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*Taihoru Nukurangi*

**Commercial catch sampling of alfonsino,  
bluenose, gemfish and rubyfish in QMA 2 in  
2000-01**

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**Final Research Report for  
Ministry of Fisheries Research Project INS2000/01**

**National Institute of Water and Atmospheric Research**

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## Final Research Report

<b>Report Title</b>	Commercial catch sampling of alfonsino, bluenose, gemfish and rubyfish in QMA 2 in 2000–01
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<b>3. Project Title</b>	Monitoring the length and age structure of commercial landings of alfonsino, gemfish, bluenose, and rubyfish in QMA 2.
<b>4. Project Code</b>	INS2000/01
<b>5. Project Leader</b>	P.J. McMillan
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### Note:

This project started on 1 January 2001 but the collection of samples between 1 October and 31 December 2000 carried out as an extension of the INS1999/01 contract is reported below.

### 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 2000–01 fishing year, and fulfils the reporting requirements of specific objectives 1–3 of project INS2000/01.

#### **Objective 1 — Sampling alfonsino and gemfish for length, sex and age**

The target numbers of landings sampled were achieved for alfonsino (20 completed of 15 planned). For gemfish, 14 landings were completed of the 15 planned.

Target numbers of otolith samples were achieved for both species. For alfonsino, 997 fish were measured and 490 otoliths were read (target 500). For gemfish, 700 were measured and 541 otoliths were read (target 500). Age estimates were made for alfonsino (2–18 years) and gemfish (2–20 years). The estimated mean weighted c.v. across all age classes was 23.4% for alfonsino (target 30%) and 27.1% for gemfish (target 30%).

### **Objective 2 — Sampling bluenose and rubyfish for length, sex and otoliths**

For bluenose, 30 landings were completed of the 32 planned, with reduced sampling required for line-caught fish because of reduced effort in that part of the fishery. For rubyfish, 20 of the 20 target samples were obtained, reduced from the target of 32 samples in 1999–2000 because of the small number of landings made, and the relatively small size of many landings. Target numbers of otolith samples were achieved for both species. For bluenose 1486 otoliths were collected (target 800), and for rubyfish 890 were collected (target 800). Proportion-at-length estimates only were made for bluenose and rubyfish, and appear to be consistent with previous fishing years. No bluenose or rubyfish ageing was carried out pending the results of a project (INS2000/02) reviewing the ageing methods for those species.

### **Objective 3 — Gemfish gonad condition**

Gonad stages of fish sampled from 14 landings taken in QMA 2 during October 2000 to February 2001 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 objective for project INS2000/01 was:**

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 2000/01 were:**

1. To conduct sampling in fish processing sheds and determine the length and age composition of the commercial catch of alfonsino in BYX 2 and gemfish in SKI 2 during the 2000/2001 fishing year. The target coefficient of variation (c.v.) for the catch at age is 30 % (mean weighted c.v. across all age classes).
2. To conduct sampling in fish processing sheds and collect otoliths and determine the length composition of the commercial catch of bluenose in BNS 2, and rubyfish in RBY 2 during the 2000/2001 fishing year. The target coefficient of variation (c.v.) for the catch at length is 30 % (mean weighted c.v. across all age classes).
3. To conduct sampling in fish processing sheds and determine the gonad condition of gemfish taken in SKI 2 target trawl fisheries during 2000/2001.

## 9. Methods

### OBJECTIVE 1:

**To conduct sampling in fish processing sheds and determine the length and age composition of the commercial catch of alfonsino in BYX 2 and gemfish in SKI 2 during the 2000/2001 fishing year. The target coefficient of variation (c.v.) for the catch at age is 30% (mean weighted c.v. across all age classes).**

Methods to carry out this objective were similar to those used to sample and determine the length and age compositions of the same species in QMA 2 in 1998–99 (McMillan et al. 2000) and 1999–2000 (Blackwell et al. 2001).

### Developing sampling strata

The sampling regime and strata used in project INS1999/01 to sample the 1999–2000 fishing year (Blackwell et al. 2001) were used to extend sampling into the 2000–01 year (1 October to 30 December 2000). No new analyses were performed and that regime was continued for the rest of the 2000–01 year from 1 January 2001 onwards. The same vessels generally fished for all four species so sampling strata were developed together for all our fishstocks to avoid an excessively complex sampling regime. That sampling regime aimed to apportion the sampling effort throughout the year in relation to the expected seasonal distribution of the commercial catch, based on analysis of the catch data from 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 trawlers (i.e., not T1) 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 included because a substantial proportion of bluenose catch was taken by target line fishing in past years. However, target line fishing in BNS 2 declined during 1999–00, and this appeared to continue into 2000–01. Most line caught bluenose is now taken as bycatch of other target line fisheries, in often small quantities. Some of this bluenose bycatch was also landed at ports outside of QMA 2 (notably Tauranga and Auckland). The small size of the landings often meant that the fish was quickly processed after landing, and was not available to the sampling programme.

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. Gilbert, NIWA, 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.

## **9.1 Catch sampling of alfonsino and gemfish in QMA 2**

### Alfonsino

The sampling aimed to collect 15 samples and about 500 otoliths for the whole of 2000–01. 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 30% was based on previous alfonsino sampling and age determination (Blackwell et al. 2001).

### Gemfish

The sampling aimed to collect 15 samples and about 500 otoliths for the whole of 2000–01. 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 30% was based on previous gemfish sampling and age determination in SKI 2 (Blackwell et al. 2001), and the results of 7 years of gemfish sampling and age determination in SKI 1 (D. Gilbert, NIWA, pers. comm.).

## **9.2 Estimate the length and age structure of the alfonsino and gemfish catch**

### **Proportion-at-length estimates**

Proportion-at-length estimates scaled to the commercial catch by stratum were produced for each species, using purpose-written 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 2000–01.

### **Otolith selection, ageing and proportion-at-age estimates**

Estimates of proportion-at-age in the commercial catch were calculated as follows. An age-length key was constructed from otolith data and applied to the scaled length frequency derived as described above (previous paragraph) to yield an age frequency, using purpose-written software developed by NIWA (B. Bull, NIWA, pers. comm.). The precision of each 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. Bootstrapping was used to calculate c.v.s, i.e., fish were resampled within each landing, landings were resampled within each stratum, and otoliths were simply randomly resampled.

