Science Policy

NIWA

Taihoro Nukurangi

Catch sampling for length/sex and age of alfonsino, bluenose, gemfish, and rubyfish in QMA 2 during the 1998–99 fishing year

P. J. McMillan, R. G. Blackwell, and L. J. Paul

Final Research Report for
Ministry of Fisheries Research Project INS9801
Objectives 1 & 2

National Institute of Water and Atmospheric Research

May 2000

Final Research Report

Report Title	Catch sampling for length/sex and age of alfonsino, bluenose, gemfish, and rubyfish in QMA 2 during the 1998–99 fishing year
Authors	P. J. McMillan, R. G. Blackwell and L. J. Paul
1. Date:	31 May 2000
2. Contractor:	National Institute of Water and Atmospheric Research Limited (NIWA)
3. Project Title:	Commercial catch sampling of alfonsino, bluenose, gemfish and rubyfish in QMA 2, and stock assessment of alfonsino and rubyfish
4. Project Code:	INS9801
5. Project Leader:	P. J. McMillan
6. Duration of Project:	20 months
Start date:	1 October 1998
Completion date:	31 May 2000

7. EXECUTIVE SUMMARY

This report describes the sampling programme carried out on commercial landings of alfonsino, bluenose, gemfish, and rubyfish in QMA 2 during the 1998–99 fishing year, Objectives 1 (alfonsino and rubyfish sampling and age) and Objective 2 (bluenose and rubyfish sampling) of Project INS9801. Objectives 3 and 4 of Project INS9801 are covered in separate NZ Fisheries Assessment Reports.

Objective 1

The target numbers of catches sampled were achieved for alfonsino with 21 completed (15 target). For rubyfish only 19 of the target 32 samples were obtained because of the small number of landings made and relatively small size of most landings. Target numbers of otoliths sampled were achieved for alfonsino 867 (target 500), and rubyfish 815 (target 800). Age estimates and catch-at-age estimates were made for alfonsino and rubyfish. The mean weighted *c.v.* across all age classes achieved for alfonsino of 19.4% (no finite population correction) was less than the target *c.v.* of 20%. This target *c.v.* was not achieved for rubyfish, 38 % (no finite population correction).

Objective 2

The target numbers of catches sampled were achieved for bluenose 32 (target 32) and for gemfish 16 (target 15). Target numbers of otoliths sampled were achieved for bluenose 1063 (target 800) and gemfish 721 (500).

8. OBJECTIVES

The objectives for Project INS9801 are:

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

2. To carry out a stock assessment of alfonsino (*Beryx splendens*) and rubyfish (*Plagiogeneion rubiginosum*) in QMA 2.

Specific Objectives for 1998/99 are:

1. To conduct the sampling and determine the length and age structure of the commercial catch of alfonsino in BYX 2 and rubyfish in QMA 2 during the 1998/99 fishing year from samples collected in fish sheds. The target coefficient of variation (*c.v.*) for the catch at age is 20 % (mean weighted *c.v.* across all age classes).

2. To measure lengths and collect otoliths from the commercial catch of bluenose in BNS 2 and gemfish in SKI 2 during the 1998/99 fishing year. The target coefficient of variation (*c.v.*) for the catch at age (to be derived in project SKI9801 and BNS9801) is 20 % (mean weighted *c.v.* across all age classes).

3. To develop standardised CPUE indices for the midwater trawl fishery for alfonsino in BYX 2 and rubyfish in QMA 2.

4. To describe the interaction between the fisheries for alfonsino, bluenose, gemfish and rubyfish.

9. METHODS

The key activities for Objective 1 (alfonsino and rubyfish) were: developing sampling strata; sampling the commercial catch; entry of validated data on the *market* database; otolith preparation, ageing and entry of data on the *age* database; estimating scaled length frequency and catch-at-age distributions.

For Objective 2 (bluenose and gemfish), key activities were: developing sampling strata; sampling the commercial catch; entry of validated data on the *market* database.

9.1 Developing sampling strata for alfonsino, bluenose, gemfish and rubyfish

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 through the year in relation to the expected seasonal distribution of the commercial catch, based on the most recently available complete catch data (June 1995 to May 1998).

