



FORM 5

FINAL RESEARCH REPORT

Date: 29 July 2013
Research Provider: National Institute of Water and Atmospheric Research
Project Code: Not specified
Project Title: Not specified
Report Title: Evaluation of combinations of minimum legal size and bag limits used to manage the recreational harvest from SNA 1
Principle Investigator: Bruce Hartill
Authors: Bruce Hartill and Richard Bian
Project Start Date: 24 May 2013
Expected Project End Date: 30 July 2013

EXECUTIVE SUMMARY

Two independent survey methods were used to estimate of the recreational harvest from SNA 1 in 2011–12, and the estimates that they provided were both in the order of 3800 t. The aerial-access methods used to provide one of the 2011–12 harvest estimates (of 3754 t) were also used in 2004–05, when the recreational harvest from SNA 1 was estimated to be 2419 t. These results suggest that there has been a significant increase in the recreational harvest from SNA 1 in recent years, and characterisations of standardised boat ramp interview data collected since 1991 suggest that this increase has been largely due to increased catch rates and an increasing trend in the size of snapper landed by amateur fishers. The recreational catch from SNA 1 is therefore far higher than the current allocation for this sector of 2300 t, and a recent stock assessment suggests that continued harvesting at this level would undermine the intended rebuild of the SNA 1 stock to 40% of B0.

The Ministry of Primary Industries therefore asked NIWA to evaluate the extent to which alternative combinations of decreasing daily bag limits and increasing minimum legal size limits could be used to constrain future recreational harvests from SNA 1. These evaluations were based primarily on data provided by boat based fishers interviewed when they returned to boat ramps throughout 2011–12. Management options were evaluated by initially removing fish smaller than a given minimum legal size limit (increasing from 27cm to 40 cm) from each fisher’s recorded catch, and then constraining any remaining catch so that it did not exceed a given daily bag limit (decreasing from 9 to 1 fish for each given size limit). These simulations suggest that appreciable increases in size limits and decreases in bag limits would have been required to reduce the recreational catch from SNA 1 in 2011–12 to 2300 t. The estimates provided do not appear to be sensitive to alternative interpretations of whether or not fishers in the same boat pool their daily bag limit. Simulation results are also provided based on data collected in 2004–05, but fisheries managers should base their considerations on the analyses of the more up-to-date data collected in 2011–12.

The relative merits of increasing minimum legal size limits and decreasing daily bag limits are discussed, as associated issues such as release mortality should also be considered when determining regulation settings.

OBJECTIVE

- 1) Assess the potential impact of changes to recreational bag limits and minimum legal size limits on levels of recreational harvesting based on data collected throughout the year in 2004–05 and 2011–12.

METHODS AND RESULTS

Information available to undertake an analysis potential impact of changes to recreational catch limits in SNA 1.

Extensive boat ramp surveys have been conducted intermittently throughout three regions of FMA 1 (East Northland, the Hauraki Gulf, and the Bay of Plenty) since 1991 (Table 1). These surveys were conducted for a wide variety of purposes, over periods ranging from four to twelve months. For the present study, therefore, the available data have therefore been pared down to ensure that all analyses are based on framework of temporally and spatially consistent data.

Data collected during 1996–97, 1997–98 and 1998–99 have been dropped from the dataset because the surveys conducted at those times were small scale, with most interview effort taking place at ramps that have rarely been surveyed since. Interview data collected over a further 6711 hours at 54 minor ramps were also dropped from the dataset because those ramps were only surveyed in a small number of years, and their inclusion could have led to some form of temporal bias. The dataset was therefore restricted to data collected at 23 key boat ramps located throughout FMA 1, that have been surveyed during most, if not all, surveys conducted since 1991 (Figure 1).

Table 1: Boat ramp surveys of recreational fishers conducted since 1991

Survey	Survey period	Interview duration (h)	Survey purpose
1990–91	17/11/90 – 28/07/91	4	Fishery characterisation
1993–94	02/01/94 – 26/06/94	4	Telephone/diary validation
1995–97	30/12/95 – 02/01/97	2	Mean fish weight estimates
1997–98	01/12/97 – 19/12/98	2	Small 3 ramp characterisation
1999–00	11/12/99 – 30/11/00	1–3	Mean fish weight estimates - KMA
2001	03/01/01 – 29/04/01	4–6	Kahawai length & age composition
2002	02/01/02 – 09/05/02	4–6	Kahawai length & age composition
2003	01/01/03 – 27/04/03	4–6	Kahawai length & age composition
2003–04	01/12/03 – 30/11/04	All daylight hours	Harvest estimates and kahawai catch composition
2004–05	01/12/04 – 30/11/05	All daylight hours	Harvest estimates and kahawai catch composition
2006	01/01/06 – 27/04/06	4–6	Kahawai length & age composition
2007	01/01/07 – 27/04/07	4–6	Kahawai length & age composition
2008	01/01/08 – 27/04/08	4–6	Kahawai length & age composition
2011	01/01/11 – 27/04/11	4–6	Kahawai length & age composition
2011–12	01/10/11 – 30/09/12	All daylight hours	Harvest estimates and kahawai catch composition

Although these surveys have been conducted for a wide variety of purposes, a consistent creel survey interview methodology has been used in all surveys conducted by NIWA (and formerly MAF Fisheries) over this time. Interviewers recorded data on: the date fished, weather conditions on that day, the number of fishers in each party, vessel type, the time at which the vessel returned to the access point, the location of the access point, the methods used by each fisher, species targeted, areas fished, time spent fishing, fisher experience, fisher age and sex, the number of each species caught,

the method by which each fish was caught, whether each fish was retained or released, and the size of the landed fish. Fishers were asked to identify which fish they personally caught, although it is likely that some fish were in fact caught by other members of the same fishing party.

The phrasing of the questions actually asked during these interviews is given in Appendix 1.

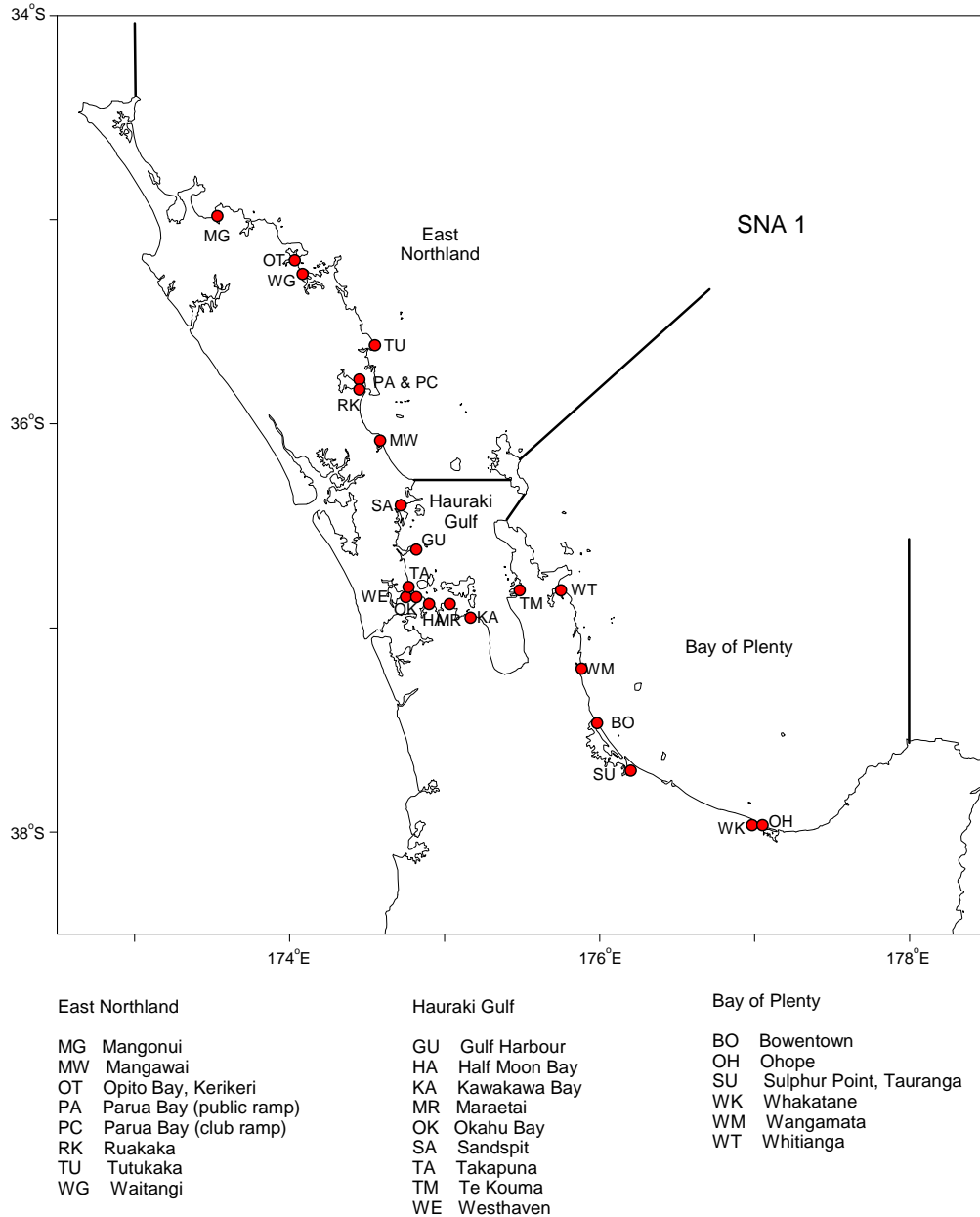


Figure 1: Location of key boat ramps where fishers have been interviewed in most, if not all, surveys conducted since 1991.

Resolution of available data

Most surveys were conducted over a relatively short period, but data are available for the first four months of each survey year (January to April), and these have been used to describe long term trends in catch composition since 1991 (Table 2). Seasonal trends in catch composition were also examined, based on data collected over two continuous 12 month periods, in 2004–05 and 2011–12.

Table 2: Number of hours during which interviewers were present at key boat ramps in in FMA 1, by month, by fishing year. Red vertical boxes delineate data that have been used to compare long term regional trends in bag size and fish size composition, and blue horizontal boxes delineate data used to evaluate alternative management measures.