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, 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).

## **OBJECTIVE 2:**

**To conduct sampling in fish processing sheds and collect otoliths and determine the length composition of the commercial catch of bluenose in BNS 2, and rubyfish in RBY 2 during the 2000/2001 fishing year. The target coefficient of variation (c.v.) for the catch at length is 30% (mean weighted c.v. across all age classes).**

Methods to carry out this objective were similar to those used to sample and determine the proportion-at-length of the same species in QMA 2 in 1998–99 (McMillan et al. 2000) and 1999–2000 (Blackwell et al. 2001). Sampling strata were developed for bluenose and rubyfish as described in Objective 1, section 9 (above)

### **9.3 Catch sampling of bluenose and rubyfish in QMA 2**

#### Bluenose

The sampling aimed to collect 32 samples and about 800 otoliths for the whole of 2000–01. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The number of samples taken was based on previous bluenose sampling (Blackwell et al. 2001).

#### Rubyfish

The sampling aimed to collect 20 samples and about 800 otoliths for the whole of 2000–01. For each landing up to 50 fish were randomly selected, measured to the nearest centimetre below fork length, sexed, and otoliths taken. The number of samples was based on previous rubyfish sampling (Blackwell et al. 2001).

### **9.4 Estimate the length structure of the bluenose and rubyfish catch**

#### **Proportion-at-length estimates**

Proportion-at-length estimates scaled to the commercial catch by stratum were produced for each species, using purpose-written 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 2000–01.

### **OBJECTIVE 3:**

**To conduct sampling in fish sheds and determine the gonad condition of gemfish taken in SKI 2 target trawl fisheries during 2000–01.**

#### **9.5 Determine gemfish gonad condition from samples taken in fish sheds from QMA 2 in 2000–01.**

Gonad condition was determined using a 5-point macroscopic scale defined in Appendix 1 and was recorded during the sampling described in Section 9.1 above. Each of the 14 samples comprised up to 50 fish that were randomly selected from the landed catch, measured to the nearest centimetre below fork length, sexed, and had their gonad stage recorded.

## **10. Results**

### **OBJECTIVE 1:**

#### **10.1 Catch sampling of alfonsino and gemfish in QMA 2**

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

##### **Sampling strata**

The sampling strata for each species and the target number of landings to be sampled for this analysis are given in Tables 1–2.

##### **Sampling of the commercial catch**

###### Alfonsino

Twenty landings, comprising a total of 196 t, were sampled between 30 October 2000 and 23 March 2001. The commercial catch landed and number of landings by stratum is given in Table 1. Little fishing occurred after February as most vessels were engaged in orange roughy or hoki fishing. A total of 997 fish were measured; 432 males and 565 females (i.e., 43% males in the sampled catch).

###### Gemfish

The 15 samples were originally allocated among four strata, with 4 samples each to T1 (Oct-Mar); T1 (Apr-May); OTH (Oct-Mar); and 3 samples to OTH (Apr-May), based on previous years sampling programmes (Blackwell et al. 2001). However, gemfish catch is seasonally variable. This fishery generally finishes in May when the fish apparently migrate north towards spawning grounds. Between June and August the vessels move on to the orange roughy or hoki fisheries. During 2000–01, the fishery was concentrated in the first two quarters (Oct-Mar), with few landings available for sampling after February 2001. Following advice from fishers, the sampling strata allocations were revised mid-season, and 14 landings, comprising a total of 127 t, were sampled between 16 October 2000 and 24 February 2001. The commercial catch landed and number of landings by stratum is given in Table 2. A total of 700 fish were measured; 234 males and 466 females (i.e., 33% males in the sampled catch).

## **10.2 Estimate the length and age structure of the alfonsino and gemfish catch**

### **Proportion-at-length estimates**

#### Alfonsino

Estimates of proportion-at-length for fish scaled to represent the total reported commercial catch from the 2000–01 fishing year, were produced (Figure 1, Appendix 2). The distributions are unimodal, but with modes about 1 cm greater than the comparable distributions from the previous fishing year (Blackwell et al. 2001). As in previous years, approximately 55% of the scaled catch were females.

#### Gemfish

Estimates of proportion-at-length for fish scaled to represent the total reported commercial catch from the 2000–01 fishing year, were produced (Figure 2, Appendix 3). Several clear modes are apparent. The catch from 2000–01 differs from that of the previous year in that there is a strong mode of fish between 45 and 53 cm. The current year's scaled catch is also strongly dominated by females (comprising 66%). This is a higher proportion than in any other year since sampling began in 1996 (proportions of females have ranged from 53 to 62%).

### **Otolith selection, ageing and proportion-at-age estimates**

#### Alfonsino

A total of 490 (210 male, 280 female) fish were aged. 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 3). The mean weighted c.v. over all age classes was 23.4%, compared to the target value of 30%. The percentage-at-age distributions from the 1998–99 to 2000–01 fishing years are plotted in Figure 3. There was an indication in 1998–99 of a relatively strong year class at age 8 (i.e., the 1991 year class), but it is not apparent in the two subsequent years. However, relatively strong year classes at ages 5 and 6 (the 1994 and 1993 year classes) in 1998–99 do progress through the three years of samples.

#### Gemfish

A total of 541 (191 male, 350 female) fish were aged. 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 4). The mean weighted c.v. over all age classes was 27.1%, lower than the target value of 30%. The percentage-at-age distributions from 1996 to 2001 (Figure 4) indicate that relatively strong year classes were spawned in 1997, 1996 and 1995 (ages 3–5 in 2001). The strong 1991 year class (currently aged 9), which has comprised a substantial proportion of the catch since sampling began, is still relatively abundant, as is the strong 1988 year class (current age 12 years), particularly in the female distribution.

## **OBJECTIVE 2:**

### **10.3 Catch sampling of bluenose and rubyfish in QMA 2**

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



## **Sampling strata**

The sampling strata for each species and the target number of landings to be sampled for this analysis are given in Tables 5–6.