A set of ten high catch trawlers (T1) that together accounted for around two thirds of this catch data, were identified for alfonsino, rubyfish and gemfish. All other vessels fishing using all other methods, were collectively grouped as a single stratum (OTH). For bluenose, approximately 30% of the total landings in BNS 2 during June 1995 to May 1998 were taken by target line fishing (Blackwell 1999). Separate bluenose method 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. The remaining vessels catching bluenose by non-trawl (e.g. line fishing) methods were included in stratum OTH.

From the catch data, October to December was identified as the peak quarter for each of these fisheries. 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 to be sampled was made proportional to the square of the anticipated catch in each stratum. This approximately minimises the variance of the estimated proportions at age (D. Gilbert, NIWA, pers. com. 1999). A minimum of three landings per stratum was set so that reasonable 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. The strata for each species and the target number of landings to be sampled that resulted from this analysis are given in Tables 1, 2, 4 and 5.

9.2 Sampling of the commercial catch of alfonsino and rubyfish

Alfonsino
The sampling aimed to collect 15 samples and about 500 otoliths. For each landing about 200 fish were randomly selected, and measured to the nearest centimetre below fork length, and sexed. Otoliths were collected from up to the first 50 fish in each landing.

Rubyfish
The sampling aimed to collect 32 samples and about 800 otoliths. For each landing about 200 fish were randomly selected, and measured to the nearest centimetre below fork length, and sexed. Otoliths were collected from up to the first 50 fish in each landing.

9.3 Estimating age and catch-at-age for alfonsino and rubyfish

Age-length keys for each species were constructed as follows: the aged otolith samples were combined and for each length class the proportion of fish at each age was calculated (for each length class the proportions of fish at each age sums to one). The proportions at each age for a given length were then multiplied by the numbers of fish at each length in the scaled length frequency (samples were scaled by size of landing and stratum catch) to give an age-length distribution for the commercial catch.

Alfonsino

867 otoliths were collected from 21 landings. Estimates of age were determined using the methods of Massey & Horn (1990), i.e., otoliths were read whole against a dark background in paraffin oil under a stereomicroscope (x10) using reflected light by one reader. Readings were loaded onto the *age* database and catch-at-age estimates were made. All the samples were collected in the period October 1998 to April 1999.

Rubyfish

815 otoliths were collected from 19 landings. Estimates of age were determined using the methods of Paul *et al.* (2000), i.e., otoliths were prepared as thin transverse sections on microscope slides and read under a compound microscope (x100) using transmitted light. 240 otoliths were read by two readers and the remaining otoliths were aged by one reader. Under current interpretation, the species is considered to be long-lived.

9.4 Sampling of the commercial catch of bluenose and gemfish

Bluenose

The sampling aimed to collect 32 samples and about 800 otoliths. For each landing about 200 fish were randomly selected and measured to the nearest centimetre below fork length and sexed. Otoliths were collected randomly from up to about 50 fish in each landing.

Gemfish

The sampling aimed to collect 15 samples and about 500 otoliths. For each landing about 200 fish were randomly selected and measured to the nearest centimetre below fork length and sexed. Otoliths were collected randomly from up to about 50 fish in each landing.

10. RESULTS

10.1 Sampling of the commercial catch of alfonsino and rubyfish

Alfonsino

The numbers of samples taken are given in Table 1. The proposed sampling regime was followed except for T1 vessels in October to December. Industry suggestions that most of the fish would be caught before January led to over sampling in October to December. Little fishing occurred between June and August, as most vessels were engaged in orange roughy or hoki fishing.

Table 1: Sampling strata, planned and actual number of landings sampled for alfonsino in QMA 2 in 1998–99

	Stratum			Total
Vessel type	T1	T1	OTH	
Months	Oct–Dec	Jan–Sep	Oct–Sep	
Planned landings sampled	4	5	6	15
Actual landings sampled	10	5	6	21

Rubyfish

The numbers of samples taken are given in Table 2. Samples proved hard to obtain 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 one 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 sell the fish quickly. Consequently there were several landings where samples had been sold before samplers arrived. Attempts to buy samples met with some success. Between June and August most vessels were engaged in orange roughy or hoki fishing.