Region	Fishing year	October	November	December	January	February	March	April	May	June	July	August	September	Total hours	Number of ramps
East Northland	1990-91	-	-	22	106	8	135	81	76	46	-	-	-	475	4
	1993-94	-	-	-	63	66	70	86	46	54	-	-	-	384	4
	1995-96	-	-	8	72	71	95	114	41	23	23	12	6	464	5
	1996-97	-	4	4	4	-	-	-	-	-	-	-	-	12	1
	1997-98	-	-	22	18	14	24	26	20	18	18	18	12	190	1
	1998-99	20	18	-	-	-	-	-	-	-	-	-	-	38	1
	1999-00	-	-	45	115	77	63	66	31	31	33	36	33	529	4
	2000-01	36	65	-	255	259	261	289	-	-	-	-	-	1 164	8
	2001-02	-	-	-	356	263	283	210	-	-	-	-	-	1 111	8
	2002-03	-	-	-	286	272	264	239	-	-	-	-	-	1 060	8
	2003-04	-	-	-	204	155	326	411	-	-	-	-	-	1 096	8
	2004-05	-	-	307	624	443	522	517	70	201	181	210	61	3 135	8
	2005-06	127	192	-	336	222	244	280	-	-	-	-	-	1 402	8
	2006-07	-	-	-	263	285	221	281	-	-	-	-	-	1 049	8
2007-08	-	-	-	325	242	301	194	-	-	-	-	-	1 063	8	
2010-11	-	-	-	293	231	148	434	-	-	-	-	-	1 105	6	
2011-12	386	321	346	341	325	408	378	232	116	195	207	209	3 463	6	
Total		569	601	753	3 661	2 930	3 364	3 606	516	488	450	482	321	17 740	
Hauraki Gulf	1990-91	-	1	40	138	38	283	167	127	22	-	-	-	816	8
	1993-94	-	-	-	151	165	377	434	319	313	-	-	-	1 759	8
	1995-96	-	-	-	44	46	41	69	64	32	19	14	8	337	8
	1996-97	9	6	2	4	-	-	-	-	-	-	-	-	21	4
	1999-00	-	-	14	62	45	38	56	37	25	20	15	18	329	4
	2000-01	16	32	-	257	207	201	213	-	-	-	-	-	926	8
	2001-02	-	-	-	325	292	274	236	6	-	-	-	-	1 133	9
	2002-03	-	-	-	342	281	299	263	-	-	-	-	-	1 184	9
	2003-04	-	-	578	783	596	399	429	140	82	77	286	386	3 755	9
	2004-05	184	111	354	805	613	678	685	107	230	236	225	80	4 307	9
	2005-06	171	244	-	345	249	328	298	-	-	-	-	-	1 635	9
	2006-07	61	262	236	443	490	349	423	97	106	170	112	220	2 968	9
	2007-08	177	253	327	560	440	478	351	-	-	-	-	-	2 586	9
	2010-11	-	-	-	246	156	222	276	-	-	-	-	-	900	8
2011-12	645	525	562	568	521	647	611	352	208	323	333	347	5 639	9	
Total	1 262	1 433	2 112	5 073	4 138	4 614	4 509	1 250	1 017	844	985	1 058	28 295		
Bay of Plenty	1990-91	-	-	42	167	35	168	138	109	35	14	-	-	707	6
	1993-94	-	-	-	98	62	73	119	128	140	-	-	-	620	5
	1995-96	-	-	-	70	62	77	61	38	28	27	26	17	404	6
	1996-97	4	4	2	-	-	-	-	-	-	-	-	-	10	2
	1997-98	-	-	16	10	2	48	52	42	18	28	24	10	250	3
	1998-99	22	18	12	-	-	-	-	-	-	-	-	-	52	2
	1999-00	-	-	51	70	107	55	90	36	30	40	48	45	570	6
	2000-01	34	65	-	40	57	48	75	-	-	-	-	-	319	6
	2001-02	-	-	-	77	50	79	127	3	-	-	-	-	336	6
	2002-03	-	-	-	62	70	90	134	-	-	-	-	-	355	6
	2003-04	-	-	-	46	40	92	114	-	-	-	-	-	292	5
	2004-05	-	-	267	529	409	448	470	45	145	150	145	47	2 654	5
	2005-06	127	174	-	116	68	80	85	-	-	-	-	-	650	5
	2006-07	-	-	-	77	85	66	109	-	-	-	-	-	338	5
2007-08	-	-	2	99	77	124	115	-	-	-	-	-	417	5	
2010-11	-	-	-	139	112	133	171	-	-	-	-	-	555	6	
2011-12	418	370	387	372	370	450	417	233	151	220	221	213	3 820	6	
Total	605	631	778	1 972	1 606	2 031	2 274	634	546	477	463	332	12 350		
Grand Total		2 437	2 664	3 644	10 706	8 674	10 008	10 389	2 400	2 051	1 771	1 930	1 711	58 384	25

NB - does not include 6711 hours of interviewing conducted at 54 other ramps that were surveyed during only a few surveys

Long term changes in recreational catch composition

Long term regional trends in fisher catch composition have been described based on creel survey data collected in the first four months of each survey year, since 1991. All available data were selected for these analyses, regardless of the fishing method used during a fishing trip, to ensure that descriptive summaries fully represented all landings encountered by boat ramp interviewers.

The size composition of snapper landed in all three regions has gradually increased since 1991 (Figure 2). The minimum legal size limit for snapper was increased from 25 cm to 27 cm on 1 October 1994, and a substantial proportion of recreational landings at that time was comprised of fish less than 30 cm in length. There has been a gradual increase in regional length frequency modes over the past 20 years, with small but still legal snapper accounting for a lower portion of the catch in recent years. This trend corroborates anecdotal reports of fishers increasingly preferring to release fish that are a few cm larger than the minimum legal size limit.

The number of snapper landed per fisher trip has also gradually increased in the Hauraki Gulf and, to a much lesser extent in East Northland and the Bay of Plenty (Figure 3). The legal daily bag limit before 1 October 1994 allowed for 20 snapper per fisher, but only a very small proportion of fishers landed more than 6 fish at that time. The daily bag limit was decreased to 15 fish in 1994, and further reduced to 9 on 1 October 1997. Increased fisher success has been most evident in the Hauraki Gulf, where there were almost as many taking their daily bag limit of 9 fish as there were zero catch trips in 2010–11 and 2011–12.

Increased average fisher success is also evident in other trip catch metrics (Figure 4). The average size (and corresponding average weight) of snapper landed has increased in each region since 1991. There has been a widespread gradual decline in the proportion of trips that were unsuccessful, and a recent increase in the proportion of fishers who landed their limit of 9 snapper.

A subset of the available data were also used to compare long term regional trends in recreational catch rate statistics with those reported by the commercial longline fishery. Rod and reel catch effort data collected in the first four months of each calendar year was used to generate two unstandardized recreational catch rate indices: one based on the average weight of snapper landed per hour fished, and another based on the average number of snapper landed per trip. Fishing events involving the use of soft plastic baits were excluded from this data set because this method has only been widely used since around 2006. The two recreational CPUE indices were compared with the standardised regional commercial bottom longline indices used in the 2013 SNA 1 stock assessment (McKenzie et al., unpub. data). All three indices follow similar trends in each region (Figure 5). There has only been a modest increase in fishing success in East Northland since 1991, but catch rates have increased to a greater extent on the Bay of Plenty, and far more noticeably in the Hauraki Gulf.

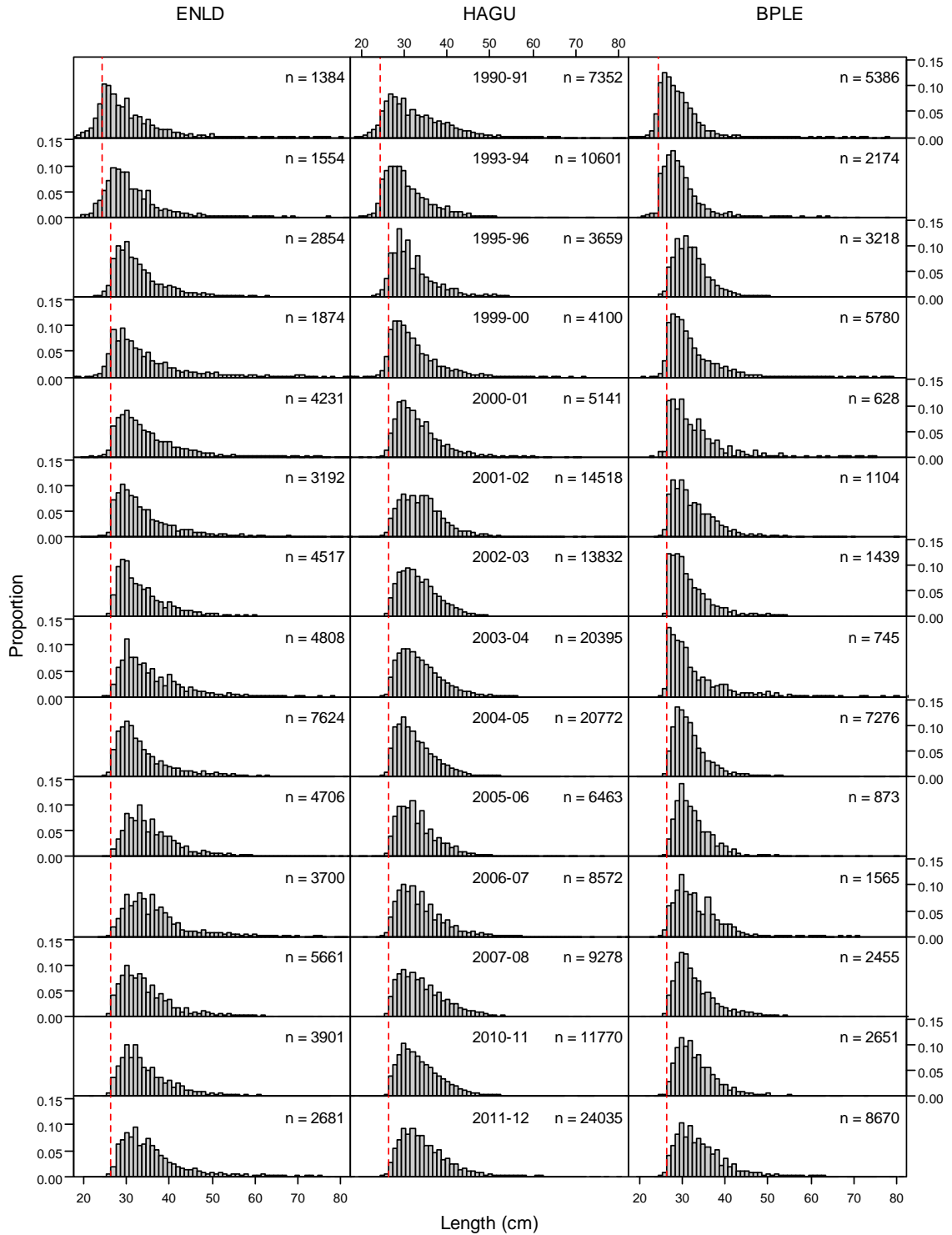


Figure 2: Length frequencies of snapper landed by recreational fishers in three sub-areas of SNA 1, by fishing year. The red dashed vertical line denotes the legal size limit at the time of sampling.

