t, were sampled between 4 November 1999 and 19 February 2000. A total of 722 fish were measured; 275 males and 447 females (i.e., 38% males in the sampled catch). The fishery occurred early in the fishing year, and few landings were available for sampling after February 2000. The fishery usually finishes in May when the fish apparently migrate north towards spawning grounds. Between June and August most vessels were engaged in orange roughy or hoki fishing. The strata used in the analysis to scale up the samples to the commercial catch were revised because two of the original strata (Table 3) had less than 3 samples. The revised (combined) strata and the commercial catch landed and number of landings by stratum is given in Table 4.

Rubyfish
Eighteen landings from RBY 2 (Table 5), comprising a total of 196 t, were sampled between 28 November 1999 and 10 April 2000. A total of 861 fish were measured 414 males and 447 females (i.e., 48% males in the sampled catch). Samples were hard to obtain in 1999–00, because most of the fish were caught by only a few vessels, (i.e., there were fewer numbers of landings than anticipated). The catches were small (many less than 1 t), and there was reluctance by processors to allow samplers to cut the fish, as the species is often sold whole. Rubyfish spoils quickly, so processors try to on-sell the fish quickly. Consequently, there were several landings where samples had been sold before the samplers arrived, and fish were unavailable for sampling. Attempts to purchase fish for sampling met with little success. Between June and August most vessels were engaged in orange roughy or hoki fishing. The strata used in the analysis to scale up the samples to the commercial catch were revised because two of the

original strata (Table 5) had less than 3 samples. The revised (combined) strata and the commercial catch landed and number of landings by stratum are given in Table 6.

10.2 Estimate the age of alfonsino, bluenose, gemfish and rubyfish from catch samples

Alfonsino

A total of 545 (255 male, 290 female) fish were aged. A length-frequency distribution, scaled to represent the total reported catch from the 1999–00 fishing year, was produced (Figure 1, Appendix 2). An age-length key was constructed, and applied to the scaled length-frequency to produce estimates of numbers-at-age and percentage-at-age in the commercial catch (Table 7). The mean weighted c.v. over all age classes was 20.2%, compared to the target value of 20%. The percentage-at-age distributions from the 1998–99 and 1999–00 fishing years are plotted in Figure 2. There was an indication in 1998–99 of a relatively weak year class at age 7 and/or a relatively strong year class at age 8. However, this pattern is not apparent in the following year for 8 and 9 year old fish (Figure 2).

Bluenose

Estimates of proportion-at-length for the commercial catch from the 1999–00 fishing year were produced (Figure 3, Appendix 3). Most males were taken in a size range 46–68 cm, whilst females were taken in a range 48–69 cm. The 1999–00 data are similar to the distributions reported for 1998–99 (Blackwell & McMillan 2000), Figure 4, but less fish in the 50–60 cm range were sampled in 1999–00. No proportion-at-age estimates were made because no age estimates were made (see Methods above).

Gemfish

A total of 506 (222 male, 284 female) fish were aged. Estimates of proportion-at-length for fish in the commercial catch from the 1999–00 fishing year were produced (Figure 5, Appendix 4). An age-length key was constructed, and applied to the scaled length frequency to produce estimates of numbers-at-age and percentage-at-age) in the commercial catch (Table 8). The mean weighted c.v. over all age classes was 30.7%, higher than the target value of 20%. The percentage-at-age distributions from 1996 to 2000 (Figure 6) indicate that relatively strong year classes spawned in 1995 and 1994 (ages 4 and 5 in 2000). The strong 1991 year class (currently age 8), which has comprised a substantial proportion of the catch since sampling began, is still relatively abundant. The 1988 year class (currently age 11), also appears to be relatively strong throughout the series.

Rubyfish

A total of 819 (389 male, 430 female) fish were aged. The length-frequency distribution, scaled to represent the total reported catch from the 1999–00 fishing year is given (Figure 7, Appendix 5). An age-length key was constructed, and applied to the scaled length-frequency to produce estimates of numbers-at-age and percentage-at-age in the commercial catch (Table 9). The mean weighted c.v. over all age classes of 32.3% was higher than the target value of 20%.The proportion-at-age data scaled to the 1999–00 commercial catch (Figure 8) indicate that the rubyfish fishery is based on

a wide spread of age classes. The population is numerically dominated by fish between 5 and 25 years old, with a possible strong recruitment of 11–12 year old fish.

OBJECTIVE 2:

10.3. Determine gemfish gonad condition from samples taken in fish sheds from QMA 2 in 1999–00.

The unscaled percentages by gonad stage for the male gemfish sampled (Table 8) show that these fish were either stage 1 (resting stage) (42%), or stage 2 (developing) (58%). Most (81%) females were stage 2 (developing), some (17%) were stage 1 (resting) state. Relatively few (1%) of females sampled had maturing gonads (stage 3).

11. Conclusions

Alfonsino
The 1999–00 sampling regime was adequate to achieve the target mean weighted c.v. across all age classes of 20%. The percentage-at-age distributions from the 1998–99 and 1999–00 fishing years indicate a relatively weak year class at age 7 and/or a relatively strong year class at age 8 in the 1998–99 data. However, this pattern is not apparent in the following year for 8 and 9 year old fish.

Bluenose
The 1999–00 scaled length frequency distribution is generally consistent with the data for 1997–98 (Blackwell 1999) and 1998–99 (Blackwell & McMillan (2000). During the 1999–00 fishing year, the number of line fishing vessels targeting BNS 2 continued to decrease. Industry sources (T. Gittens, fish processor, Napier, pers. comm.) indicated that this quota has been re-allocated to bluenose bycatch in the alfonsino and gemfish trawl fisheries. No age estimates have been completed for BNS 2 as the age estimates for this species are the subject of a validation study under project INS2000/02.

Gemfish
The 1999–00 sampling regime was not adequate to achieve the target mean weighted c.v. across all age classes of 20% and it would appear that either more samples are required or the target c.v. needs to be relaxed. The current commercial catch is dominated by 4 and 5 year old fish of the 1995 and 1994 year classes. The 1991 year class (current age 8 years), which previously dominated the catch in both SKI 1 and SK 2 (Horn & Hurst 1999), is still relatively abundant, and the 1988 year class (current age 11 years) also appears to be relatively strong throughout the series. Most gemfish gonads were in the resting or developing stages. This indicates that the gemfish fishery in QMA 2 is based on pre-spawning fish. After June vessels target hoki and orange roughy and gemfish are thought to migrate to northern waters to spawn (Hurst *et al.* 1999).

Rubyfish
The 1999–00 sampling regime was not adequate to achieve the target mean weighted c.v. across all age classes of 20% and it would appear that either more samples are required, more fish should be aged, or the target c.v. needs to be relaxed. Obtaining more samples is difficult because the fishery is small (303 t in 1999–00) and there are a limited number of landings available to sample. The age frequency distribution for rubyfish is consistent with previous data described by Paul *et al.* (2000) but the age estimates for this species are the subject of a validation study under project INS2000/02.

12. Publications

Nil.

13. Data Storage

All data are stored on MFish databases (Market and Age).