## **Sampling of the commercial catch**

### Bluenose

The proposed sampling regime was generally followed, although no line-caught bluenose were available for sampling in the Oct-Dec stratum. These strata were collapsed into a single OTH stratum when the data were scaled up to the commercial catch. Two of the 32 samples collected from BNS 2 were subsequently found to have included fish from the BNS 3 stock, where vessels had fished in more than one QMA per trip. These two samples were excluded from the analysis. The remaining 30 landings from BNS 2 which were sampled between 1 October 2000 and 29 May 2001, comprised a total weight of 246 t. The commercial catch landed and number of landings by stratum are given in Table 5. 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 (1077 t) is less than the sum of QMR reported catches for BNS 2 (1136 t for 2000–01).

A total of 1486 bluenose were measured; 874 males and 612 females (i.e., 59% males in the sampled catch).

### Rubyfish

Twenty of the planned 20 landings were sampled between 16 October 2000 and 25 May 2001, comprising a total of 191 t. The 20 samples were originally allocated into four quarterly strata (Oct-Dec; Jan-Mar; Apr-Jun; Jul-Sep) among the T1 vessels. However, few samples were available after May from the T1 vessels, as most of the vessels in this fishery were engaged in orange roughy or hoki fishing between June and August. As the T1 Jul-Sep stratum, and the OTH stratum each contained less than the required minimum of 3 samples, the sample design was revised and a single Oct-Dec stratum was formed from the T1 and OTH vessels. The commercial catch data and number of landings per stratum determined for these combined strata are given in Table 6.

A total of 890 fish were measured; 406 males and 484 females (i.e., 46% males in the sampled catch).

## **10.4 Estimate the length structure of the bluenose and rubyfish catch**

### **Proportion-at-length estimates**

#### Bluenose

Estimates of the proportion-at-length in the commercial catch from the 2000–01 fishing year (Figure 5, Appendix 4) shows the catch to be dominated by small fish (46–55 cm), and males. The distributions are quite similar to those derived in the previous year (Blackwell et al. 2001). However, over the past three sampled years

there has been a trend of an increasing proportion of males in the scaled catch (from 52% in 1998–99, to 65% in 2000–01).

### Rubyfish

Estimates of proportion-at-length for fish in the commercial catch from the 2000–01 fishing year are clearly bimodal with peaks at about 37 and 42–44 cm (Figure 6, Appendix 5). The distribution from the previous fishing year was also similarly bimodal (Blackwell et al. 2001), although in that year the mode of larger fish was more dominant. Sex ratios in the scaled catch have been close to unity in both years.

## **OBJECTIVE 3:**

### **10.5 Determine gemfish gonad condition from samples taken in fish sheds from QMA 2 in 2000–01.**

The unscaled percentages by gonad stage summarise landings from October 2000 to February 2001. Few (3%) of the male gemfish (Table 7) were recovering (stage 5), and most were resting (stage 1) (37%), or developing (stage 2) (59%). Relatively few (<1%) males sampled had maturing gonads (stage 3).

Most (60%) of the females were developing (stage 2), recovering (stage 5) (13%), or resting (stage 1) (26%). Relatively few (<1%) of females sampled had maturing gonads (stage 3).

## **11. Conclusions**

### **Objective 1**

#### Alfonsino

The c.v. for the 2000–01 sampling regime (23.4%) was below the target mean weighted c.v. across all age classes of 30%. The length-frequency distribution is consistent with those from previous years. The proportion-at-age distributions from the 1998–99 to 2000–01 fishing years indicate that relatively strong year classes were spawned in 1993 and 1994.

#### Gemfish

The c.v. achieved by the 2000–01 sampling regime (27.1%) was less than the target mean weighted c.v. across all age classes of 30%. The current commercial catch is dominated by 3–5 year old fish of the 1995–1997 year classes. The 1991 year class (current age 9 years), which previously dominated the catch in both SKI 1 and SKI 2 (Horn & Hurst 1999), is still relatively abundant, and the strong 1988 year class (current age 12 years) is still apparent.

## Objective 2

### Bluenose

The 2000–01 scaled length-frequency distribution is generally consistent with the data from 1999–2000 (Blackwell et al. 2001), although the proportion of males is higher in the current year. No ageing of bluenose has been conducted (even though otoliths were collected) as the ageing method for this species is currently under review in project INS2000/02.

### Rubyfish

The 2000–01 scaled length-frequency distribution is similar to that from the 1999–2000 fishing year (Blackwell et al. 2001). Obtaining samples of this species is difficult because the fishery is small (332 t in 2000–01) and there are a limited number of landings of a useful volume. No ageing of rubyfish has been conducted (even though otoliths were collected) as the ageing method for this species is currently under review in project INS2000/02.

## Objective 3

Most gemfish gonads were in the resting or developing stages, which is consistent with previous data, and indicates that the gemfish fishery in QMA 2 is based on pre-spawning fish (Blackwell et al. 2001). After May, vessels tend to target hoki and orange roughy, and gemfish are thought to migrate to northern waters to spawn (Hurst et al. 1999).

## 12. Publications

Nil.

## 13. Data Storage

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

## 14. References

- Blackwell, R.G.; McMillan, P.J.; Horn, P.L.; Paul, L.J. (2001). Commercial catch sampling of alfonso, bluenose, gemfish and rubyfish in QMA 2 in 1999–2000. Final Research Report for Ministry of Fisheries Research Project INS1999/01. 25 p.
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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 2000–01.**

Vessel type	Stratum				Total
	T1	T1	OTH	OTH	
	Oct-Dec	Jan-Sep	Oct-Dec	Jan-Sep	
Planned landings sampled	3	5	3	4	15
Actual landings sampled	3	5	5	7	20
Landed catch (t)	457	468	233	493	1 651
Number of landings	33	69	57	216	375

**Table 2: Gemfish. Revised sampling strata, showing actual number of landings sampled, landed commercial catch, and number of landings by stratum in QMA 2 in 2000–01.**

Vessel type	Stratum				Total
	T1	OTH	T1	OTH	
	Oct-Jun	Oct-Jun	Jul-Sep	Jul-Sep	
Planned landings sampled	10	5	0	0	15
Actual landings sampled	9	5	0	0	14
Landed catch (t)	228	76	3	8	315
Number of landings	70	390	4	76	540