Table 2: Sampling strata, planned and actual number of landings sampled for rubyfish in QMA 2 in 1998–99

	Stratum				Total
Vessel type	T1	T1	OTH	OTH	
Months	Oct–Dec	Jan–Sep	Oct–Dec	Jan–Sep	
Planned landings sampled	4	20	3	5	32
Actual landings sampled	3	16	0	0	19

10.2 Estimating age and catch-at-age for alfonsino and rubyfish

Alfonsino

The scaled length frequency distribution is in Appendix 1 and the catch-at-age estimates are given in Table 3. The mean weighted *c.v.* across all age classes was 19.4%. The "finite population correction" of Blackwell *et al.* (1999) was not applied. This correction would be expected to lower the value slightly. Scaled proportion-at-age data are presented in Figure 1.

Table 3: Estimated commercial catch-at-age for alfonsino samples collected from QMA 2 in 1998–99. Coefficient of variation (*c.v.*) values are absolute

Age (years)	Males		Females	
	Number	*c.v.*	Number	*c.v.*
1	1	113.61	0	0
2	148	1.42	5	49.89
3	1 125	0.68	305	1.23
4	4 221	0.32	4 779	0.30
5	14 132	0.15	14 440	0.16
6	17 331	0.14	20 127	0.13
7	10 271	0.18	12 861	0.16
8	15 764	0.14	16 043	0.14
9	7 098	0.22	10 391	0.17
10	6 810	0.23	9 836	0.17
11	4 648	0.27	4 888	0.26
12	4 651	0.28	3 589	0.29
13	849	0.60	2 296	0.35
14	627	0.67	1 822	0.38
15	18	5.07	794	0.53
16	196	1.22	0	0
17	0	0	153	1.19
18	0	0	18	2.31