14. References

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Table 1: Alfonsino. Sampling strata, planned and actual number of landings sampled, landed commercial catch, and number of landings in QMA 2 in 1999–00

	Stratum				Total
Vessel type	T1	T1	OTH	OTH	
Months	Oct-Dec	Jan-Sep	Oct-Dec	Jan-Sep	
Planned landings sampled	3	5	3	4	15
Actual landings sampled	3	4	6	5	18
Landed catch (t)	386	565	262	638	1 851
Number of landings	14	35	61	174	284

Table 2: Bluenose. Sampling strata, planned and actual number of landings sampled, landed commercial catch, and number of landings in QMA 2 during 1999–00. The stratum landings were derived from estimated catches, as that was the only way to get catch by method (i.e., large trawlers, small trawlers, line), and consequently the sum of estimated catches (1010 t) is less than the sum of QMR reported catches for BNS 2 (1136 t for 1999–00)

	Stratum						Total
Vessel type	T1	T1	T2	T2	OTH	OTH	
Months	Oct-Dec	Jan-Sep	Oct-Dec	Jan-Sep	Oct-Dec	Jan-Sep	
Planned landings sampled	5	6	3	7	3	8	32
Actual landings sampled	4	7	5	9	3	4	32
Landed catch (t)	114	254	56	224	108	253	1 010
Number of landings	41	89	57	174	37	104	502

Table 3: Gemfish. Sampling strata, planned and actual number of landings sampled in QMA 2 in 1999–00. *, less than the minimum number of samples (3)

	Stratum				Total
Vessel type	T1	T1	OTH	OTH	
Months	Oct-Mar	Apr-May	Oct-Mar	Apr-May	
Planned landings sampled	4	4	4	3	15
Actual landings sampled	11	0*	4	0*	15

Table 4: Gemfish. Revised sampling strata, planned and actual number of landings sampled, landed commercial catch, and number of landings in QMA 2 in 1999–00

	Stratum		Total
Vessel type	T1	OTH	
Months	Oct-May	Oct-May	
Planned landings sampled	8	7	15
Actual landings sampled	11	4	15
Landed catch (t)	394	113	507
Number of landings	42	249	291

Table 5: Rubyfish. Sampling strata, planned and actual number of landings sampled in QMA 2 in 1999–00. *, less than the minimum number of samples (3)

				Stratum		Total
Vessel type	BT1	BT1	BT1	BT1	OTH	
Months	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Sep	
Planned landings sampled	12	5	4	4	7	32
Actual landings sampled	9	5	1*	0*	3	18

Table 6: Rubyfish. Revised sampling strata, planned and actual number of landings sampled, landed commercial catch, and number of landings in QMA 2 in 1999–00

		Stratum		Total
Vessel type	T1	T1	OTH	
Months	Oct-Dec	Jan-Sep	Oct-Sep	
Planned landings sampled	12	13	7	32
Actual landings sampled	9	6	3	18
Landed catch (t)	100	177	26	303
Number of landings	10	21	101	132

Table 7: Alfonsino estimated numbers-at-age (No., scaled to the total reported catch), percentage at age (%), and coefficients of variation (c.v.,%), from commercial catches in BYX 2, in the 1999–00 fishing year

	Male			Female		
Age	No.	%	c.v	No.	%	c.v
3	1 500	0.095	205.4	4 165	0.263	130.0
4	35 015	2.213	36.0	17 188	1.086	63.5
5	159 456	10.077	23.7	11 618	7.054	24.4
6	154 575	9.769	22.3	147 217	9.304	24.2
7	151 667	9.585	17.3	144 858	9.155	17.2
8	80 500	5.088	19.6	121 770	7.696	16.8
9	55 360	3.499	25.6	82 959	5.243	21.8
10	30 082	1.901	40.1	62 187	3.930	25.8
11	33 801	2.136	38.7	63 383	4.006	25.9
12	23 626	1.493	41.7	46 926	2.966	31.4
13	13 374	0.845	59.1	21 924	1.386	49.9
14	5 332	0.337	85.1	9 119	0.576	68.0
15	1 207	0.076	155.0	1 773	0.112	124.3
16	0	0	0	589	0.037	157.7
17	0	0	0	0	0	0
18	0	0	0	1 126	0.071	160.0
19	0	0	0	12	0.001	441.6
Measured	556			666		
Aged	255			290		

Table 8: **Gemfish estimated numbers-at-age (No., scaled to the total reported catch), percentage at age (%), and coefficients of variation (c.v., %) from commercial catches in SKI 2, in the 1999–00 fishing year**

	Male			Female		
Age	No.	%	c.v	No.	%	c.v
3	4 747	3.414	55.8	3 014	2.168	72.8
4	22 285	16.027	54.9	23 932	17.211	30.8
5	11 440	8.227	25.9	12 411	8.926	19.8
6	2 129	1.531	51.2	2 656	1.910	45.9
7	4 118	2.962	31.8	3 428	2.465	35.0
8	9 183	6.604	24.7	7 885	5.671	26.3
9	1 466	1.054	51.9	2 795	2.010	40.5
10	2 303	1.656	50.3	5 079	3.653	33.2
11	3 501	2.518	46.4	6 199	4.458	29.1
12	703	0.506	84.5	2 011	1.446	46.3
13	1 416	1.018	65.4	2 281	1.640	42.0
14	460	0.331	102.6	616	0.443	72.5
15	532	0.383	93.9	959	0.690	56.7
16	151	0.109	173.0	367	0.264	90.3
17	271	0.195	119.3	199	0.143	135.8
18	236	0.170	155.5	116	0.083	169.1
19	0	0	0	161	0.116	144.9
Measured	275			447		
Aged	222			284		

Table 9: **Rubyfish estimated numbers-at-age (No., scaled to the total reported catch), percentage (%), and coefficients of variation (c.v., %), from commercial catches in RBY 2, in the 1999–00 fishing year**

	Male			Female		
Age	No.	%	c.v	No.	%	c.v
6	866	0.371	73.4	1 230	0.528	64.8
7	844	0.362	76.1	874	0.375	72.0
8	1 941	0.833	45.7	960	0.412	56.6
9	1 771	0.760	48.8	4 174	1.790	33.1
10	6 185	2.653	26.0	4 356	1.868	35.1
11	20 052	8.600	20.7	22 584	9.686	21.0
12	6 668	2.860	30.0	5 427	2.328	31.4
13	10 566	4.532	26.6	6 844	2.935	30.3
14	2 365	1.014	45.0	1 959	0.840	43.3
15	1 859	0.797	49.2	3 334	1.430	46.0
16	3 078	1.320	37.5	4 155	1.782	30.7
17	1 618	0.694	51.0	2 220	0.952	41.0
18	1 213	0.520	65.1	3 097	1.328	51.9
19	3 552	1.523	51.6	1 865	0.800	42.7
20	1 673	0.718	48.0	3 121	1.339	46.6
21	2 342	1.005	52.1	4 683	2.009	31.9
22	2 329	0.999	47.0	4 222	1.811	32.0
23	2 118	0.908	46.6	1 521	0.652	55.7
24	2 308	0.990	49.6	2 648	1.136	47.6
25	2 994	1.284	46.7	3 024	1.297	43.1
26	1 268	0.544	65.7	2 141	0.918	48.6
27	831	0.356	84.7	2 985	1.280	46.7
28	417	0.179	130.7	1 304	0.559	54.9
29	1 572	0.674	56.3	849	0.364	65.9
30	1 144	0.491	60.8	1853	0.795	48.2
31	3 697	1.586	45.2	1 073	0.460	66.5
32	1 442	0.618	56.5	1 607	0.689	45.9
33	1 270	0.545	71.1	1 298	0.557	55.3
34	1 341	0.575	56.5	1 866	0.800	47.9
35	2 744	1.177	49.0	2 393	1.026	45.3
36	2 925	1.255	42.3	2 371	1.017	39.0
37	1 127	0.483	61.4	1 509	0.647	52.0
38	630	0.270	90.3	1 989	0.853	49.2
39	304	0.130	114.5	1 380	0.592	55.0
40	508	0.218	85.3	932	0.400	60.7
41	1 343	0.576	61.3	2 029	0.870	41.1
42	1 069	0.459	73.2	670	0.287	79.1
43	609	0.261	87.5	670	0.287	80.2
44	1 228	0.527	54.8	850	0.365	69.0
45	1 038	0.445	74.0	727	0.312	73.6
46	623	0.267	83.6	694	0.298	70.0
47	1 230	0.528	59.3	427	0.183	92.0
48	727	0.312	81.6	0	0	0
49	305	0.131	124.6	406	0.174	108.4
50	297	0.127	112.4	832	0.357	71.1