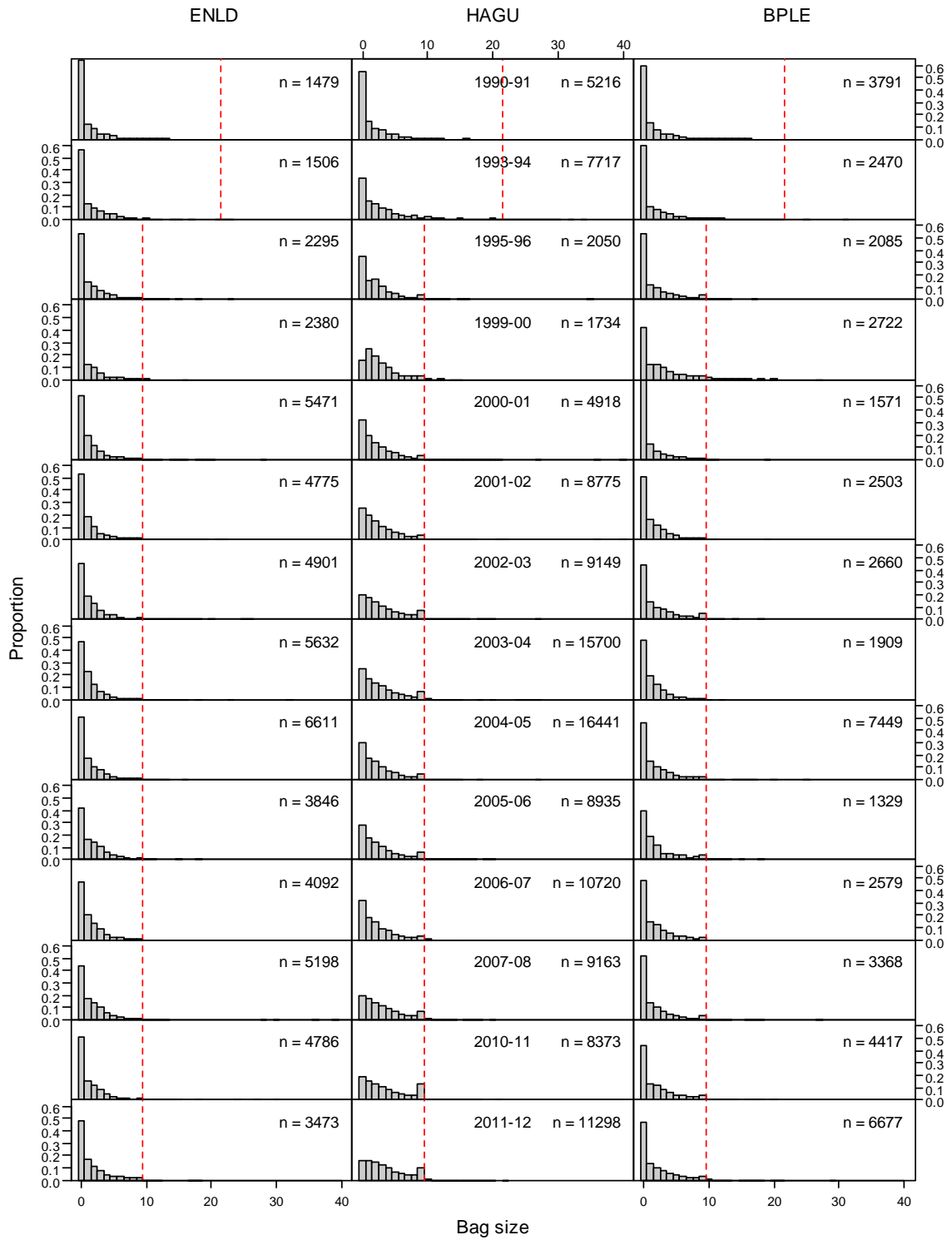


Figure 3: Number of snapper landed per trip by recreational fishers in three sub-areas of SNA 1, by fishing year. The red dashed vertical line denotes the legal daily bag limit at the time of sampling.

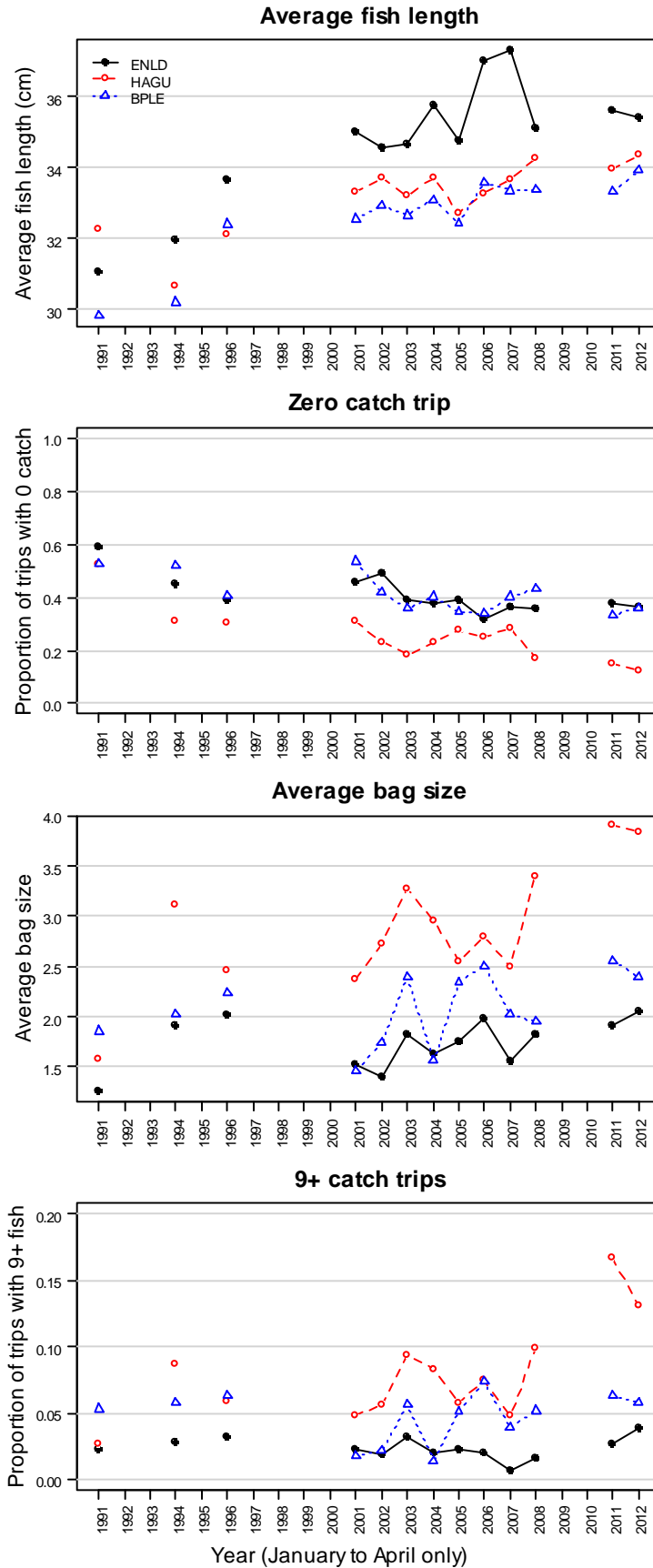


Figure 4: Trends in length and bag size composition based on summary statistics for three sub-areas of SNA 1, by fishing year.

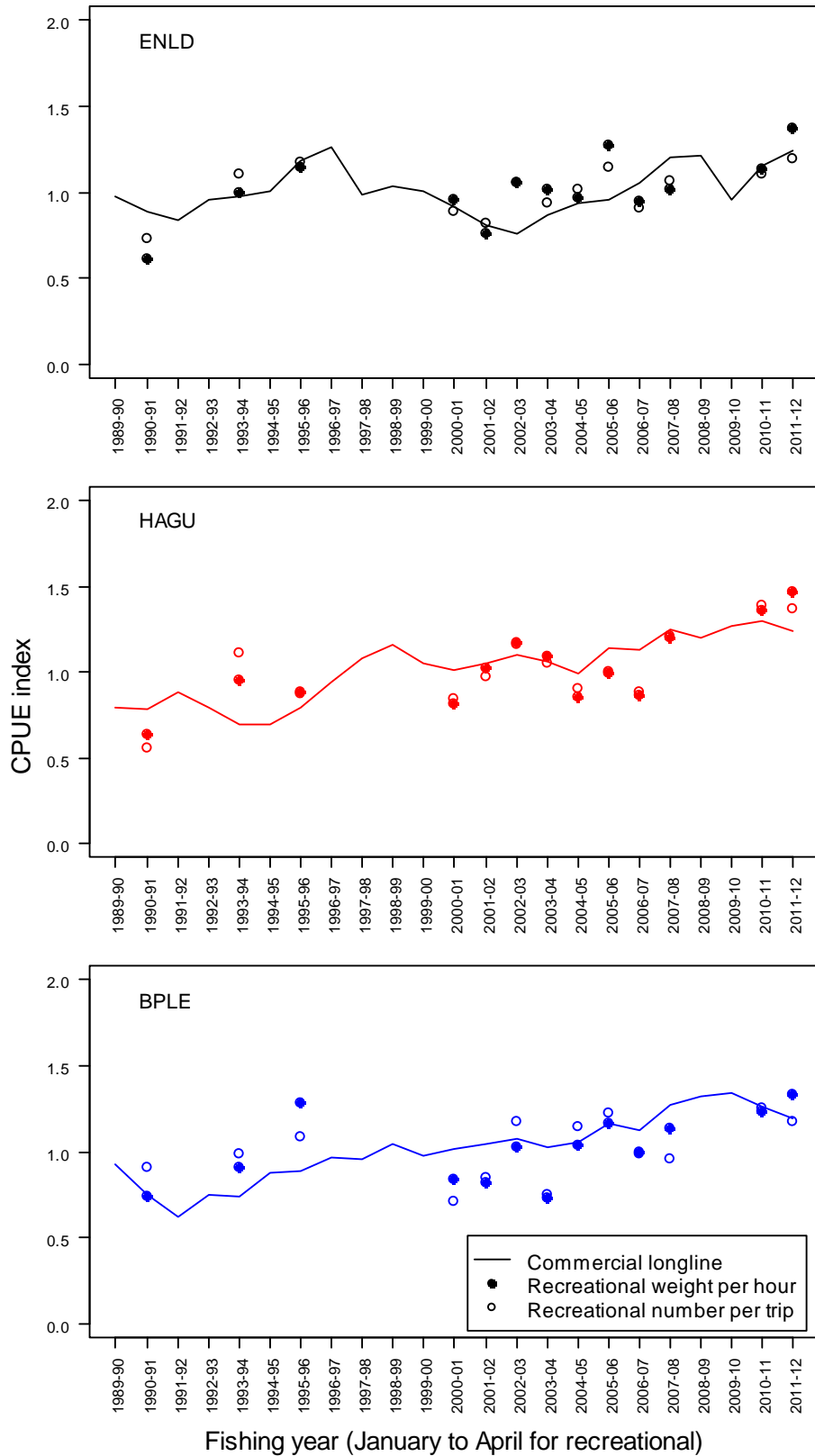


Figure 5: Unstandardised recreational and standardised commercial catch rate indices for three regions of SNA 1.

These trends in trip catch data largely explain the difference between the 2004–05 and 2011–12 recreational harvest estimates for SNA 1, which were provided by aerial-access surveys (Table 3; Hartill et al. 2007, Hartill et al. 2013). These estimates suggest that the recreational harvest from SNA 1 has increased by about 55% over the last seven years, with most of the increase occurring in the Hauraki Gulf, with more modest increases occurring in East Northland and the Bay of Plenty. The harvest estimates provided by the 2011–12 aerial-access survey are comparable with those provided by a concurrent but independent national panel survey conducted by the National Research Bureau (NRB; Wynne-Jones et al. 2013), which suggest that the aerial-access harvest estimates are reasonably accurate (Table 3, Figure 6).