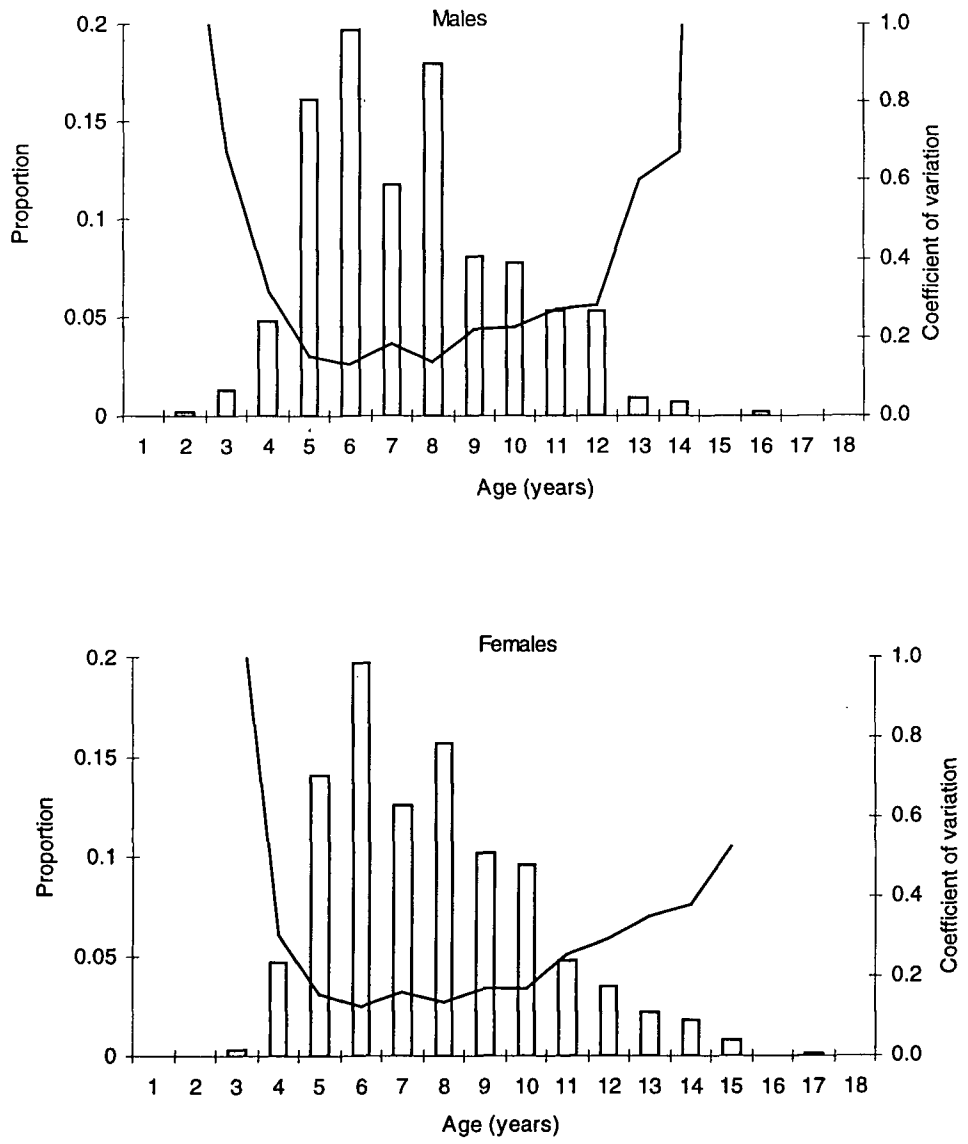

Figure 1: Proportion at age estimates (bars) and coefficient of variation (line) for alfonsino (BYX 2) commercial catch landings, by sex from October 1998 to April 1999.

Rubyfish

The scaled length frequency distribution is in Appendix 2, the catch-at-age estimates for rubyfish are given in Table 4, and the proportion-at-age data are given in Figure 2. The uncorrected mean weighted *c.v.* across all age classes was 38.0%. A "finite population correction" (Blackwell *et al.* 1999) was not applied.

Table 4: Estimated catch-at-age for rubyfish samples collected from QMA 2 in 1998–99. Coefficient of variation (*c.v.*) values are absolute

Age (years)	Males		Females	
	Number	*c.v.*	Number	*c.v.*
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	41	1.59	162	0.94
6	393	0.62	162	1.08
7	841	0.43	733	0.38
8	1 028	0.37	743	0.37
9	1 765	0.30	1 294	0.27
10	2 866	0.24	2 080	0.22
11	6 922	0.15	5 541	0.14
12	1 769	0.30	1 171	0.28
13	2 773	0.24	1 275	0.30
14	2 011	0.28	889	0.37
15	1 061	0.38	369	0.52
16	1 209	0.36	497	0.42
17	1 115	0.37	583	0.41
18	512	0.52	947	0.32
19	1 724	0.29	1 065	0.30
20	1 143	0.37	1 065	0.31
21	1 218	0.34	759	0.36
22	974	0.38	776	0.36
23	1 143	0.36	921	0.32
24	1 095	0.36	437	0.45
25	922	0.38	551	0.41
26	306	0.72	575	0.41
27	555	0.51	792	0.36
28	122	1.01	386	0.50
29	610	0.45	217	0.71
30	1 079	0.36	421	0.50
31	965	0.39	469	0.46
32	758	0.43	417	0.52
33	528	0.52	586	0.41
34	1 105	0.38	837	0.34
35	666	0.43	1 352	0.27
36	789	0.40	603	0.41
37	714	0.43	489	0.45
38	173	1.01	97	1.01
39	291	0.61	715	0.38
40	660	0.47	414	0.49
41	304	0.61	558	0.42
42	378	0.53	293	0.58
43	295	0.53	688	0.38
44	833	0.43	106	1.00
45	881	0.37	355	0.54
46	648	0.45	542	0.42
47	499	0.53	291	0.59
48	221	0.61	97	1.01
49	363	0.62	235	0.63