Table 9: – continued

	Male			Female		
Age	No.	%	c.v	No.	%	c.v
51	332	0.142	100.6	607	0.260	74.6
52	941	0.404	76.8	196	0.084	154.6
53	29	0.012	249.3	0	0	0
54	213	0.091	163.1	457	0.196	85.2
55	630	0.270	88.6	571	0.245	92.7
56	59	0.025	261.2	439	0.188	95.9
57	828	0.355	73.9	361	0.155	97.1
58	310	0.133	110.8	432	0.185	80.3
59	59	0.025	213.6	0	0	0
60	204	0.087	118.1	89	0.038	170.3
61	106	0.045	185.7	615	0.264	72.5
62	106	0.045	150.7	700	0.300	85.1
63	99	0.042	152.8	325	0.139	108.2
64	99	0.042	146.7	277	0.119	114.1
65	404	0.173	92.0	0	0	0
66	205	0.088	105.8	89	0.038	182.1
67	99	0.042	169.1	0	0	0
68	0	0	0	345	0.148	104.7
69	0	0	0	81	0.035	140.7
70	32	0.014	385.3	0	0	0
71	110	0.047	172.9	0	0	0
72	128	0.055	167.0	345	0.148	103.6
73	204	0.087	128.8	89	0.038	159.9
74	417	0.179	129.9	0	0	0
75	99	0.042	158.0	0	0	0
76	0	0	0	0	0	0
77	0	0	0	0	0	0
78	140	0.060	166.6	0	0	0
79	0	0	0	0	0	0
80	0	0	0	0	0	0
81	0	0	0	0	0	0
82	0	0	0	0	0	0
83	0	0	0	0	0	0
84	99	0.042	158.7	0	0	0
Measured	414			447		
Aged	389			430		

Table 10: Gemfish gonad condition in SKI 2, Oct 1999–Mar 2000. Unscaled numbers of fish and unscaled percentages by gonad stage and sex

Stratum T1	Males		Females	
Gonad stage	No.	%	No.	%
1	97	45	68	20
2	117	55	269	79
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
Total	214	100	337	100

Stratum OTH	Males		Females	
Gonad stage	No.	%	No.	%
1	19	31	10	9
2	42	69	94	85
3	0	0	6	5
4	0	0	0	0
5	0	0	0	0
Total	61	100	110	

All strata	Males		Females	
Gonad stage	No.	%	No.	%
1	116	42	78	17
2	159	58	363	81
3	0	0	6	1
4	0	0	0	0
5	0	0	0	0
Total	275	100	447	100

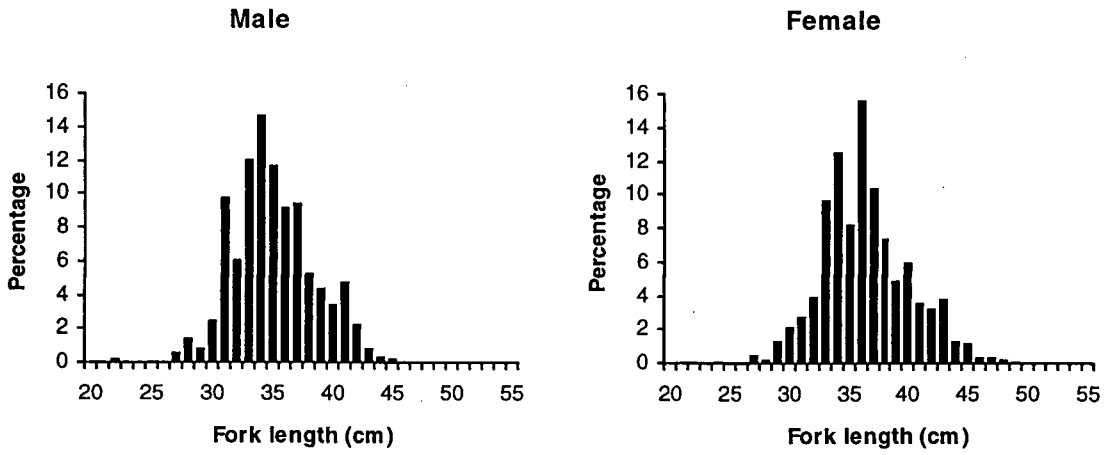


Figure 1: Alfonsino length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in BYX 2 from the 1999–00 fishing year.