Table 3: Estimates of recreational harvests from SNA 1 by region, for the 2004–05 and 2011–12 fishing years and coefficient of variation (in brackets). These estimates account for all forms of non-commercial harvesting except those taken from charter boats, by customary fishers, and those taken from commercial fishing vessels where are reported under S. 111 of the 1996 Fisheries Act. Panel survey data suggests that these additional sources of harvest would approximately account for a further 200 tonnes.

	Aerial-access		Panel survey
	2004–05	2011–12	2011–12
East Northland	557 (0.13)	718 (0.14)	869 (0.13)
Hauraki Gulf	1 345 (0.10)	2 490 (0.08)	2 254 (0.12)
Bay of Plenty	517 (0.10)	546 (0.12)	669 (0.12)
SNA 1	2 419 (0.06)	3 754 (0.06)	3 792 (0.08)

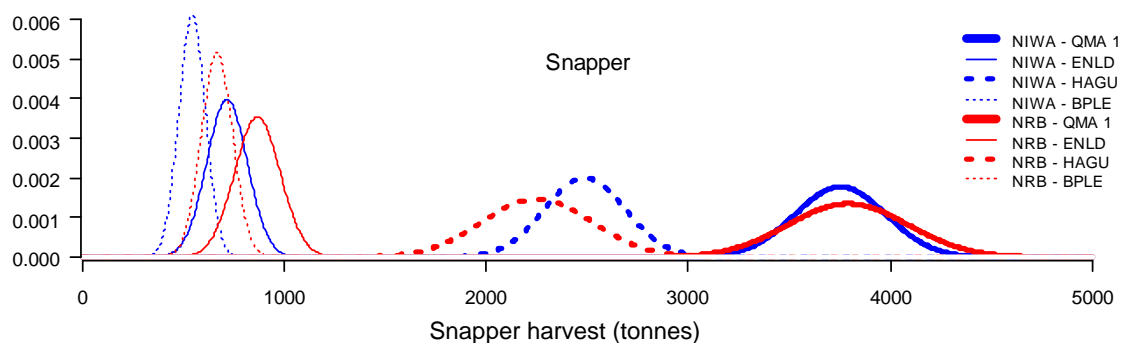


Figure 6: Comparison of aerial-access and panel survey estimates of the recreational harvest of snapper from regions of SNA 1 for the 2011–12 fishing year.

The regional recreational catch histories used in the 2013 stock assessment for SNA 1 were based on the harvest estimates given in Table 3 and the catch rate indices shown in Figure 5 (Figure 7). It is assumed that levels of recreational fishing effort have remained constant since at least 1991. The aerial-access estimates for 2004–05 and 2011–12 were of a broadly similar magnitude.

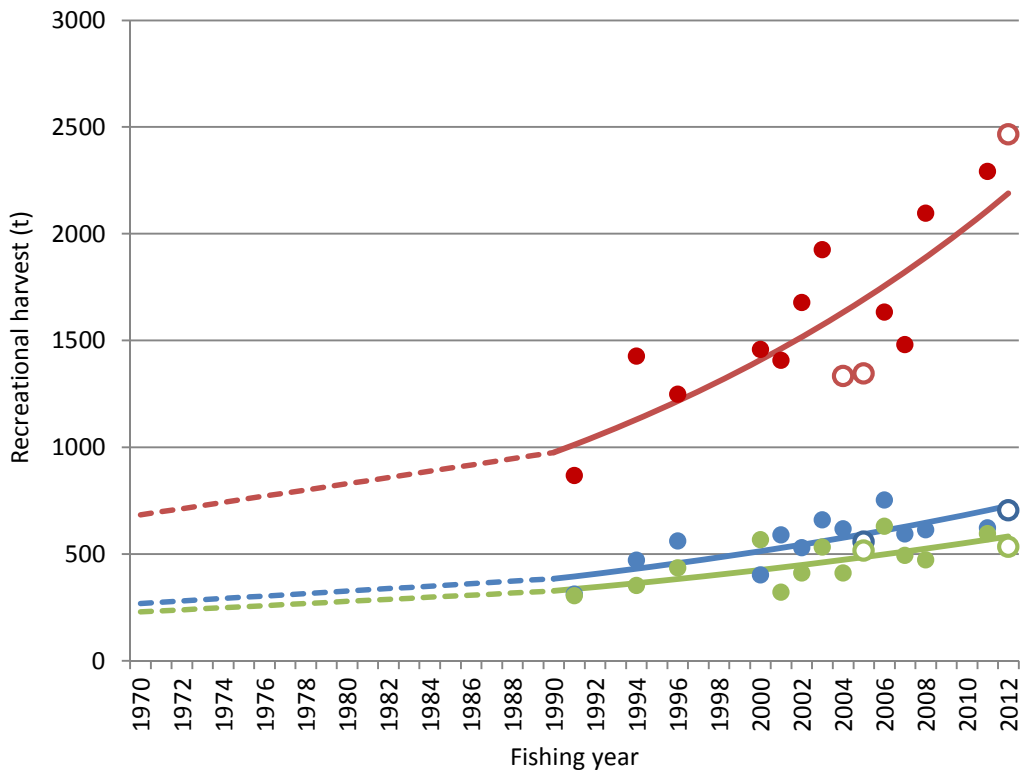


Figure 7: Regional recreational catch histories used in the 2013 assessment of the SNA 1 stock (Hauraki Gulf in red, East Northland in blue, and the Bay of Plenty in green). Open circles denote aerial-access survey estimates, closed circles denote recreational kg per trip indices scaled to the geometric mean of the aerial-access estimates, solid curved lines denote exponential fits to the scaled kg per trip indices which were used to predict harvests for those years for which creel survey data were not available, and dashed lines denote linear interpolations between 1990 and 1970 (when harvests were assumed to be at 70% of that predicted for 1990).

Evaluation of bag and size limit options based on interview data collected in 2011–12

The recreational harvest estimates discussed above are greater than the current non-commercial catch allowance for SNA 1 of 2600 t (2300 t for the recreational sector and 300 t for customary fishers) and there is good evidence to suggest that the catch landed by this sector has trended upwards in recent years. NIWA was therefore asked to evaluate the potential influence that changes to recreational bag limits and minimum legal size limits could have on levels of recreational harvesting in the future.

These evaluations were primarily based on interview data collected throughout 2011–12, which is the most recent year in which fishers were interviewed over a full twelve month period. The following analyses were also repeated using data collected throughout 2004–05 (see Appendix 3) which provide an indication of how management limits could influence recreational harvests when the fishery was in a different state. The impact of changes to limits was assessed separately for each region, as size compositions and bag distributions differ by region (Figure 8).

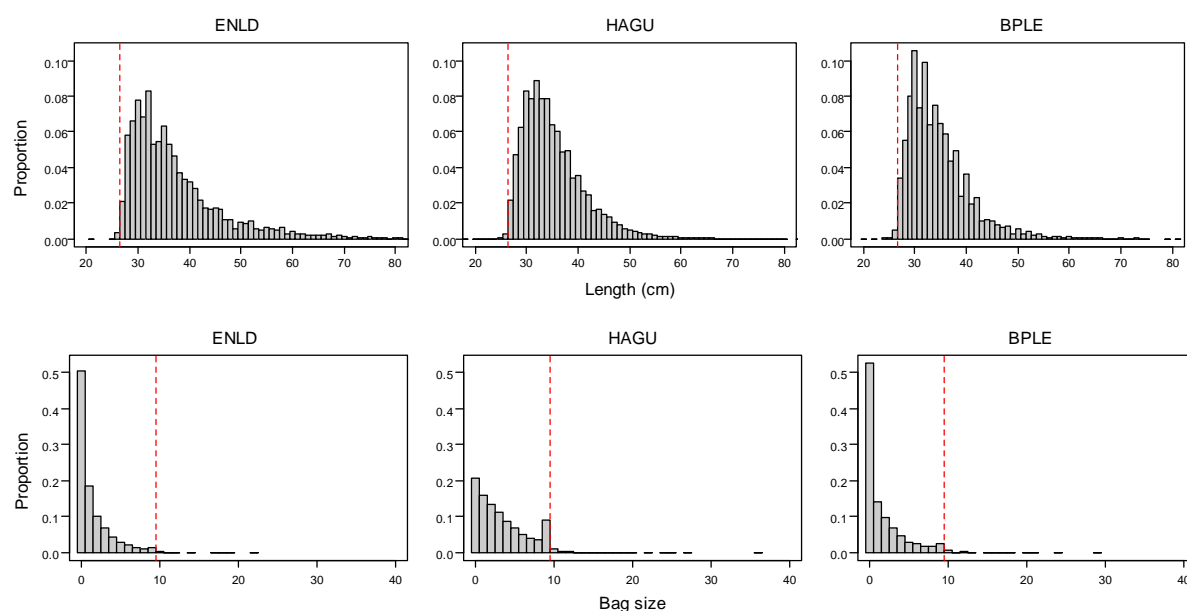


Figure 8: The length composition of snapper landed by fishers interviewed in each region of SNA 1 during the 2011–12 fishing year (top panels) and associated distributions of the number of snapper landed by these fishers (bottom panel).

Regional length frequency and bag distribution data were initially summarised by month, to determine whether seasonal trends in fisher behaviour and snapper availability could influence the composition of recreational landings throughout the year. Only slight seasonal differences in catch composition were apparent in all three regions, with larger fish and bag sizes more evident during the first few months of the fishing year (Figures 9 and 10 respectively). Regional evaluations of potential changes to recreational bag and size limits were therefore further stratified by season (summer – 1 October to 30 April, and winter – 1 May to 30 September). The definitions of these seasonal strata match those used in the 2011–12 aerial access survey design.