**Table 3: 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 2000–01 fishing year.**

Age	Male			Female		
	No.	%	c.v	No.	%	c.v
2	2 210	0.16	185.2	0	0	0
3	11 236	0.81	82.0	0	0	0
4	41 453	3.00	41.2	42 605	3.08	51.0
5	86 612	6.27	29.2	91 809	6.65	43.9
6	123 996	8.98	20.0	88 121	6.38	26.9
7	102 111	7.39	20.9	150 726	10.91	16.5
8	114 591	8.30	23.1	151 086	10.94	16.3
9	56 411	4.08	28.0	78 299	5.67	25.6
10	32 311	2.34	30.7	44 797	3.24	31.8
11	23 047	1.67	43.1	25 937	1.88	40.5
12	12 384	0.90	55.9	41 838	3.03	27.3
13	8 008	0.58	68.9	22 041	1.60	38.3
14	4 580	0.33	80.3	13 473	0.98	47.6
15	0	0	0	9 268	0.67	64.5
16	0	0	0	1 361	0.10	126.3
17	0	0	0	0	0	0
18	0	0	0	1 012	0.07	160.8
Measured	432			565		
Aged	210			280		

**Table 4: 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 2000–01 fishing year.**

Age	Male			Female		
	No.	%	c.v	No.	%	c.v
2	73	0.07	177.7	408	0.42	110.0
3	6 980	7.11	35.8	16 948	17.25	39.4
4	7 213	7.34	29.8	10 498	10.69	27.4
5	6 501	6.62	26.1	13 234	13.47	20.5
6	2 525	2.57	36.2	4 462	4.54	28.2
7	702	0.71	67.0	1 065	1.08	50.3
8	1 617	1.65	49.2	2 753	2.80	30.8
9	2 733	2.78	44.6	4 169	4.24	22.2
10	680	0.69	66.4	1 275	1.30	41.4
11	850	0.87	62.9	2 501	2.55	31.8
12	1 139	1.16	55.2	3 033	3.09	26.0
13	504	0.51	96.5	1 085	1.10	41.4
14	636	0.65	80.0	1 482	1.51	37.6
15	194	0.20	143.7	743	0.76	55.3
16	461	0.47	69.6	921	0.94	51.9
17	126	0.13	115.3	216	0.22	101.8
18	191	0.19	165.1	295	0.30	90.3
19	0	0.00	0	0	0.00	0
20	22	0.02	226.5	0	0.00	0
Measured	234			466		
Aged	191			350		

**Table 5: Bluenose. Sampling strata, planned and actual number of landings sampled, landed commercial catch, and number of landings in QMA 2 during 2000–01. 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 2000–01). The two OTH strata were combined for scaling to commercial catch.**

Vessel type	Stratum						Total
	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	7	3	7	9	0	4	30
Landed catch (t)	174	207	58	164	118	356	1 077
Number of landings	39	77	43	182	77	220	638

**Table 6: Rubyfish. Revised sampling strata, showing actual number of landings sampled, landed commercial catch, and number of landings by stratum in QMA 2 in 2000–01 (where ALL indicates all vessels that landed during the Oct-Dec quarter)**

Vessel type	Stratum					Total
	ALL	T1	T1	T1	OTH	
Months	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Jan-Sep	
Planned landings sampled	12	3	2	0	3	20
Actual landings sampled	9	8	3	0	0	20
Landed catch (t)	203	42	21	20	46	332
Number of landings	53	17	12	5	97	127

**Table 7: Gemfish gonad condition in SKI 2, Oct 2000–Mar 2001. Numbers represent fish sampled. Unscaled percentages by gonad stage and by sex.**

Stratum T1	Males		Females	
	No.	%	No.	%
Gonad stage				
1	32	19	14	5
2	133	80	265	93
3	1	<1	1	<1
4	0	0	0	0
5	0	0	4	1
Total	166	100	284	100

Stratum OTH	Males		Females	
	No.	%	No.	%
Gonad stage				
1	56	82	108	59
2	5	7	15	8
3	0	0	0	0
4	0	0	0	0
5	7	10	59	32
Total	68	100	250	100

All strata	Males		Females	
	No.	%	No.	%
Gonad stage				
1	88	38	122	26
2	138	59	280	60
3	1	<1	1	<1
4	0	0	0	0
5	7	3	63	13
Total	234	100	466	100

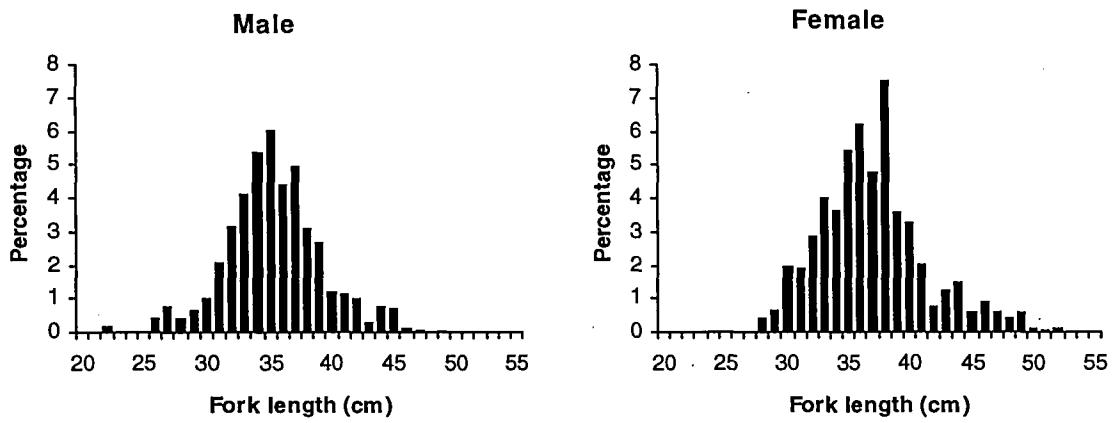


Figure 1: Alfonsino length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in BYX 2 from the 2000–01 fishing year.