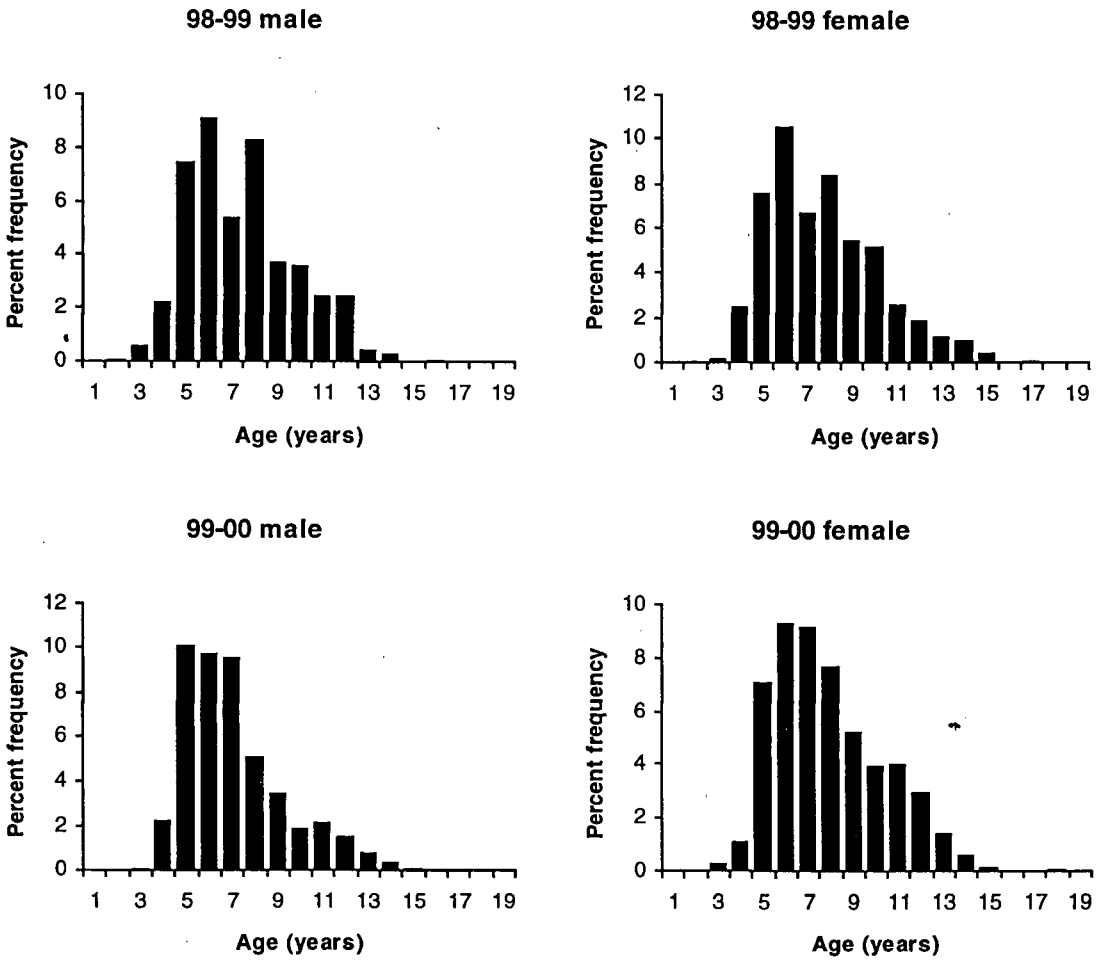


Figure 2: Alfonsino age frequency distributions by sex. Scaled to the total commercial; catch from samples taken in BYX 2, from the 1998–99 and 1999–00 fishing years.

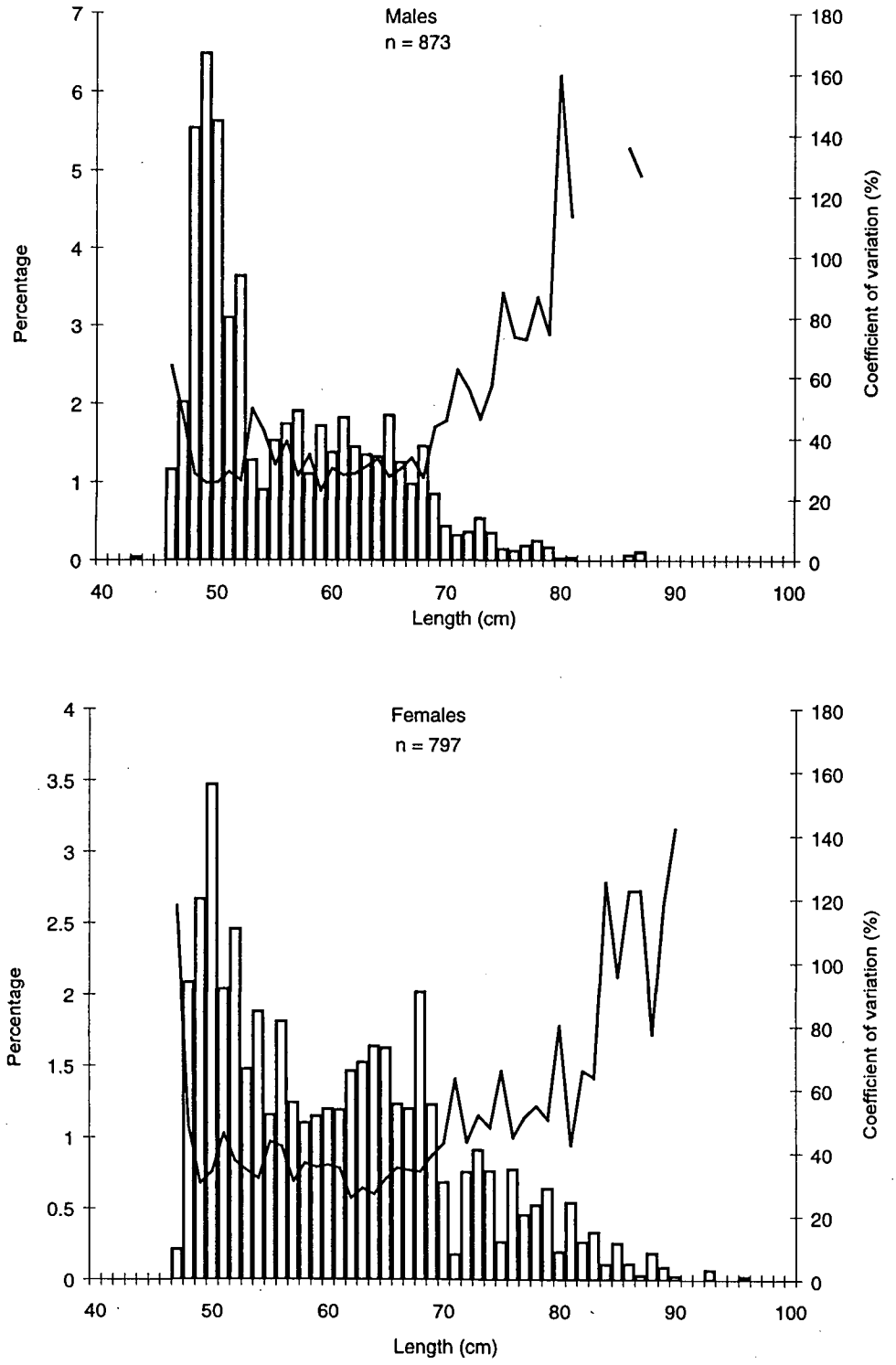
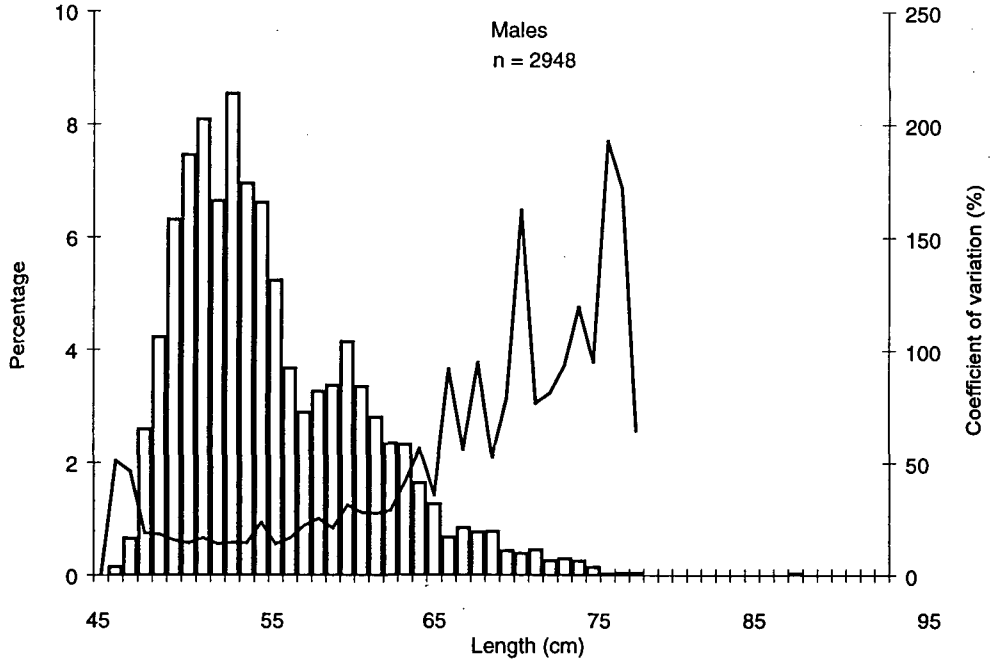