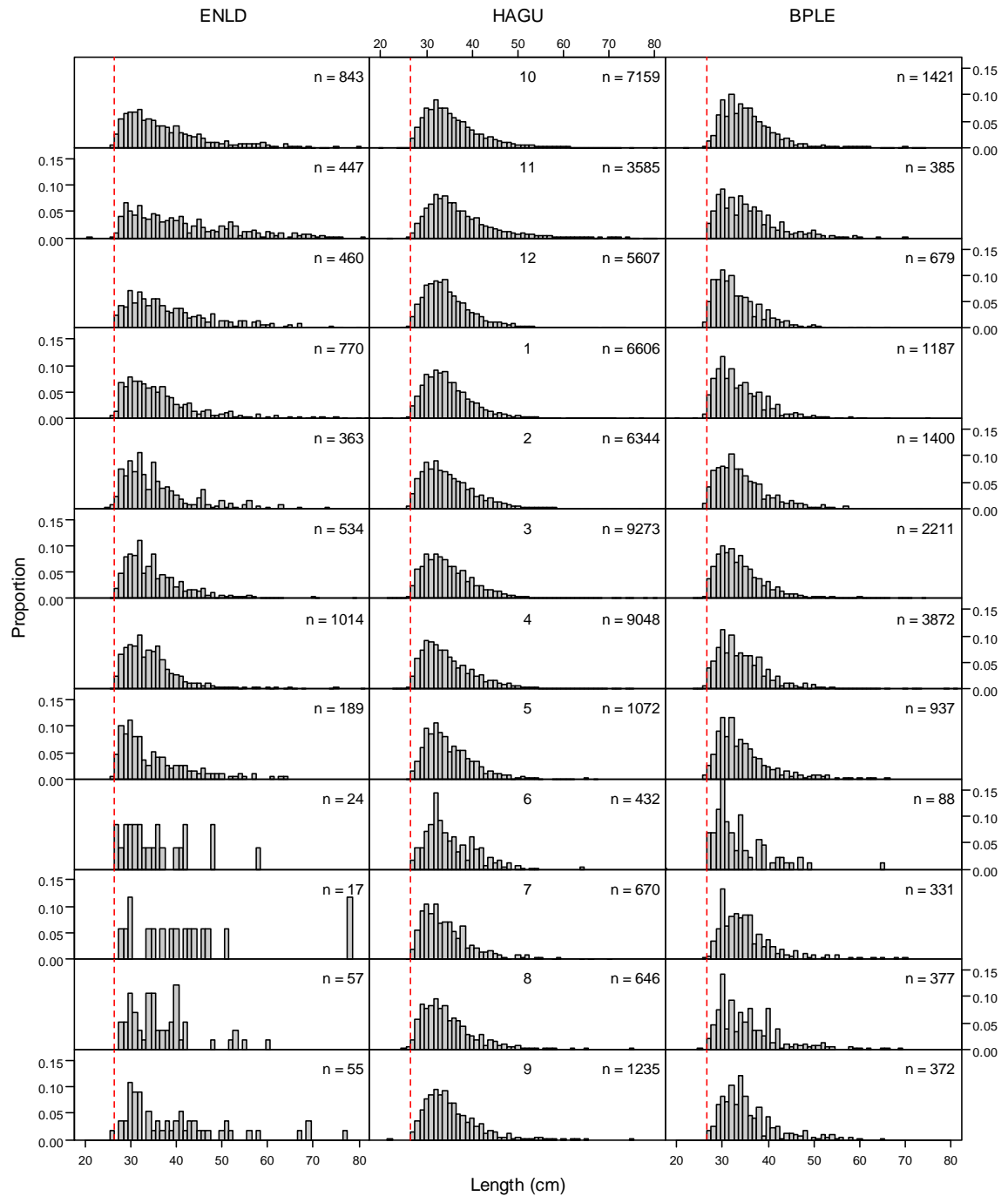


Figure 9: Length frequencies of snapper landed by recreational fishers in three sub-areas of SNA 1 in 2011–12, by month.

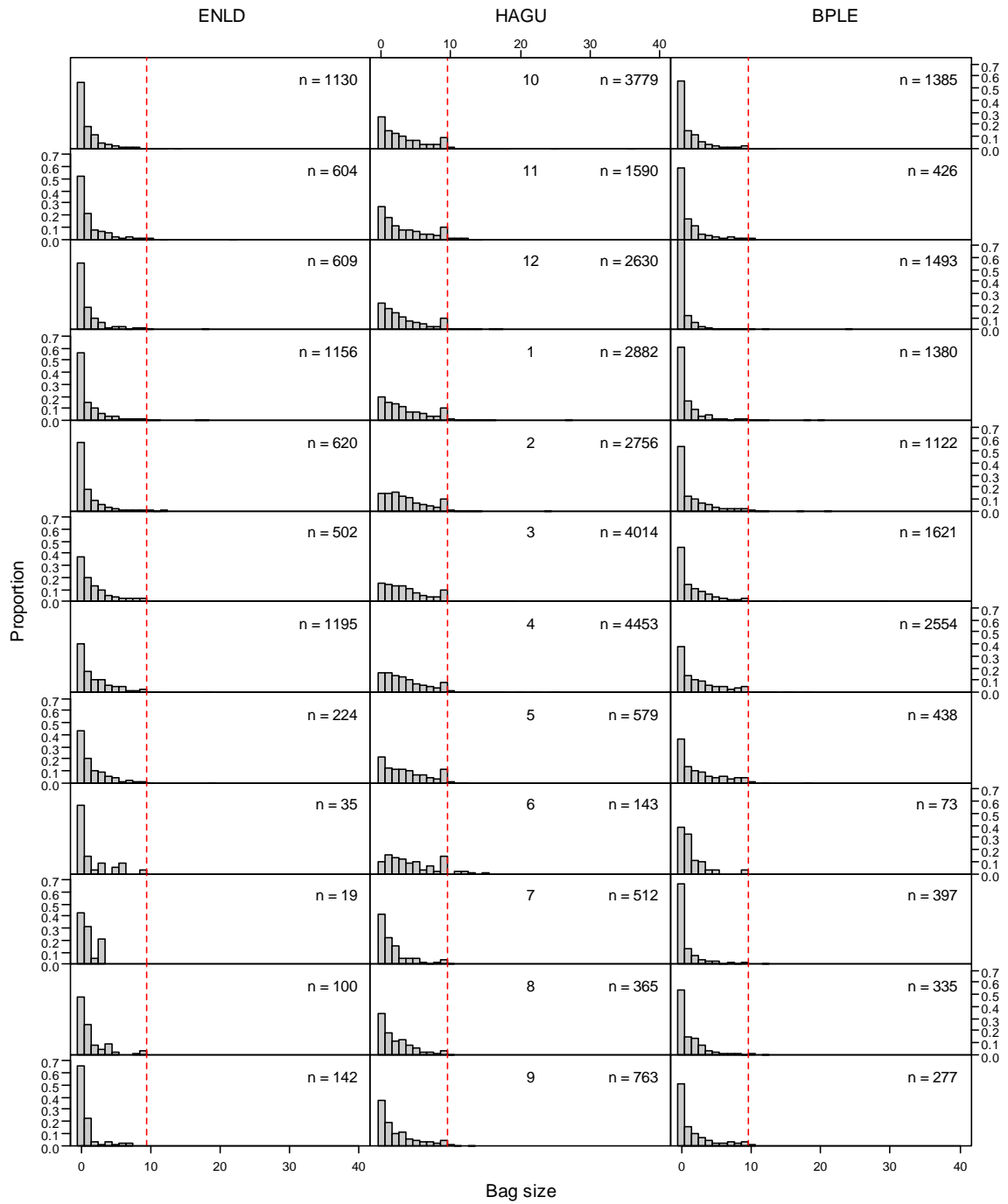


Figure 10: Number of snapper landed per trip by recreational fishers in three sub-areas of SNA 1 in 2011-12, by month.

The impact of differing combinations of reduced daily bag limits and increased minimum legal size limits was assessed by adjusting observed fisher catch data by region, by season. Although boat ramp interviewers attempt to measure all fish landed by interviewed fishers, this is not always possible because fishers are sometimes reluctant to wait around for their fish to be measured, given the time that the interview had already taken. Interviewers were also instructed to just count fish when there were many fishers returning to the ramp, to maximise the number of interviews attained. This meant that there were many landings for which counts of fish were available, for which there were no corresponding fish lengths. It was therefore necessary to assign fish length data to these unmeasured landings, to determine the impact that any change to the minimum legal size limit would have on those landed catches. Simply removing unmeasured landings from the data set was not an option as there was a lower likelihood of a landing being measured when a greater number of fish were landed (Figure 11).

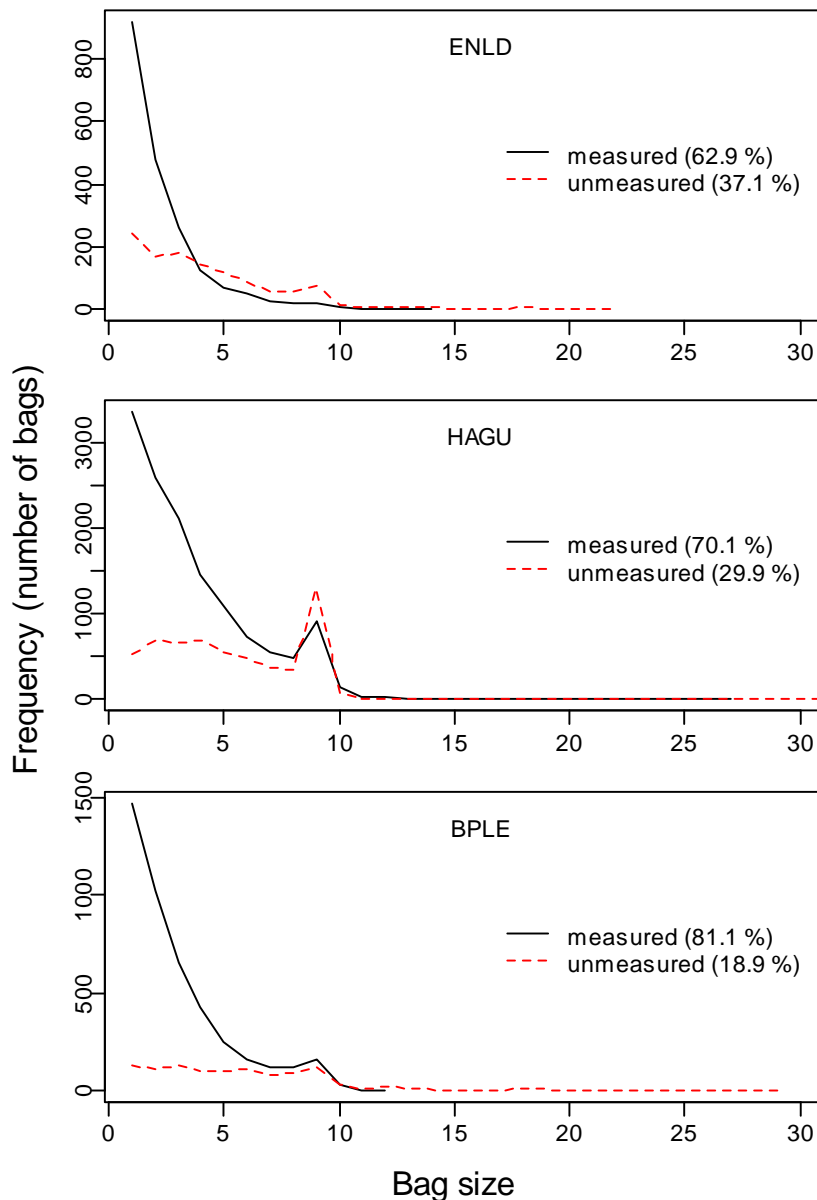


Figure 11: Frequency of 2011–12 landings where snapper were measured and where they were not measured by the interviewer, by region.

Length data from measured landings were therefore sampled without replacement, and assigned to unmeasured landings that were encountered within the same region and season. Length data for unmeasured landings were only sampled from measured landings of the same bag size, as the length composition of landings of large numbers of fish could conceivably differ from the length composition of landings of small numbers of fish. In some instances lengths from measured landings were resampled without replacement for a second time, as the number of unmeasured landings of a given bag size was greater than the number of measured landings.

Weights of individual fish were estimated using the length-weight relationship

$$\text{Weight} = 0.04467 * \text{Length}^{2.793} \quad (\text{Paul 1976})$$

and these estimates were used to calculate the mean weight of the fish landed by each fisher. This estimate was used for two purposes.