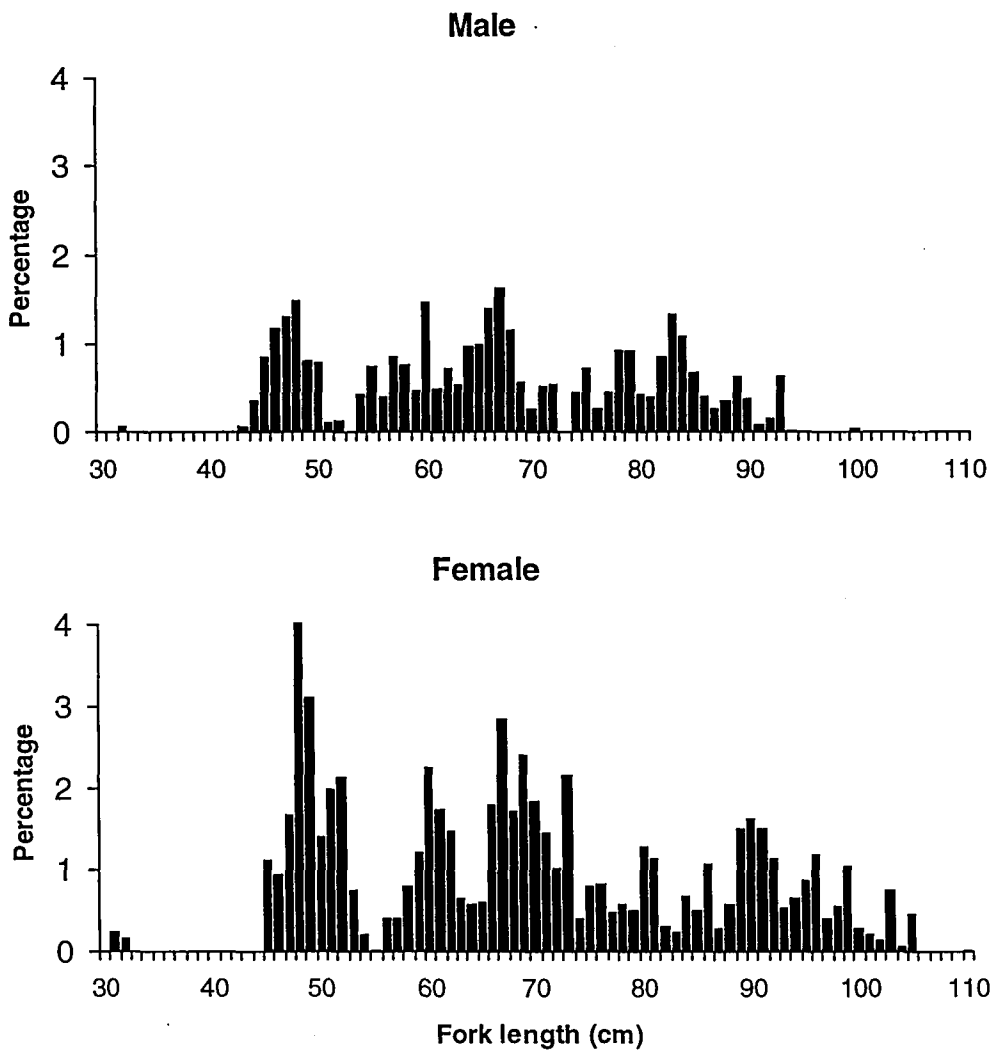


Figure 2: Gemfish length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in SKI 2 from the 2000–01 fishing year.