Figure 3: **Bluenose length (fork) frequency distributions (bars) and c.v. (lines) by sex. Scaled to the total commercial catch from samples taken in BNS 2 from the 1999–00 fishing year.**



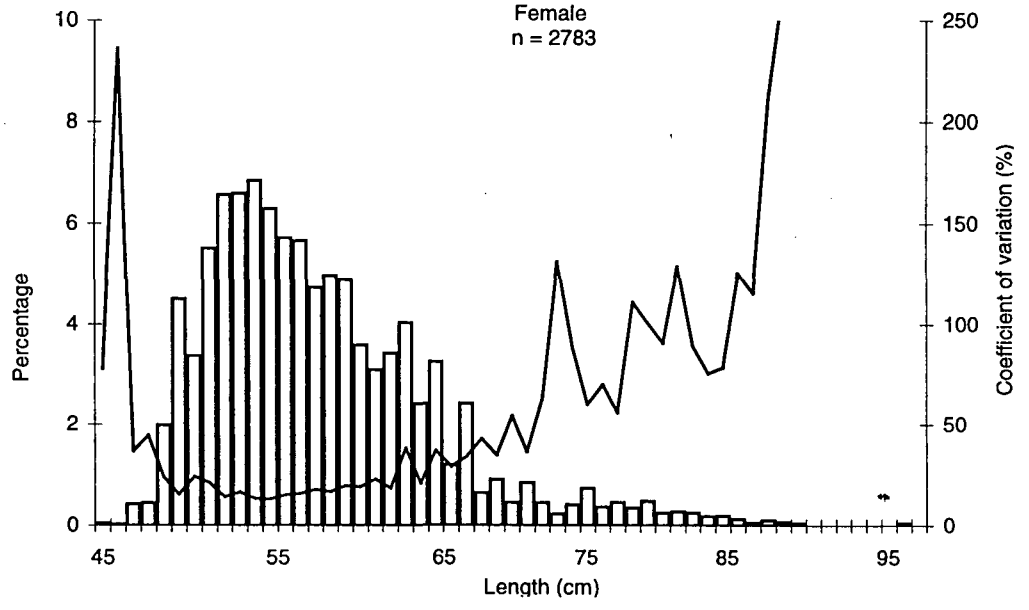


Figure 4: **Bluenose length (fork) frequency distribution (bars) and c.v. (lines) by sex. Scaled to the total commercial catch from samples taken in BNS 2 from the 1998–99 fishing year. Data from Blackwell & McMillan (2000).**

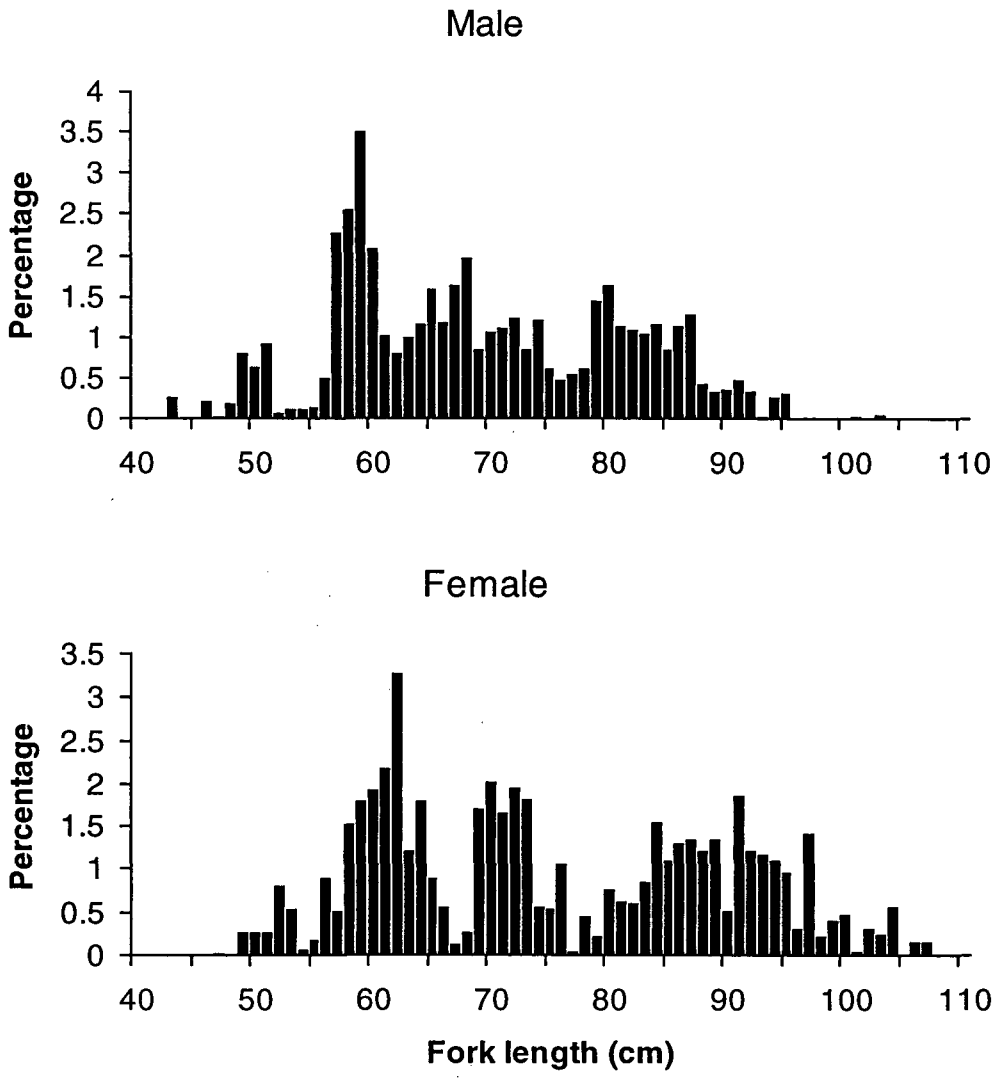


Figure 5: **Gemfish length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in SKI 2 from the 1999–00 fishing year.**