Table 4: – ***continued***

50	215	0.75	297	0.58
51	148	0.74	0	0
52	432	0.48	91	1.00
53	173	1.01	191	0.71
54	370	0.59	154	0.72
55	545	0.45	587	0.39
56	340	0.80	305	0.58
57	465	0.54	197	0.71
58	786	0.41	387	0.51
59	189	0.75	258	0.58
60	373	0.56	210	0.60
61	338	0.55	0	0
62	0	0	38	1.31
63	414	0.61	285	0.60
64	209	0.91	258	0.60
65	0	0	196	0.64
66	0	0	219	0.62
67	165	0.78	84	1.09
68	0	0	77	1.03
69	0	0	42	1.40
70	301	0.72	0	0
71	0	0	0	0
72	0	0	106	1.00
73	0	0	77	1.03
74	169	0.76	0	0
75	74	1.04	0	0
76	265	0.77	0	0
77	0	0	17	1.84
78	0	0	133	0.82
79	1	81.26	0	0
80	0	0	0	0
81	0	0	0	0
82	0	0	0	0
83	9	11.93	42	1.40
84	173	1.01	0	0
85	0	0	17	1.84
86	0	0	0	0
87	0	0	0	0
88	0	0	0	0
89	92	1.13	0	0
90	0	0	0	0
91	0	0	0	0
92	0	0	0	0
93	0	0	0	0
94	0	0	0	0
95	0	0	3	30.32
96	0	0	17	1.84
97	0	0	0	0
98	0	0	0	0
99	0	0	0	0
100	0	0	6	6.30

The scaled proportion at age data (Figure 2), show that the rubyfish fishery appears to be based on a wide spread of age classes. Rubyfish appear to begin to recruit into the fishery at age 5. Although a strong recruitment is suggested for the 11 year old fish, the preliminary nature of the age estimates for rubyfish mean that this could also be an artifact of aging error.

The population appears to be numerically dominated by fish aged between 5 and 25 years old, although 10% of the population appear to be aged between 26 and 40 years. A further 10% of the population appear to be aged greater than 40 years, with a maximum observed age of 89 for males and 100 for females. The clumped nature of the age classes suggests some recruitment variability, but this too may be influenced by aging error.