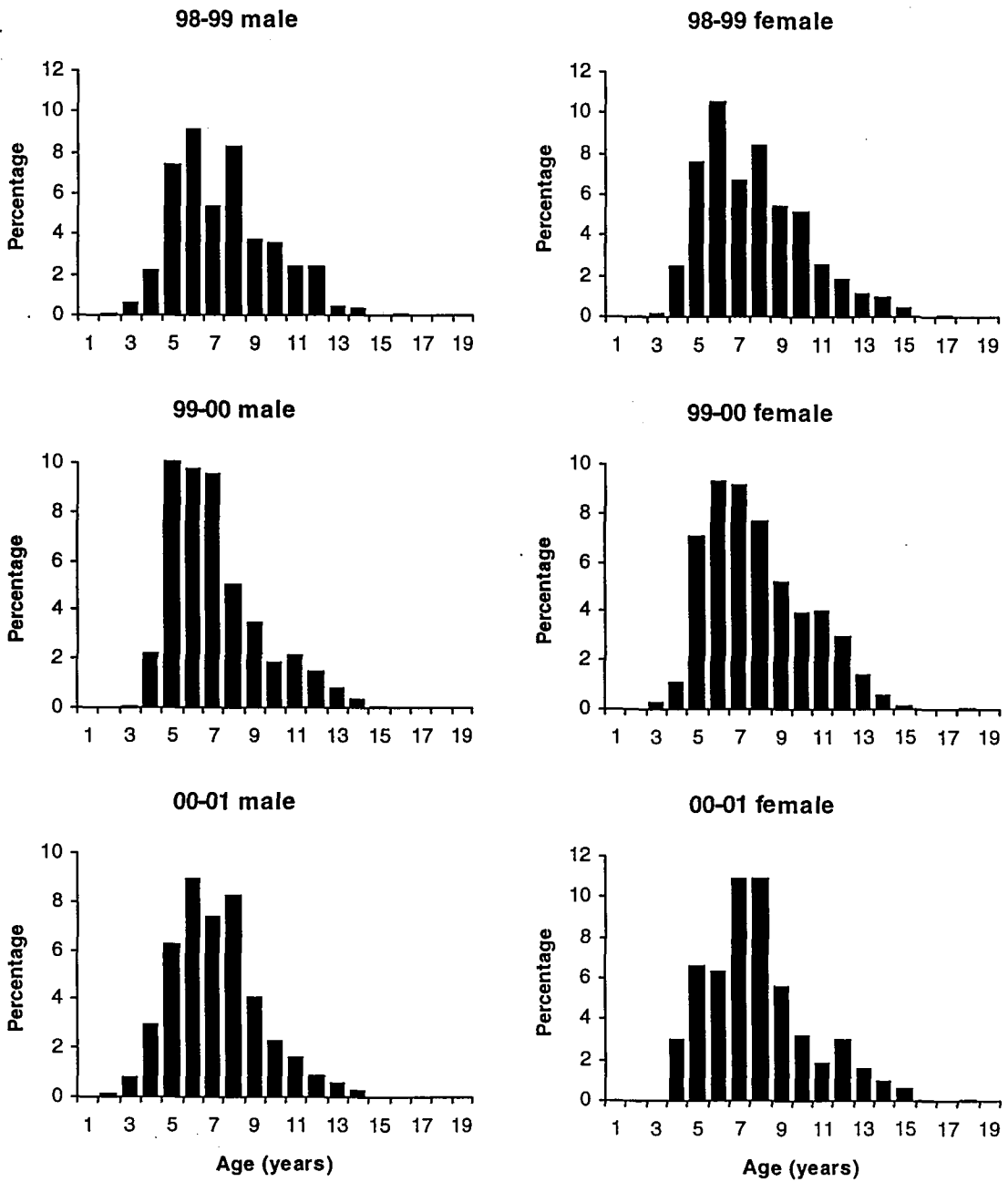
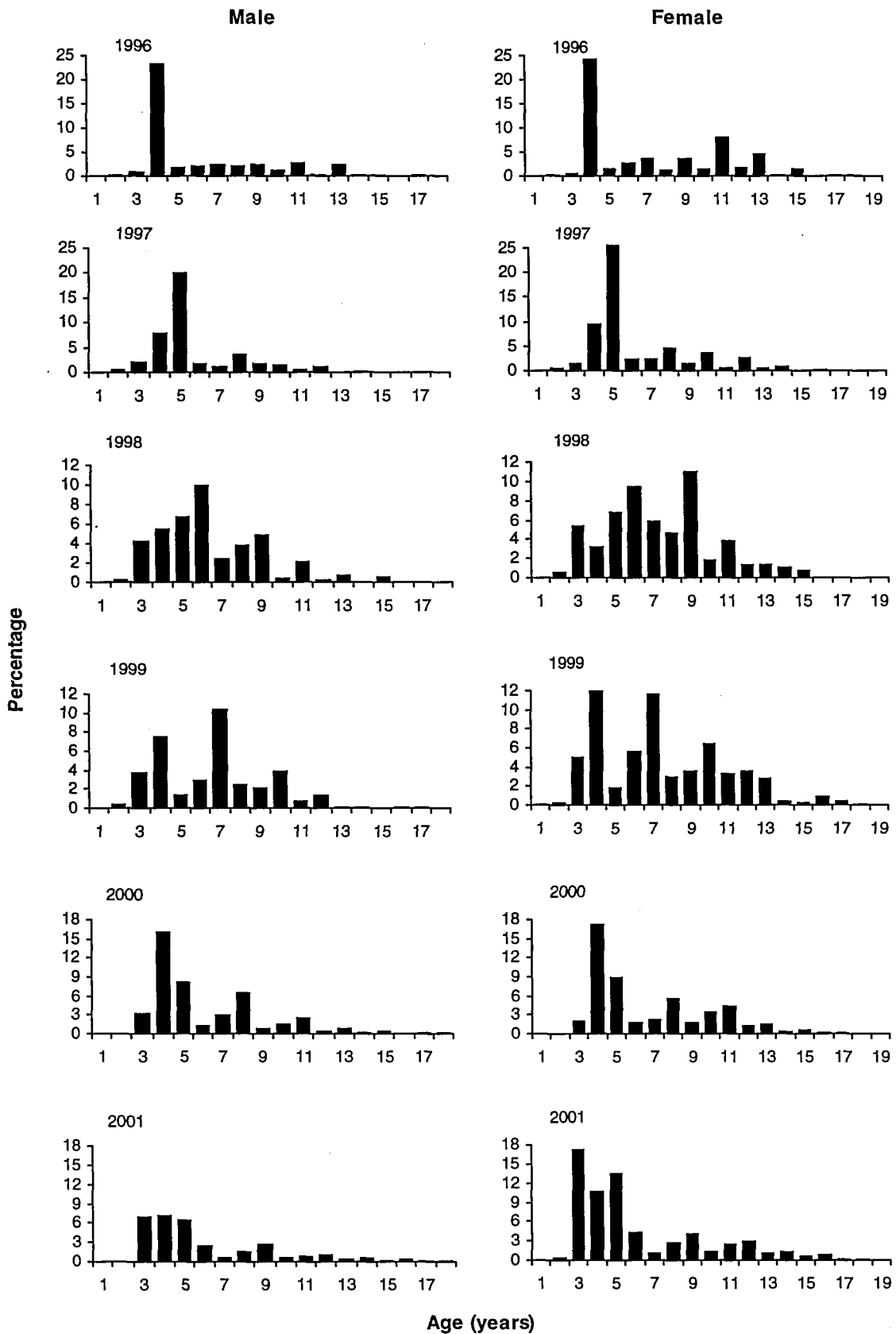


Figure 3: Alfonsino age frequency distributions by sex. Scaled to the total commercial; catch from samples taken in BYX 2, from the 1998-99, 1999-00, and 2000-01 fishing years.





**Figure 4: Gemfish age frequency distributions by sex. Scaled to the total commercial catch from samples taken in SKI 2 from 1995-96 to 2000-01. [Note: "1996" refers to the 1995-96 fishing year, etc.]**