Firstly, because some interviewed fishers landed more than 9 fish and a mean weight estimate was required for each fisher so that we could remove the weight of these excess fish in an unbiased fashion. Fish taken in excess of the current daily bag limit of 9 fish, and those that were less than the current minimum legal size limit accounted for 1.3 % of the directly observed harvest in 2011–12 and 3.0% in 2004–05. These fish were removed from our data set because it is necessary to assume that fishers will fully comply with regulatory limits when evaluating alternative scenarios, including those currently in force.

Secondly, because the annual catch allowance for the recreational sector is specified in terms of landed weight (currently 2300 t), and the impact of any change in minimum legal size limits and daily bag limits should therefore be expressed in terms of weight, rather than numbers of fish still caught.

The impact of changes in minimum legal size limits and daily bag limits was assessed by adjusting the reported catch of each interviewed fisher so that it reflected that which would have been landed given an alternative regulatory regime, for each combination of region and season. Incremental adjustments were applied to each fisher's catch, by first removing fish smaller than a revised minimum legal size limit (increasing from 27 cm to 40 cm in 1 cm increments), and then for each minimum legal size limit, reducing the remaining catch if the number of fish exceed a revised bag limit (decreasing incrementally from 9 to 1 fish).

$$p_{s',b'} = \frac{\sum_F c_{F,s',b'}}{\sum_F c_{F,s,b}}$$

where $p_{s',b'}$ is the proportional change in total catch landed under a revised minimum legal size limit s' and daily bag limit b' , and $c_{F,s,b}$ is the catch c of fisher F taken under the current size limit s of 27 cm given the current bag limit b of 9 fish.

The relative influence of changes to management controls differs by region (Figure 12, Table 4). Differences are most apparent when estimates of proportional change for East Northland and the Hauraki Gulf are compared. Reductions in daily bag limits and increases in minimum legal sizes have a far greater effect on levels of recreational harvesting in the Hauraki Gulf than in East Northland, because smaller fish make up a greater proportion of the catch in the Gulf, where larger bag sizes are also more commonly landed.

Changes to the daily bag limit have less effect if the minimum legal size limit is also increased, as some of the smaller fish associated with larger bag sizes in 2011–12 would no longer be retained if they were deemed to be under size. Two thirds of the estimated harvest from SNA 1 in 2011–12 was taken from the Hauraki Gulf, and consequently the relative trends predicted for SNA 1 are largely determined by those predicted for the Hauraki Gulf.

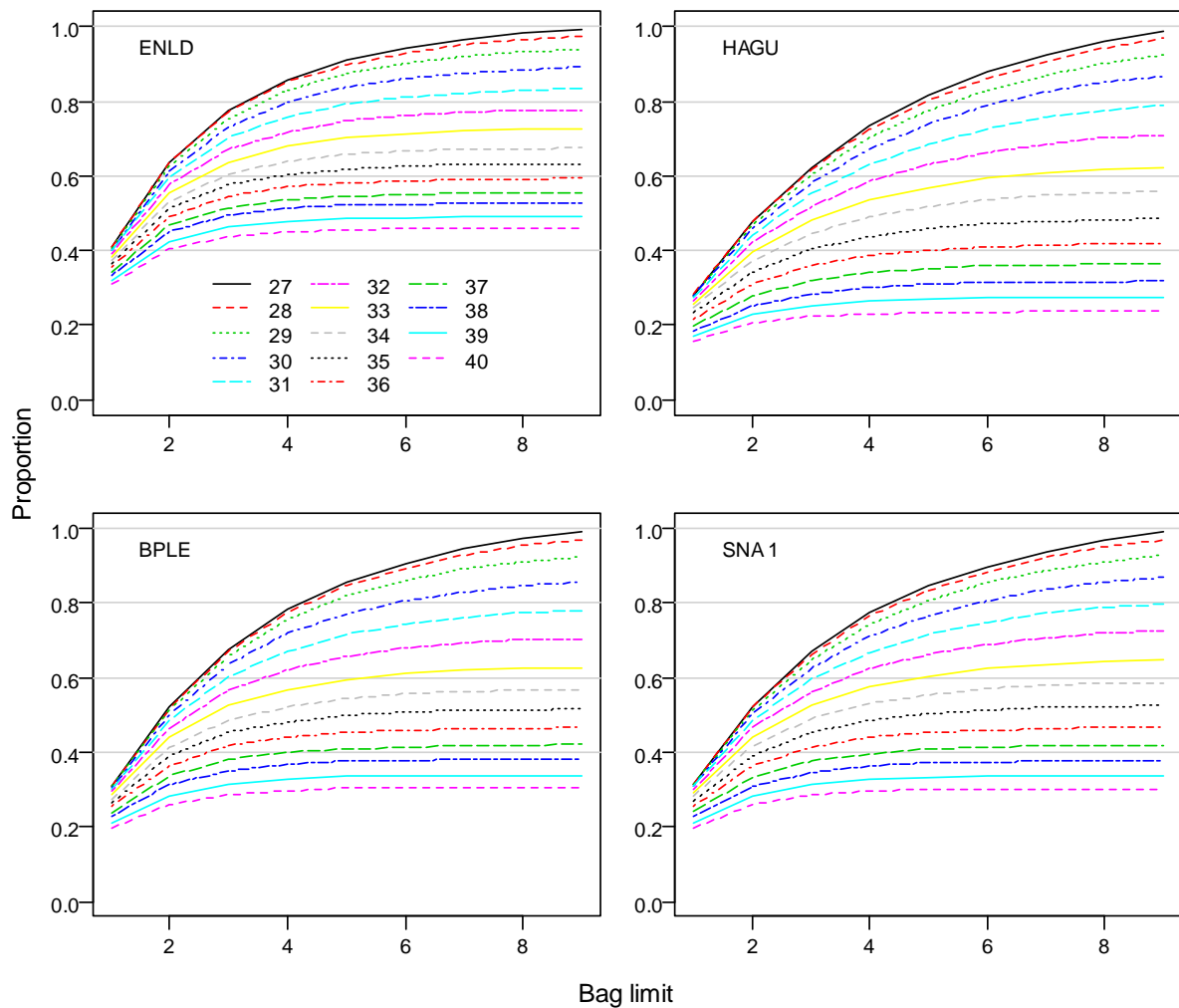


Figure 12: Estimates of the proportional change in the total weight of snapper landed in each region of SNA 1 in 2011–12 for alternative minimum legal size limits ranging from 27 to 40 cm, for daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates.

Table 4: Estimates of the proportion by which the regional recreational harvest from SNA 1 in 2011–12 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates.

region	baglimit	Minimum legal size												
		27	28	29	30	31	32	33	34	35	36	37	38	39
ENLD	1	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.66	0.66	0.67	0.67	0.68	0.69
ENLD	2	0.43	0.43	0.43	0.44	0.45	0.46	0.47	0.47	0.49	0.50	0.52	0.53	0.55
ENLD	3	0.28	0.28	0.29	0.30	0.32	0.33	0.35	0.36	0.38	0.41	0.44	0.47	0.49
ENLD	4	0.18	0.18	0.20	0.21	0.23	0.25	0.28	0.30	0.33	0.36	0.40	0.43	0.46
ENLD	5	0.11	0.12	0.13	0.15	0.18	0.20	0.23	0.26	0.29	0.33	0.37	0.41	0.44
ENLD	6	0.07	0.07	0.09	0.11	0.14	0.17	0.21	0.24	0.27	0.32	0.36	0.40	0.44
ENLD	7	0.04	0.04	0.06	0.08	0.12	0.15	0.19	0.22	0.26	0.31	0.35	0.40	0.44
ENLD	8	0.01	0.02	0.04	0.06	0.10	0.13	0.18	0.22	0.26	0.31	0.35	0.39	0.43
ENLD	9	0.00	0.01	0.03	0.06	0.09	0.13	0.18	0.22	0.25	0.30	0.35	0.39	0.43
HAGU	1	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.78	0.79	0.80
HAGU	2	0.57	0.57	0.57	0.57	0.57	0.57	0.58	0.59	0.60	0.62	0.64	0.66	0.68
HAGU	3	0.42	0.42	0.42	0.42	0.43	0.44	0.46	0.48	0.50	0.53	0.56	0.59	0.63
HAGU	4	0.30	0.30	0.30	0.31	0.33	0.34	0.37	0.40	0.44	0.48	0.52	0.56	0.60
HAGU	5	0.21	0.21	0.22	0.23	0.25	0.28	0.31	0.35	0.40	0.45	0.50	0.54	0.59
HAGU	6	0.13	0.14	0.15	0.17	0.19	0.23	0.27	0.32	0.38	0.43	0.48	0.53	0.58
HAGU	7	0.08	0.08	0.10	0.12	0.15	0.19	0.25	0.30	0.36	0.42	0.47	0.52	0.58
HAGU	8	0.03	0.04	0.06	0.08	0.12	0.17	0.23	0.29	0.35	0.41	0.47	0.52	0.58
HAGU	9	0.00	0.01	0.03	0.06	0.11	0.16	0.22	0.28	0.35	0.41	0.47	0.52	0.58
BPLE	1	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.74	0.75	0.76	0.77	0.79
BPLE	2	0.50	0.50	0.50	0.51	0.52	0.54	0.55	0.57	0.59	0.62	0.64	0.67	0.70
BPLE	3	0.35	0.35	0.36	0.38	0.40	0.42	0.45	0.47	0.51	0.54	0.58	0.61	0.66
BPLE	4	0.24	0.25	0.26	0.28	0.31	0.34	0.38	0.41	0.45	0.50	0.54	0.59	0.64
BPLE	5	0.16	0.17	0.19	0.21	0.25	0.28	0.33	0.37	0.42	0.47	0.53	0.57	0.63
BPLE	6	0.10	0.11	0.13	0.16	0.20	0.24	0.30	0.34	0.40	0.46	0.52	0.57	0.63
BPLE	7	0.06	0.07	0.09	0.12	0.17	0.22	0.28	0.33	0.39	0.45	0.51	0.56	0.62
BPLE	8	0.02	0.03	0.06	0.10	0.15	0.20	0.27	0.32	0.39	0.45	0.51	0.56	0.62
BPLE	9	0.00	0.01	0.04	0.08	0.14	0.19	0.27	0.32	0.38	0.45	0.51	0.56	0.62
SNA 1	1	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.75	0.76	0.77
SNA 1	2	0.54	0.54	0.54	0.54	0.54	0.55	0.56	0.57	0.58	0.60	0.62	0.64	0.66
SNA 1	3	0.38	0.39	0.39	0.40	0.41	0.42	0.44	0.46	0.48	0.51	0.54	0.57	0.61
SNA 1	4	0.27	0.27	0.28	0.29	0.31	0.33	0.36	0.38	0.42	0.46	0.50	0.54	0.58
SNA 1	5	0.18	0.19	0.20	0.21	0.24	0.26	0.30	0.34	0.38	0.43	0.48	0.52	0.57
SNA 1	6	0.12	0.12	0.14	0.16	0.18	0.22	0.26	0.31	0.36	0.41	0.47	0.51	0.56
SNA 1	7	0.07	0.07	0.09	0.11	0.15	0.19	0.24	0.29	0.35	0.40	0.46	0.51	0.56
SNA 1	8	0.03	0.04	0.05	0.08	0.12	0.17	0.23	0.28	0.34	0.40	0.45	0.50	0.56
SNA 1	9	0.00	0.01	0.03	0.06	0.11	0.16	0.22	0.27	0.34	0.39	0.45	0.50	0.56