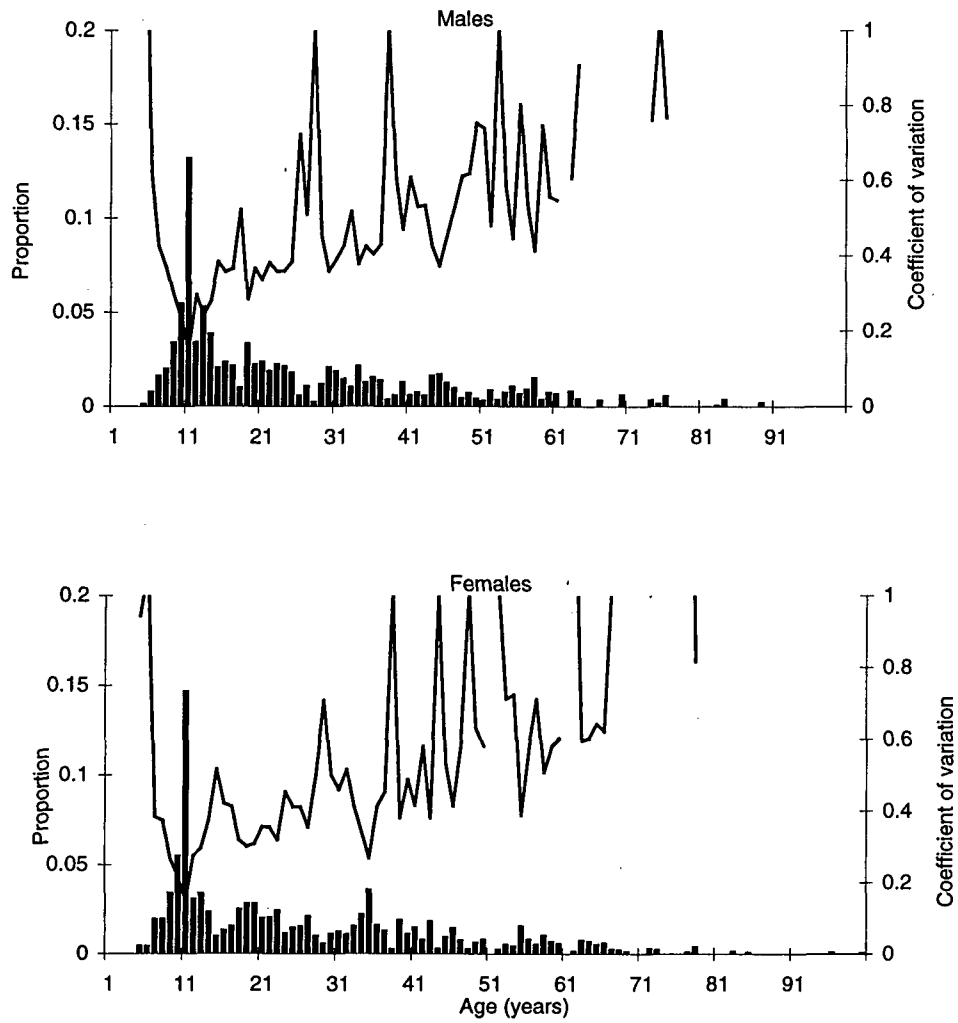

Figure 2: Proportion at age estimates (bars) and coefficient of variation (line) for rubyfish (RBY 2) from commercial catch landings, by sex from October 1998 to May 1999.

10.3 Catch sampling of bluenose and gemfish in QMA 2

Bluenose

The numbers of samples taken are in Table 5. 1063 otoliths were collected. The proposed sampling regime was generally followed although industry suggestions that most of the fish would be caught early in the season resulted in sampling being completed by June. Between June and August most vessels were engaged in orange roughy or hoki fishing.

Table 5: Sampling strata, planned, and actual number of landings for bluenose in QMA 2 in 1998–99

	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	7	9	3	4	4	5	32
Actual landings sampled	8	6	3	6	4	5	32

Gemfish

The numbers of samples taken are in Table 6. 721 otoliths were collected. The proposed sampling regime was generally followed although only two landings in the OTH stratum were obtained. 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.

Table 6: Sampling strata, planned, and actual number of landings for gemfish in QMA 2 in 1998–99

	Stratum			Total
Vessel type	T1	T1	OTH	
Months	Oct–Dec	Jan–May	Jan–May	
Planned landings sampled	3	8	4	15
Actual landings sampled	3	11	2	16

11. CONCLUSIONS

The specific objectives and targets including numbers of landings sampled and numbers of otoliths collected were achieved for alfonsino, bluenose and gemfish. The target number of landings for rubyfish was not achieved because of the relatively small number of landings available to be sampled in 1998–99. Industry comments (C. Robinson, Pacific Trawling Ltd, pers. comm.) indicated that the rubyfish fishery is tailored to market demands. The market in recent years has been relatively poor and target fishing has thus been at a lower level than in previous years. Only 180 t of rubyfish catch was reported (QMS) for the year and landings sampled comprised 120 t of the reported catch. The commercial TACC for QMA 2 was 433 t. The target number of otoliths for rubyfish was taken by collecting about 50 otoliths per sample.

For alfonsino the length frequency from the commercial catch data is consistent with those reported by Massey & Horn (1990) with most fish caught being in the range 28 to 43 cm FL. The age distribution is also consistent with that reported by Massey &

Horn (1990) who reported ages of 3 to 16 years for fish from QMA 2 compared to 1 to 18 years for this study.