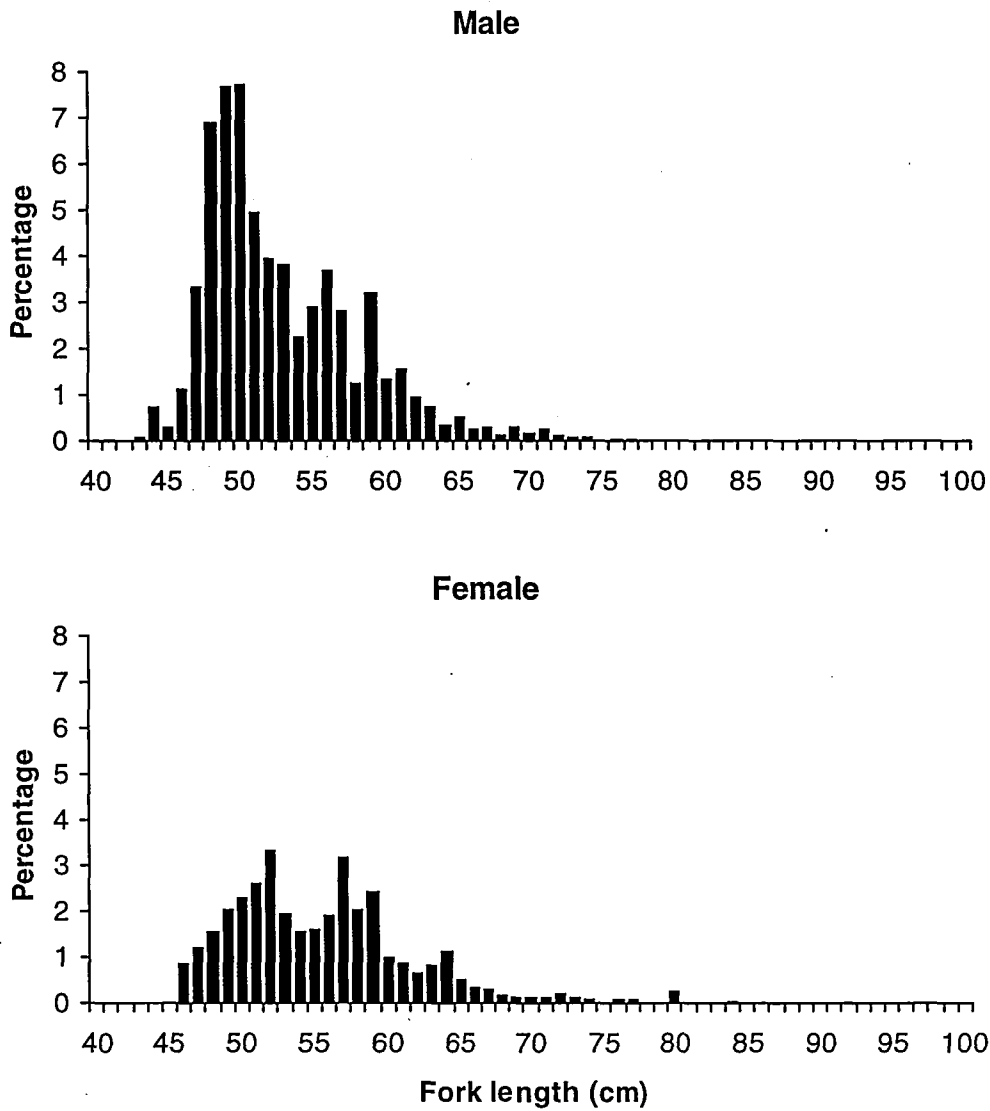
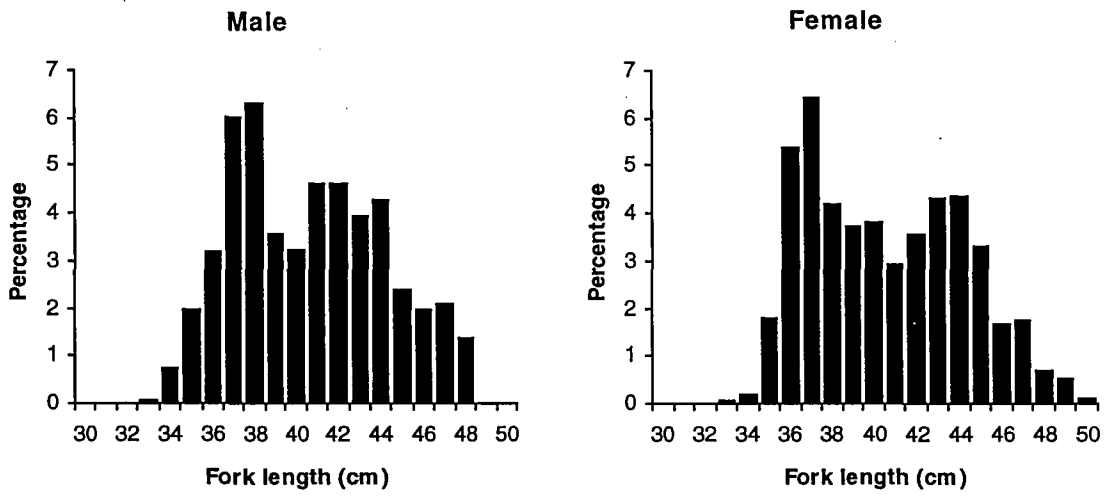


Figure 5: Bluenose length frequency distributions (bars) and c.v. (lines) by sex. Scaled to the total commercial catch from samples taken in BNS 2 from the 1999–2000 fishing year.



**Figure 6: Rubyfish length-frequency distributions by sex. Scaled to the total commercial catch from samples taken in RBY 2 from the 2000–01 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 2000-01:**

Length	Male		Female	
	No.	c.v.	No.	c.v.
22	2 210	140	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	6 044	95.5	0	0
27	11 038	76.5	0	0
28	5 389	100.4	6 032	88.7
29	9 301	76.2	8 671	76.1
30	14 205	67.7	27 014	40.5
31	28 579	42.4	26 402	59.6
32	44 047	42.0	39 643	57.0
33	57 187	27.0	55 257	46.1
34	74 095	21.7	50 214	27.2
35	83 204	25.4	74 707	31.0
36	60 733	22.0	85 468	23.9
37	68 753	32.1	65 942	21.1
38	43 238	28.4	103 961	22.3
39	37 175	39.6	49 432	27.6
40	16 594	49.4	45 646	37.6
41	15 469	57.8	27 887	56.7
42	14 000	60.8	11 095	59.4
43	4 190	73.2	17 181	40.5
44	10 447	59.9	20 700	40.3
45	10 120	75.3	8 190	61.4
46	1 814	132.5	12 309	60.8
47	1 117	113.5	8 056	61.1
48	0	0	5 654	67.7
49	0	0	8 166	63.2
50	0	0	1 814	127.1
51	0	0	907	136.3
52	0	0	2 024	110.6

**Appendix 3: Gemfish. Estimated numbers-at-length (No.) with coefficients of variation (c.v., %), by sex, from the SKI 2 commercial fishery in the 2000–01 fishing year.**