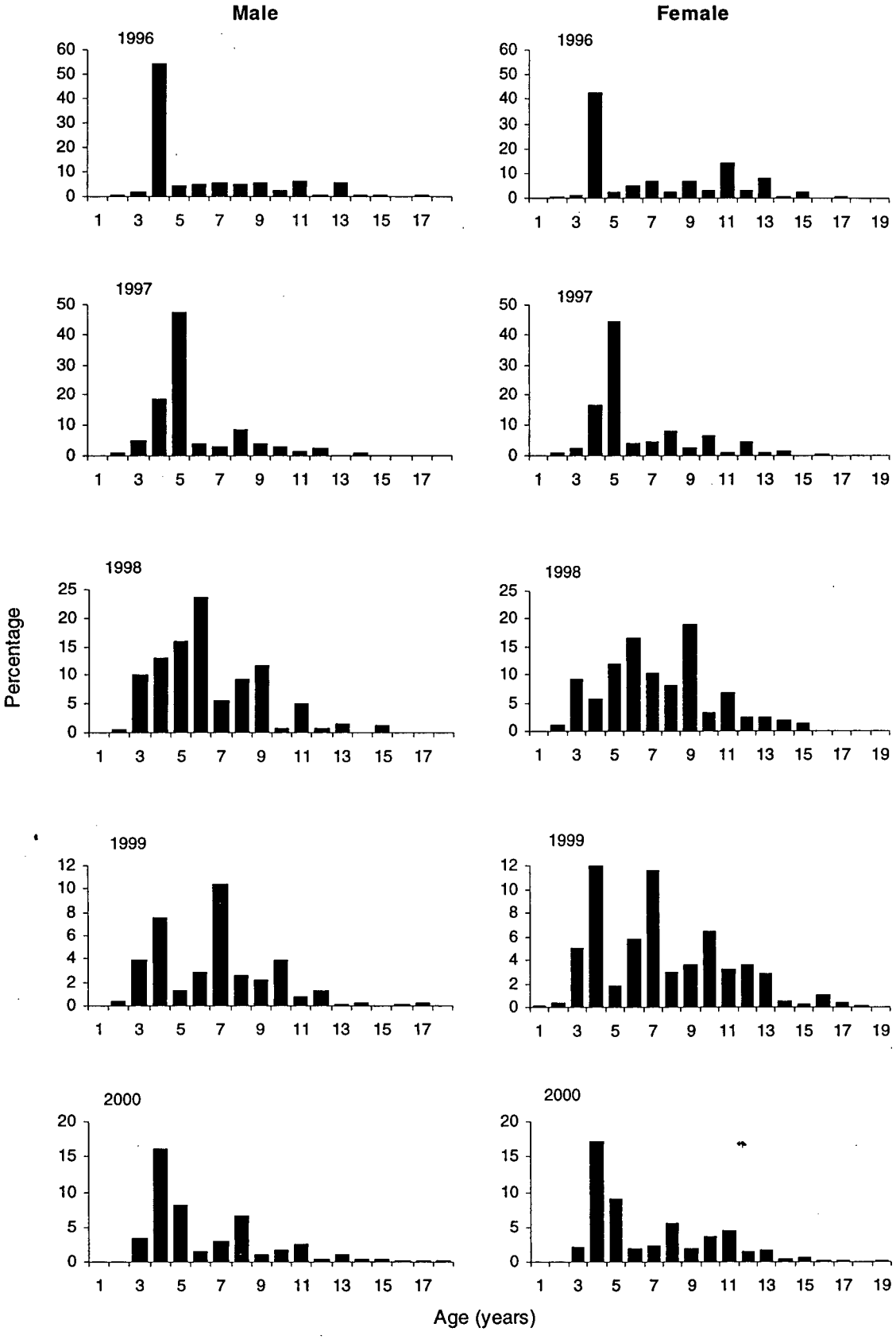


Figure 6: Gemfish age frequency distributions by sex. Scaled to the total commercial catch from samples taken in SKI 2 from 1995–96 to 1999–00. [Note: "1996" refers to the 1995–96 fishing year, etc.]

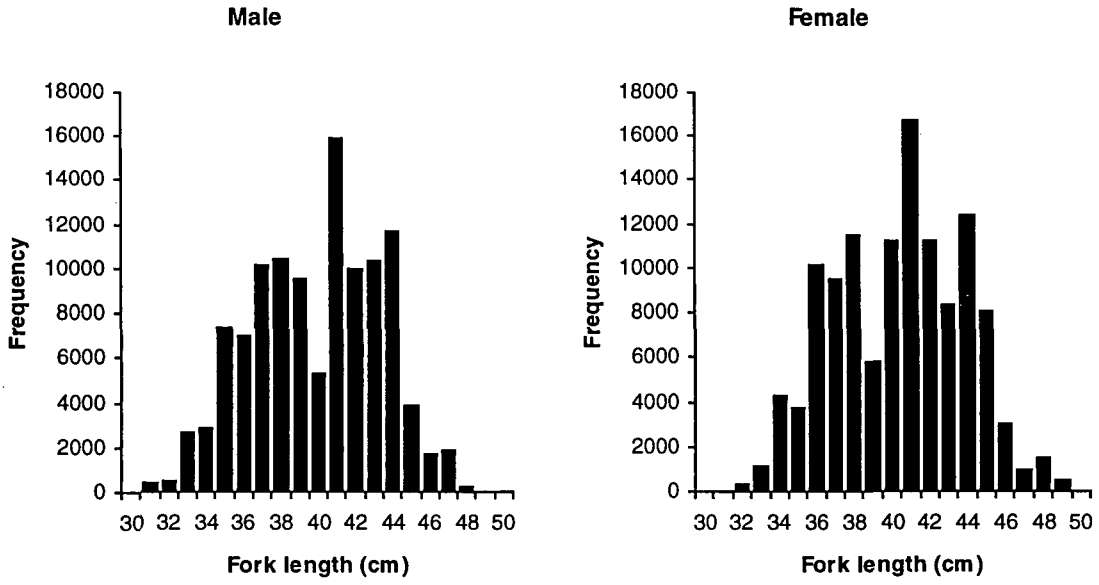


Figure 7: **Rubyfish length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in RBY 2 from the 1999–00 fishing year.**