For rubyfish, the length frequency data are consistent with those from previous research trawl surveys with most fish caught being in the range 30 to 50 cm FL. Fish smaller than 30 cm SL were rarely caught in commercial catches and were present in numbers in only one of the research trawl surveys reported by Paul (1997), i.e., a survey of the central west coast of New Zealand (COR9001). Horn (1991) reported catches of rubyfish on the 1990 survey from the "edge of the continental shelf". Information from a skipper (M. Jensen, Pacific Trawling Ltd, pers. comm.) suggests that fish less than about 30 cm SL are not found with the larger fish and tend to school off the bottom at specific sites but that the species is usually associated with seamounts with about 200 m being the favoured habitat depth. No previous age estimates are available for this species. The catch-at-age data indicate that the fish are relatively long lived. The data suggest some recruitment variability but the preliminary nature of the age estimates for rubyfish, and the lack of a time series of available age data mean that firm conclusions cannot be reached.

12. Publications

Nil.

13. Data storage

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

14. References

Blackwell, R. G. 1999: Catch sampling for size and age of bluenose (*Hyperoglyphe antarctica*) in BNS 2 during summer 1997–98. N.Z. Fisheries Assessment Research Document 99/46. 15 p.

Blackwell, R.G., Gilbert, D.J., & Davies, N.M. 1999: Age composition of commercial snapper landings in SNA 2 and Tasman Bay/Golden Bay, 1997–98. N.Z. Fisheries Assessment Research Document 99/17. 23 p.

Horn, P.L. 1991: Trawl survey for jack mackerels (*Trachurus* spp.) off the central west coast, New Zealand, February-March 1990. *N.Z. Technical Report No. 28.* 39 p.

Massey, B.R. & Horn, P.L. 1989: 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.

Paul. L.J. 1997: A summary of biology and commercial landings, and a stock assessment of rubyfish, *Plagiogeneion rubiginosum* (Hutton, 1875) (Percoidei: Emmelichthyidae). N.Z. Fisheries Research Document 97/27. 22 p.

Paul, L.J., Horn, P.L., & Francis, M.P. (in press, 2000): Development of an ageing methodology, and first estimates of growth parameters and natural mortality for rubyfish (*Plagiogeneion rubiginosum*) off the east coast of the North Island (QMA 2). *N.Z. Fisheries Assessment Report.*

Appendix 1: Scaled numbers of male and female alfonsino, and *c.v.* by fish length (FL, cm), from the commercial fishery 1998–99.

Length (cm)	Males	*c.v.* (%)	Females	*c.v.* (%)
21	1	11 361	0	0
22	0	0	0	0
23	0	0	0	0
24	33	169	0	0
25	58	176	5	4 989
26	57	307	34	285
27	47	709	79	354
28	1 000	59	576	69
29	1 445	50	614	108
30	2 715	35	1 311	49
31	6 100	19	3 253	34
32	10 266	14	6 989	18
33	11 361	13	10 572	14
34	9 665	14	11 639	13
35	8 797	15	11 068	12
36	7 233	18	9 290	14
37	7 882	15	9 250	15
38	6 849	21	7 678	14
39	4 592	26	6 981	13
40	3 487	29	5 738	18
41	2 495	54	4 443	26
42	1 767	56	4 012	30
43	1 094	52	3 312	34
44	629	51	2 064	40
45	150	159	1795	33
46	0	0	613	62
47	102	126	669	61
48	0	0	230	127
49	18	507	96	171
50	45	132	18	231
51	0	0	18	231

Appendix 2: Scaled numbers of male and female rubyfish, and *c.v.* by fish length (FL, cm), from the commercial fishery 1998–99.

Length (cm)	Males	*c.v.* (%)	Females	*c.v.* (%)
29	0	0	12	870
30	75	77	5	876
31	212	50	183	42
32	414	92	567	43
33	1 383	32	584	44
34	2 035	38	1 297	39
35	2 642	30	1 845	30
36	4 205	20	2 318	24
37	5 021	16	2 807	20
38	3 455	16	2 330	19
39	3 704	14	2 280	16
40	3 859	15	2 275	16
41	3 915	15	3 140	16
42	5 690	15	3 662	13
43	5 377	15	3 773	15
44	3 806	21	3 616	15
45	2 730	23	2 972	14
46	1 904	34	1 991	16
47	1 284	42	1 310	24
48	568	80	591	73
49	226	71	191	71
50	9	1 193	86	120
51	0	0	3	3 032
52	0	0	11	511
53	1	8 126	0	0