Length	Male		Female	
	No.	c.v.	No.	c.v.
31	0	0	241	104.9
32	73	139.8	168	143.7
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	58	155.2	0	0
44	347	134.1	0	0
45	843	82.4	1 110	81.2
46	1 153	79.4	928	80
47	1 287	66.5	1 644	99.8
48	1 455	58.7	3 957	55
49	809	117.6	3 066	63.5
50	777	119	1 398	75.2
51	113	91	1 960	62.9
52	138	120.9	2 112	61.5
53	0	0	742	87
54	429	101.8	214	141.5
55	733	114.8	32	146.3
56	405	112.7	405	96.8
57	847	75.7	405	115.5
58	753	77.3	786	74.5
59	476	94.3	1 200	58
60	1 441	76.7	2 232	52.5
61	492	72.8	1 726	59
62	717	71.8	1 470	62.9
63	527	83.5	642	77.1
64	958	90.8	574	66.8
65	986	70.1	595	87.6
66	1 368	48.8	1 777	55.7
67	1 608	53.9	2 813	50.4
68	1 125	54.9	1 702	56.3
69	544	80.2	2 374	39.6
70	277	103.5	1 833	40.1
71	518	60.2	1 435	47
72	532	81.4	1 017	63.4
73	0	0	2 142	40.6
74	441	78.9	417	65.7
75	717	73.9	783	77.1
76	269	69.4	816	72.2
77	435	82.7	486	66.8
78	917	71	570	89.1
79	910	73.6	493	61.1
80	422	70.3	1 258	50
81	397	78.5	1 123	57.3
82	834	90.5	301	64.2
83	1 302	57.6	235	68.4
84	1 071	67.8	668	73.7
85	672	61.8	514	83.4

Appendix 3: – *continued*

Length	Male		Female	
	No.	c.v.	No.	c.v.
86	403	99.1	1 055	61.9
87	260	77.4	281	73.2
88	361	93	566	47.9
89	632	53	1 489	57
90	382	106.5	1 603	38.5
91	92	142.1	1 497	48.1
92	160	98.4	1 122	52.1
93	621	88.5	530	58.9
94	22	166.3	640	53.1
95	0	0	871	57.9
96	0	0	1 180	55.1
97	0	0	399	81.6
98	0	0	550	53.4
99	0	0	1 030	41
100	39	143.6	276	73.9
101	0	0	215	75.9
102	0	0	147	92.9
103	0	0	740	67.9
104	0	0	60	110
105	0	0	454	76.8
106	0	0	0	0
107	0	0	0	0
108	0	0	0	0
109	0	0	0	0
110	0	0	22	154.1

**Appendix 4: Bluenose. Estimated numbers-at-length (No.) from the commercial catch, with coefficients of variation (c.v., %), by sex from the BNS 2 commercial fishery in the 2000–01 fishing year.**

Length	Male		Female	
	No.	c.v.	No.	c.v.
41	95	140.3	0	0
42	0	0	0	0
43	247	127.1	0	0
44	2 593	111	0	0
45	1 102	63.4	0	0
46	3 879	59.6	3 004	85.1
47	11 495	36.9	4 178	61
48	23 742	26.4	5 379	49.6
49	26 482	26.5	6 978	44.7
50	26 642	23.4	7 916	48.3
51	17 070	26.3	8 948	41.1
52	13 675	27	11 456	45
53	13 097	36.9	6 769	38.6
54	7 716	37	5 337	32.9
55	9 973	43	5 577	35.6
56	12 647	30	6 610	32.2
57	9 730	34.9	10 919	36.3
58	4 321	45.8	6 990	40.7
59	11 007	34.5	8 353	44
60	4 631	29.1	3 400	40.7
61	5 348	48.9	2 942	32.5
62	3 259	41.5	2 311	42.2
63	2 594	55.1	2 775	46.2
64	1 221	50.9	3 927	69.3
65	1 770	35.1	1 850	51.4
66	953	48	1 172	43.6
67	1 062	58.2	1 095	46
68	407	63.3	570	69.5
69	985	66.2	398	57.7
70	557	73.2	378	96.3
71	872	65.7	513	71.2
72	431	78.5	789	70.5
73	373	98.3	443	79.8
74	372	67.4	324	99.7
75	0	0	0	0
76	98	88.6	324	106.4
77	146	96.9	231	84.9
78	38	150.3	68	103.7
79	0	0	51	149.8
80	34	133.6	892	90
81	0	0	48	134.5
82	0	0	66	105.2
83	0	0	48	132.7
84	0	0	95	150.5
85	0	0	51	132
86	0	0	48	130.6
87	0	0	0	0
88	0	0	17	132
89	0	0	0	0
90	0	0	48	133.3

**Appendix 4: – continued**

Length	Male		Female	
	No.	c.v.	No.	c.v.
91	0	0	0	0
92	0	0	0	0
93	0	0	17	140.7
94	0	0	0	0
95	0	0	0	0
96	0	0	0	0
97	0	0	48	136.5



**Appendix 5: Rubyfish. Estimated numbers-at-length (No.) with coefficients of variation (c.v., %), by sex, from the RBY 2 commercial fishery in the 2000–01 fishing year.**

Length	Male		Female	
	No.	c.v.	No.	c.v.
24	2	174.3	0	0
25	0	0	0	0
26	0	0	0	0
27	2	150.4	2	158
28	3	142.7	3	152.9
29	3	159.3	7	141.8
30	5	140.4	5	138.4
31	24	163.3	10	147.9
32	9	133	28	155.3
33	195	162.2	193	103
34	1 915	97	542	63.3
35	4 954	54.3	4 537	69.4
36	7 984	36.9	13 439	33
37	14 936	41	16 054	33.1
38	15 695	32.2	10 481	37.8
39	8 916	45.6	9 359	45.1
40	8 096	48.8	9 504	33.1
41	11 526	29.5	7 341	31.1
42	11 574	32.4	8 925	32
43	9 856	41.4	10 773	33.2
44	10 688	33	10 904	28.1
45	5 995	57.8	8 254	38
46	4 934	50.1	4 208	55.5
47	5 261	54.8	4 382	54.8
48	3 479	89	1 754	72.3
49	0	0	1 363	102.9
50	0	0	321	125.5
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	22	149.6