These estimates of proportional change in harvest weight (relative to the current minimum legal size limit of 27 cm and bag limit of 9) were then scaled by aerial-access estimates of the tonnage harvested from each region in each season, to provide an estimate of the harvest tonnage taken by all fishers, not just those interviewed.

$$h_{s',b'}^a = p_{s',b'} \cdot h^a$$

where $h_{s',b'}^a$ is the estimated harvest taken under a revised minimum legal size limit s' and daily bag limit b' , and h^a is the 2011–12 aerial-access harvest estimate for the same region in the same season. The total annual harvest estimate for SNA 1 taken under a revised minimum legal size limit and daily bag limit is the sum of all regional and seasonal estimates of $h_{s',b'}^a$

Table 5: Estimates of the regional tonnage of snapper landed by boat based fishers in SNA 1 in 2011–12 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates. These harvest estimates do not include any provision for harvest taken by shore based fishers, which are included in the estimates given in Table 6.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	215	214	214	214	213	213	211	210	207	204	200	197	191	187
ENLD	2	346	345	341	339	334	329	321	317	310	301	291	281	269	258
ENLD	3	435	433	427	422	412	404	392	384	371	355	338	323	306	290
ENLD	4	494	492	484	475	463	452	435	422	407	386	364	344	326	307
ENLD	5	534	532	522	511	496	482	462	445	427	403	378	355	335	314
ENLD	6	562	560	549	536	519	502	478	459	438	412	385	360	340	318
ENLD	7	582	579	566	552	534	514	488	468	446	417	390	364	343	320
ENLD	8	595	592	579	564	544	522	493	472	449	418	391	365	344	321
ENLD	9	603	600	587	570	547	525	495	473	450	419	392	366	345	322
HAGU	1	564	565	569	573	577	580	580	579	571	562	550	532	506	484
HAGU	2	1019	1019	1019	1021	1017	1009	994	974	942	906	862	813	753	700
HAGU	3	1381	1379	1375	1368	1349	1324	1285	1241	1179	1115	1038	963	874	801
HAGU	4	1663	1658	1647	1630	1596	1553	1490	1420	1330	1239	1138	1043	936	850
HAGU	5	1882	1874	1856	1829	1779	1717	1630	1537	1422	1312	1194	1087	968	876
HAGU	6	2052	2041	2015	1978	1913	1832	1724	1612	1479	1356	1227	1113	986	890
HAGU	7	2185	2172	2140	2091	2009	1912	1786	1658	1513	1382	1245	1127	995	896
HAGU	8	2290	2274	2234	2171	2073	1963	1824	1685	1532	1396	1255	1133	1000	899
HAGU	9	2369	2349	2299	2222	2112	1992	1845	1700	1542	1403	1260	1136	1002	900
BPLE	1	128	128	128	128	125	124	121	119	114	109	103	98	92	88
BPLE	2	219	218	217	213	207	202	194	187	177	167	156	145	131	123
BPLE	3	284	282	278	272	261	253	240	230	215	200	183	169	149	138
BPLE	4	330	328	322	313	300	288	271	257	238	219	198	180	157	144
BPLE	5	365	361	355	344	327	313	292	275	252	229	206	186	160	147
BPLE	6	391	387	379	366	346	330	304	286	260	235	210	189	163	149
BPLE	7	411	406	397	382	360	341	313	292	265	238	213	191	164	150
BPLE	8	426	420	410	393	368	348	317	296	268	240	214	192	165	151
BPLE	9	435	429	417	399	372	351	320	298	269	241	215	192	165	151
SNA 1	1	906	908	911	915	915	916	912	908	893	875	853	827	789	759
SNA 1	2	1583	1582	1577	1573	1558	1539	1509	1478	1429	1374	1309	1239	1154	1081
SNA 1	3	2100	2094	2080	2061	2022	1980	1918	1855	1765	1670	1560	1454	1330	1229
SNA 1	4	2488	2478	2453	2419	2359	2293	2196	2099	1975	1844	1701	1567	1419	1301
SNA 1	5	2781	2767	2732	2683	2602	2511	2383	2257	2101	1944	1778	1628	1463	1337
SNA 1	6	3005	2988	2943	2879	2778	2664	2506	2356	2178	2003	1822	1662	1488	1356
SNA 1	7	3178	3157	3104	3025	2902	2767	2587	2418	2224	2037	1848	1681	1502	1366
SNA 1	8	3311	3286	3223	3128	2985	2833	2634	2453	2248	2055	1861	1690	1508	1371
SNA 1	9	3408	3378	3303	3191	3032	2868	2660	2471	2261	2063	1867	1694	1511	1373

The aerial-access harvest estimates used to scale the estimates of relative change given in Table 4 do not include any provision for the harvest taken by shore based fishers, because the data these estimates were based on were solely derived from interviews with boat based fishers. The adjusted harvest tonnage estimates given in Table 5 do not, therefore, include any provision for harvests taken by shore based fishers.

Shore based fishers usually land fewer fish per trip than boat based fishers (Figure 13) and any likely reduction of the current daily bag limit would probably have little impact on harvests taken by this type of fisher. It is therefore assumed that any likely change to recreational catch regulations would have little impact on levels of harvesting by these fishers, and unadjusted regional harvest estimates for shore based fishers were simply added to all of the tonnage estimates given in Table 5 (Table 6). Any evaluation of the impact of an alternative minimum legal size limit on levels of shore based harvesting is not possible, because there are no length data available from onsite interviews of shore based fishers.

The regional estimates of the shore based harvest added to the tonnage estimates given in Table 5 were based on estimates provided by an offsite panel survey conducted by the National Research Bureau in 2011–12 (Wynne-Jones 2013).

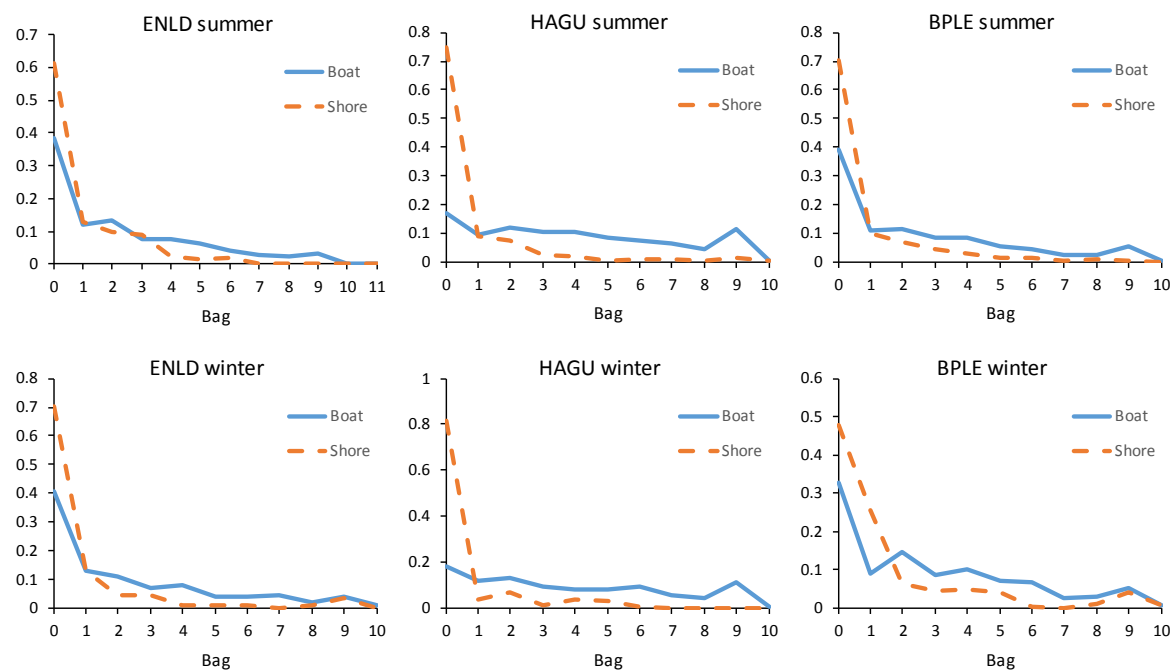


Figure 13: Comparison of bag size distributions reported by boat based and shore based fishers in each region of SNA 1, by season. These data were provided by a panel survey provided by the National Research Bureau in 2011–12.

The tonnage estimates given in Table 6 therefore provide the best available estimates of the likely impact that alternative combinations of alternative minimum legal size limits and daily bag limits might have had on the majority of the recreational harvest taken from each region of SNA 1 in 2011–12. These estimates do not, however, include any provision for harvests taken by recreational fishers from charter boats, which are likely to be in the order of 200 t (NRB, unpub. data).

Table 6: Estimates of the regional tonnage of snapper landed by boat and shore based fishers in SNA 1 in 2011–12 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	320	320	320	320	319	318	317	316	313	310	306	303	297	293
ENLD	2	451	450	447	445	440	434	427	423	416	407	396	387	375	364
ENLD	3	541	539	533	527	518	509	498	490	477	461	444	429	412	396
ENLD	4	600	598	590	581	569	558	541	528	513	492	470	450	432	413
ENLD	5	640	638	628	617	602	587	568	551	533	509	484	461	441	419
ENLD	6	668	666	654	642	625	608	583	564	544	517	491	466	446	424
ENLD	7	688	684	672	658	640	620	594	574	551	522	495	470	449	426
ENLD	8	701	698	685	670	649	628	599	578	554	524	497	471	450	427
ENLD	9	709	706	692	676	653	631	601	579	556	525	498	472	450	427
HAGU	1	654	656	659	664	668	671	671	670	661	653	640	622	597	574
HAGU	2	1110	1110	1110	1112	1108	1100	1084	1065	1032	997	953	904	844	791
HAGU	3	1472	1470	1465	1458	1440	1414	1376	1332	1270	1205	1129	1053	965	892
HAGU	4	1754	1748	1738	1721	1687	1643	1580	1510	1421	1330	1229	1133	1027	941
HAGU	5	1973	1964	1946	1919	1869	1807	1720	1627	1513	1402	1284	1178	1058	967
HAGU	6	2142	2132	2106	2068	2003	1923	1815	1702	1570	1447	1318	1204	1076	980
HAGU	7	2276	2263	2231	2181	2099	2003	1877	1748	1604	1473	1336	1217	1086	987
HAGU	8	2381	2364	2324	2262	2164	2053	1914	1776	1623	1487	1346	1223	1090	990
HAGU	9	2460	2440	2389	2313	2202	2082	1935	1790	1633	1493	1350	1226	1092	991
BPLE	1	229	230	230	229	227	225	222	220	216	210	205	200	193	189
BPLE	2	320	320	318	315	308	303	295	289	279	268	257	246	233	224
BPLE	3	385	383	380	373	363	354	342	331	316	301	285	270	251	239
BPLE	4	432	429	424	415	401	389	372	359	339	320	300	281	258	245
BPLE	5	466	463	456	445	429	414	393	377	353	331	307	287	262	248
BPLE	6	492	488	480	467	448	431	406	387	361	336	311	290	264	250
BPLE	7	512	508	498	484	461	442	414	394	366	340	314	292	265	251
BPLE	8	527	522	511	494	470	449	419	397	369	342	315	293	266	252
BPLE	9	537	530	519	501	474	453	421	399	370	343	316	294	266	252
SNA 1	1	1204	1206	1209	1212	1213	1214	1210	1206	1190	1173	1151	1125	1087	1057
SNA 1	2	1881	1880	1875	1871	1856	1837	1807	1776	1727	1672	1606	1537	1451	1379
SNA 1	3	2398	2392	2378	2359	2320	2278	2216	2153	2063	1968	1858	1752	1628	1527
SNA 1	4	2786	2775	2751	2716	2657	2590	2494	2397	2273	2142	1998	1865	1716	1599
SNA 1	5	3079	3065	3030	2981	2900	2809	2681	2555	2399	2242	2075	1925	1761	1635
SNA 1	6	3303	3286	3241	3177	3076	2961	2804	2654	2475	2301	2120	1960	1786	1654
SNA 1	7	3476	3455	3402	3323	3200	3065	2884	2715	2522	2335	2146	1979	1800	1664
SNA 1	8	3609	3584	3521	3426	3283	3130	2932	2751	2546	2353	2158	1988	1806	1669
SNA 1	9	3705	3676	3601	3489	3329	3166	2957	2769	2559	2361	2164	1992	1809	1671