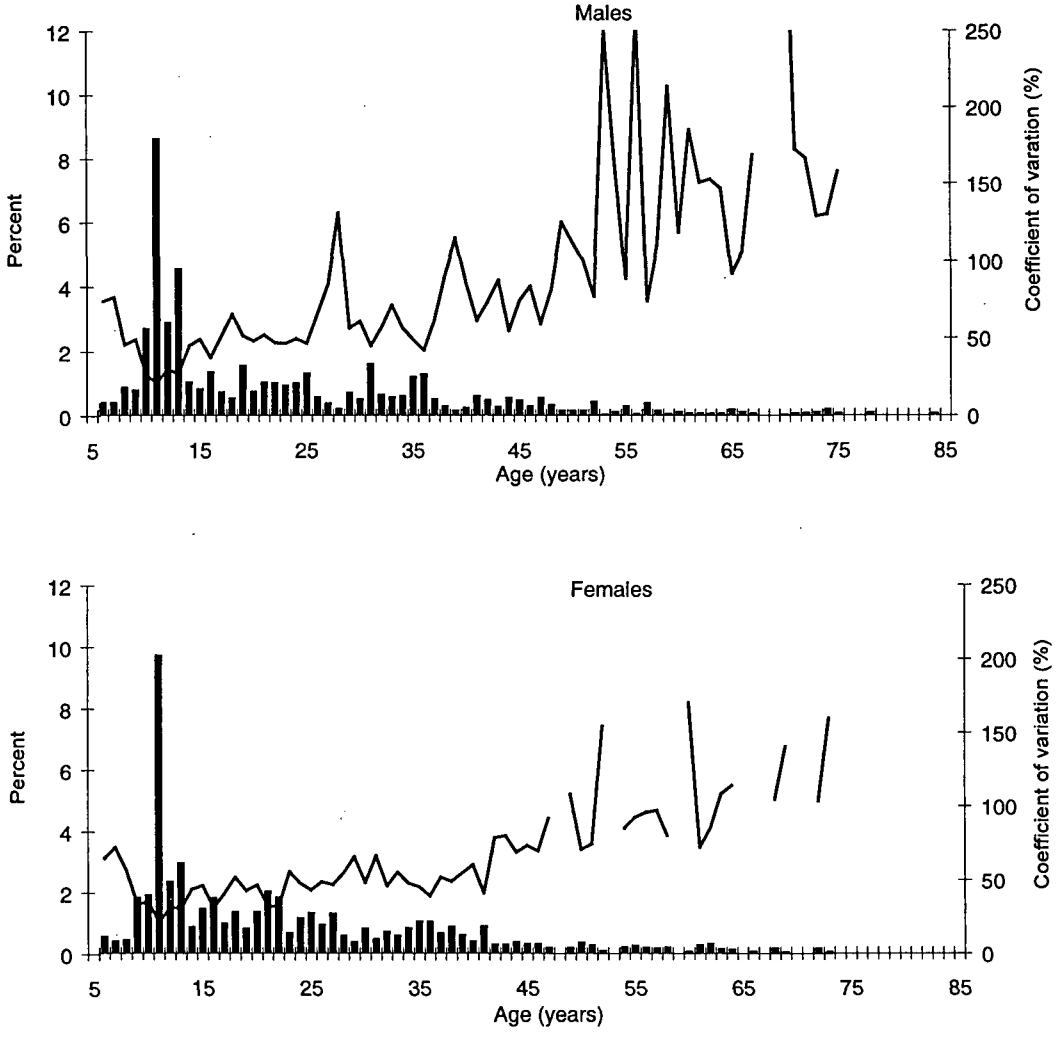


Figure 8: **Rubyfish age frequency distributions estimates (bars) and coefficient of variation (line) by sex. Scaled to the total commercial catch from samples taken in RBY 2 from the 1999–00 fishing year.**

Appendix 1: Gemfish macroscopic gonad stages.

Stage	Name of stage	Description	
		Female	**Male**
1	Immature/resting	Oval, transparent	Threadlike
2	Developing	Granular, cells/oocytes visible	Hard with edge
3	Maturing	Some hyaline (transparent) eggs	Viscous milt if cut
4	Running ripe	Hyaline eggs, running	Running milt
5	Spent	Bloody, flabby	Blotchy, bloody, hard

Appendix 2: Alfonsino estimated numbers-at-length (No.) with coefficients of variation (c.v., %), by sex, from the BYX 2 commercial fishery in the 1999–00 fishing year.

	Male		Female	
Length	No.	c.v.	No.	c.v.
22	1 500	161.9	0	0
23	0	0	0	0
24	0	0	1 805	131.5
25	0	0	0	0
26	0	0	0	0
27	2 993	114.2	2 360	154.9
28	8 208	82.9	1 493	124.0
29	7 838	80.7	8 257	109.0
30	19 493	50.4	12 193	56.1
31	63 395	33.1	22 969	48.4
32	47 457	36.1	31 227	42.3
33	94 447	34.5	74 471	35.5
34	104 060	27.8	97 646	28.0
35	89 587	21.1	72 978	23.1
36	71 883	23.5	122 566	22.6
37	65 263	23.8	78 166	19.4
38	37 700	31.2	55 985	24.8
39	37 110	32.7	47 635	24.4
40	28 806	41.3	44 930	27.8
41	31 875	43.6	37 553	30.9
42	19 251	55.7	39 358	27.9
43	9 041	69.8	37 307	33.1
44	3 164	74.3	20 276	50.8
45	2 389	83.9	10 640	65.8
46	25	161.6	5 767	68.8
47	12	178.0	5 079	62.2
48	0	0	3 826	80.2
49	0	0	1 178	122.5
50	0	0	1 126	125.4
51	0	0	12	172.4
52	0	0	0	0
53	0	0	0	0
54	0	0	12	174.2

Appendix 3: Bluenose estimated numbers-at-length (No.) and proportion at length (%) from the commercial catch, with coefficients of variation (c.v., %), by sex from the BNS 2 commercial fishery in the 1999–00 fishing year.

	Males			Females		
Length	No.	%	c.v.	No.	%	c.v.
43	90	0	130.2	0	0	0
44	0	0	0	0	0	0
45	0	0	0	0	0	0
46	2 813	1.2	63.6	0	0	0
47	4 920	2.0	47.2	518	0.2	117.9
48	13 468	5.5	28.5	5 072	2.1	48.6
49	15 763	6.5	25.5	6 493	2.7	30.5
50	13 682	5.6	25.6	8 439	3.5	34.1
51	7 550	3.1	29.1	4 960	2.0	46.4
52	8 853	3.6	26.3	5 984	2.5	37.6
53	3 107	1.3	49.7	3 595	1.5	34.6
54	2 208	0.9	42.6	4 580	1.9	32.1
55	3 723	1.5	31.5	2 820	1.2	43.8
56	4 237	1.7	39.1	4 412	1.8	42.2
57	4 635	1.9	28.0	3 030	1.2	31.2
58	2 691	1.1	34.7	2 687	1.1	37.0
59	4 181	1.7	23.0	2 801	1.2	35.7
60	3 351	1.4	30.3	2 921	1.2	36.3
61	4 441	1.8	28.1	2 906	1.2	35.3
62	3 524	1.4	28.5	3 560	1.5	25.8
63	3 276	1.3	30.8	3 714	1.5	29.0
64	3 213	1.3	33.3	3 992	1.6	27.1
65	4 509	1.9	27.6	3 957	1.6	31.9
66	3 042	1.3	30.1	3 006	1.2	35.4
67	2 377	1.0	33.7	2 923	1.2	34.7
68	3 542	1.5	27.3	4 911	2.0	34.2
69	2 078	0.9	43.8	2 993	1.2	39.4
70	1 064	0.4	46.0	1 660	0.7	43.3
71	791	0.3	62.4	427	0.2	63.5
72	880	0.4	56.3	1 840	0.8	43.7
73	1 317	0.5	46.6	2 218	0.9	52.0
74	876	0.4	57.2	1 856	0.8	48.1
75	362	0.1	88.3	648	0.3	66.0
76	313	0.1	73.5	1 886	0.8	45.2
77	466	0.2	72.6	1 113	0.5	51.5
78	615	0.3	86.8	1 273	0.5	55.0
79	408	0.2	74.5	1 558	0.6	50.6
80	71	0.0	159.5	472	0.2	80.3
81	89	0.0	113.5	1 318	0.5	42.7
82	0	0	0	643	0.3	65.9
83	0	0	0	808	0.3	63.8
84	0	0	0	266	0.1	125.4
85	0	0	0	621	0.3	95.7
86	168	0.1	135.9	274	0.1	122.6
87	266	0.1	127.1	75	0	122.8
88	0	0	0	451	0.2	77.7
89	0	0	0	213	0.1	118.4
90	0	0	0	59	0	42.3
91	0	0	0	0	0	0
92	0	0	0	0	0	0
93	0	0	0	165	0.1	92.2
94	0	0	0	0	0	0
95	0	0	0	0	0	0
96	0	0	0	52	0	159.1

Appendix 4: Gemfish estimated numbers-at-length (No.) with coefficients of variation (c.v., %), by sex, from the SKI 2 commercial fishery in the 1999–00 fishing year.

	Male		Female	
Length	No.	c.v.	No.	c.v.
43	363	148.2	0	0
44	0	0	0	0
45	0	0	0	0
46	290	112.0	0	0
47	35	136.4	35	158.5
48	247	111.9	0	0
49	1 121	103.8	366	137.0
50	887	115.9	366	133.7
51	1 288	91.3	366	142.0
52	111	138.3	1 124	92.5
53	164	156.7	758	146.0
54	162	106.5	83	137.1
55	196	135.6	247	105.4
56	678	84.9	1 243	91.1
57	3 160	59.1	733	86.0
58	3 563	82.6	2 137	51.5
59	4 869	82.2	2 505	69.5
60	2 893	80.0	2 697	57.8
61	1 429	82.6	3 031	50.5
62	1 121	102.4	4 556	40.9
63	1 374	83.5	1 694	94.9
64	1 599	111.7	2 483	75.6
65	2 215	60.5	1 237	93.0
66	1 636	66.7	777	84.0
67	2 281	54.8	173	101.5
68	2 739	59.0	376	87.0
69	1 189	61.9	2 363	51.9
70	1 496	46.2	2 818	43.5
71	1 544	66.5	2 296	55.0
72	1 722	72.7	2 703	38.7
73	1 173	67.7	2 518	47.3
74	1 672	66.5	782	75.7
75	857	73.3	750	65.5
76	656	85.6	1 461	70.3
77	758	146.3	59	161.3
78	847	77.5	632	85.7
79	2 018	70.3	320	92.4
80	2 277	46.2	1 063	80.6
81	1 579	64.3	872	66.1
82	1 507	75.8	856	59.7
83	1 433	78.5	1 197	64.5
84	1 609	50.1	2 161	46.8
85	1 191	58.0	1 538	66.9
86	1 592	67.1	1 818	42.0
87	1 767	66.3	1 861	60.4
88	606	93.7	1 692	52.1
89	474	109.3	1 876	53.3
90	508	111.3	717	61.0
91	648	98.1	2 578	43.9
92	472	102.1	1 677	49.6
93	35	150.5	1 622	52.9
94	363	144.8	1 514	54.1
95	436	126.9	1 351	61.9
96	0	0	423	79.3

Appendix 4: – continued

	Male		Female	
Length	No.	c.v.	No.	c.v.
97	0	0	1 978	53.9
98	0	0	325	80.9
99	0	0	548	81.7
100	0	0	642	86.7
101	24	209.5	69	146.9
102	0	0	431	85.2
103	67	140.3	353	85.8
104	0	0	795	69.1
105	0	0	0	0
106	0	0	232	87.3
107	0	0	231	107.3
108	0	0	2	363.4

Appendix 5: Rubyfish estimated numbers-at-length (No.) with coefficients of variation (c.v., %), by sex, from the RBY 2 commercial fishery in the 1999–00 fishing year.

	Male		Female	
Length	No.	c.v.	No.	c.v.
31	437	115.9	5	274.5
32	526	112.2	368	100.8
33	2 680	49.1	1 203	69.2
34	2 890	49.2	4 357	55.0
35	7 339	43.5	3 764	49.7
36	7 022	36.7	10 178	39.0
37	10 140	28.6	9 531	35.0
38	10 438	29.1	11 537	32.0
39	9 536	33.0	5 882	47.9
40	5 304	35.7	11 290	30.1
41	15 897	47.2	16 759	48.3
42	9 968	31.3	11 270	31.1
43	10 352	38.6	8 336	39.8
44	11 684	45.9	12 435	26.3
45	3 871	44.4	8 113	37.5
46	1 701	97.2	3 065	58.2
47	1 883	94.5	973	77.3
48	265	184.8	1 564	90.2
49	23	231.0	533	100.0
50	32	346.7	4	153.4

Corrigendum (Table 10) and addendum (Table 11) to Final Research Report for Ministry of Fisheries Research Project INS1999/01

R. Blackwell and P. McMillan, 3 July 2001

Table 10: Gemfish gonad condition in SKI 2, Oct 1999–Mar 2000. Unscaled numbers of fish and unscaled percentages by gonad stage and sex. Corrected *

Stratum T1	Males		Females	
Gonad stage	No.	%	No.	%
1	97	45	68	20
2	117	55	269	79
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
Total	214	100	337	100

Stratum OTH	Males		Females	
Gonad stage	No.	%	No.	%
1	19	31	10	9
2	42	69	94	85
3	0	0	0	0*
4	0	0	0	0
5	0	0	6	5*
Total	61	100	110	

All strata	Males		Females	
Gonad stage	No.	%	No.	%
1	116	42	78	17
2	159	58	363	81
3	0	0	6	1
4	0	0	0	0
5	0	0	0	0
Total	275	100	447	100

Note - Six female samples recorded as stage 5 were erroneously attributed to stage 3 in the original report.

Table 11: Gemfish sampled for length, gonad stage, and sex in SKI 2, Oct 1999–Mar 2000

	Males				Females				
Length	Stage 1	Stage 2	Total		Length	Stage 1	Stage 2	Stage 5	Total
43	1		1		43				
46	2		2		46				
47	1		1		47		1		1
48	2		2		49	1	1		2
49	2		2		50	1	1		2
50	3		3		51	1	1		2
51	3	1	4		52	2	1		3
52	1	1	2		53	1			1
53	1		1		54		1		1
54	1	1	2		55		2		2
55	3	1	4		56	2	2		4
56	1	3	4		57		4		4
57	8	4	12		58	2	7		9
58	9	3	12		59	2	9		11
59	8	5	13		60	5	12		17
60	11	1	12		61	2	18		20

61	1	3	4
62	2		2
63	3	1	4
64	2	1	3
65	3	3	6
66	3	6	9
67	2	7	9
68	3	10	13
69		7	7
70	4	6	10
71	3	4	7
72	2	3	5
73	1	4	5
74	3	1	4
75	1	6	7
76	2	2	4
77	1		1
78	1	11	12
79	1	7	8
80	2	12	14
81	3	6	9
82	3	3	6
83		5	5
84	3	6	9
85	2	5	7
86	1	6	7
87	1	3	4
88	3	1	4
89		2	2
90		2	2
91		2	2
92	1	1	2
93		1	1
94	1		1
95		1	1
101		1	1
103	1		1
Total	116	159	275

62	6	12		18
63	2	6		8
64	2	2		4
65	2	4		6
66	1	4		5
67		2		2
68		6		6
69	2	10		12
70	1	12		13
71		15		15
72	1	22		23
73	2	10		12
74		5		5
75	2	4		6
76	3	4		7
77		2		2
78		4		4
79		6		6
80		4		4
81		6		6
82	1	7		8
83	2	6		8
84	3	7	1	11
85	2	10	2	14
86	2	10	1	13
87		9		9
88	1	8		9
89	2	12		14
90	2	7		9
91	1	13		14
92	4	9		13
93		9		9
94		8		8
95	1	6		7
96	1	5		6
97	1	9		10
98	1	4		5
99	2	7		9
100	1	2	1	4
101	1		1	2
102	4	4		8
103		4		4
104		4		4
106	1	2		3
107	1	1		2
108	1			1
Total	78	363	6	447

Note. The fact that maturing or spawning gonads (stage 3 or 4) were not recorded is not surprising given prior knowledge of gemfish from SKI 2, i.e., that they migrate out of the area during autumn to spawn, probably in the Bay of Plenty (Hurst et al. 1999). Sampling was carried from October to March.