Table 7: Estimates of the proportion by which the regional recreational harvest landed by boat and shore based fishers in SNA 1 in 2011–12 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

region	ENLD	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.56	0.57	0.58	0.59	
ENLD	2	0.36	0.36	0.37	0.37	0.38	0.39	0.40	0.40	0.41	0.43	0.44	0.45	0.49	
ENLD	3	0.24	0.24	0.25	0.26	0.27	0.28	0.30	0.31	0.33	0.35	0.37	0.40	0.44	
ENLD	4	0.15	0.16	0.17	0.18	0.20	0.21	0.24	0.26	0.28	0.31	0.34	0.36	0.42	
ENLD	5	0.10	0.10	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28	0.32	0.35	0.41	
ENLD	6	0.06	0.06	0.08	0.10	0.12	0.14	0.18	0.20	0.23	0.27	0.31	0.34	0.40	
ENLD	7	0.03	0.03	0.05	0.07	0.10	0.13	0.16	0.19	0.22	0.26	0.30	0.34	0.40	
ENLD	8	0.01	0.02	0.03	0.06	0.08	0.11	0.16	0.19	0.22	0.26	0.30	0.34	0.40	
ENLD	9	0.00	0.00	0.02	0.05	0.08	0.11	0.15	0.18	0.22	0.26	0.30	0.33	0.40	
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.75	0.76	0.77
HAGU	2	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.57	0.58	0.59	0.61	0.63	0.66	0.68
HAGU	3	0.40	0.40	0.40	0.41	0.41	0.43	0.44	0.46	0.48	0.51	0.54	0.57	0.61	0.64
HAGU	4	0.29	0.29	0.29	0.30	0.31	0.33	0.36	0.39	0.42	0.46	0.50	0.54	0.58	0.62
HAGU	5	0.20	0.20	0.21	0.22	0.24	0.27	0.30	0.34	0.38	0.43	0.48	0.52	0.57	0.61
HAGU	6	0.13	0.13	0.14	0.16	0.19	0.22	0.26	0.31	0.36	0.41	0.46	0.51	0.56	0.60
HAGU	7	0.07	0.08	0.09	0.11	0.15	0.19	0.24	0.29	0.35	0.40	0.46	0.51	0.56	0.60
HAGU	8	0.03	0.04	0.06	0.08	0.12	0.17	0.22	0.28	0.34	0.40	0.45	0.50	0.56	0.60
HAGU	9	0.00	0.01	0.03	0.06	0.10	0.15	0.21	0.27	0.34	0.39	0.45	0.50	0.56	0.60
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	0.57	0.57	0.57	0.57	0.58	0.58	0.59	0.59	0.60	0.61	0.62	0.63	0.64	0.65
BPLE	2	0.40	0.40	0.41	0.41	0.43	0.44	0.45	0.46	0.48	0.50	0.52	0.54	0.57	0.58
BPLE	3	0.28	0.29	0.29	0.30	0.32	0.34	0.36	0.38	0.41	0.44	0.47	0.50	0.53	0.55
BPLE	4	0.20	0.20	0.21	0.23	0.25	0.27	0.31	0.33	0.37	0.40	0.44	0.48	0.52	0.54
BPLE	5	0.13	0.14	0.15	0.17	0.20	0.23	0.27	0.30	0.34	0.38	0.43	0.47	0.51	0.54
BPLE	6	0.08	0.09	0.11	0.13	0.17	0.20	0.24	0.28	0.33	0.37	0.42	0.46	0.51	0.53
BPLE	7	0.05	0.05	0.07	0.10	0.14	0.18	0.23	0.27	0.32	0.37	0.41	0.46	0.51	0.53
BPLE	8	0.02	0.03	0.05	0.08	0.12	0.16	0.22	0.26	0.31	0.36	0.41	0.45	0.50	0.53
BPLE	9	0.00	0.01	0.03	0.07	0.12	0.16	0.22	0.26	0.31	0.36	0.41	0.45	0.50	0.53
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.68	0.68	0.69	0.70	0.71	0.71
SNA 1	2	0.49	0.49	0.49	0.50	0.50	0.50	0.51	0.52	0.53	0.55	0.57	0.59	0.61	0.63
SNA 1	3	0.35	0.35	0.36	0.36	0.37	0.39	0.40	0.42	0.44	0.47	0.50	0.53	0.56	0.59
SNA 1	4	0.25	0.25	0.26	0.27	0.28	0.30	0.33	0.35	0.39	0.42	0.46	0.50	0.54	0.57
SNA 1	5	0.17	0.17	0.18	0.20	0.22	0.24	0.28	0.31	0.35	0.39	0.44	0.48	0.52	0.56
SNA 1	6	0.11	0.11	0.13	0.14	0.17	0.20	0.24	0.28	0.33	0.38	0.43	0.47	0.52	0.55
SNA 1	7	0.06	0.07	0.08	0.10	0.14	0.17	0.22	0.27	0.32	0.37	0.42	0.47	0.51	0.55
SNA 1	8	0.03	0.03	0.05	0.08	0.11	0.16	0.21	0.26	0.31	0.37	0.42	0.46	0.51	0.55
SNA 1	9	0.00	0.01	0.03	0.06	0.10	0.15	0.20	0.25	0.31	0.36	0.42	0.46	0.51	0.55

Co-fishers pooling bag limits

The analyses presented so far were based on catch-per-fisher data as reported to the interviewer in 2011–12. The assumption has been made that the catch of each fisher was constrained by their personal daily bag limit, regardless of the uncaught bag allowance of others fishing from the same boat. This “independent harvesting” behaviour is most likely in situations where fishers fish competitively, or when fishing with strangers from a charter boat. Although this assumption may be valid for most interviewed fishers, it is less likely to hold true when at least one fisher in a party reaches the current daily bag limit of 9 fish.

Fishers in other parties will often fish together, sharing any fish caught, and essentially pooling their daily bag limits. This “co-fisher harvesting” behaviour is more likely when there is a strong social bond between fishers, e.g. when a family fishes together. A scenario comparing the outcome of these two behaviours is shown in (Figure 14).

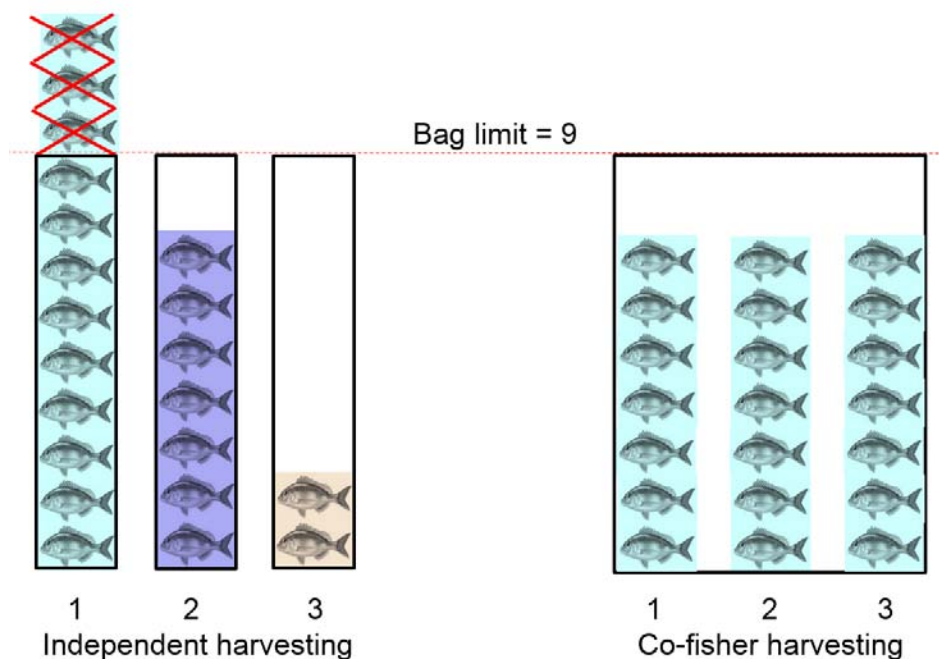


Figure 14: Schematic representation of two ways that a party of three fishers might interpret how the current daily bag limit of 9 snapper per fisher constrains their catch. Under the independent harvesting scenario, fisher 1 discards the last 3 fish they caught (or stops fishing early), to stay within their daily bag limit. Under the co-fisher harvesting scenario, all fishers in a party can retain fish as long as they stay within their combined daily bag limit, and there is therefore no need to discard any fish in this instance.

Most fishers do not currently land their daily bag limit of 9 fish, and the incidence of co-fisher harvesting behaviour will therefore not be as pronounced as it would be if a lower daily bag limit was set.

The impact of alternative combinations of increased minimum legal size limits and decreased daily bag limits was therefore reassessed, based on 2011–12 boat catch data reconfigured to reflect that which would have been reported if co-fishers in the same party had pooled their daily catch limits.

Under this scenario, any uncaught component of a fisher's daily bag allowance was allocated between other fishers in the same party in the following manner. If there are n fishers in a surveyed boat v , and the fishers' catch bags are $c_1, c_2, \dots, c_m, \dots, c_n$ and $c'_1, c'_2, \dots, c'_m, \dots, c'_n$ before and after applying bag limit b , and the mean catch of the n fishers is $\bar{c} = \frac{1}{n} \sum_{i=1}^n c_i$ and c_1, c_2, \dots, c_m are larger than b , then when $\bar{c} \leq b$, $c'_1 = c_1, c'_2 = c_2, \dots, c'_m = c_m, \dots, c'_n = c_n$.

When $\bar{c} > b$ however, the excess catch for boat v is $c^o = \sum_{i=1}^n c_i - n \cdot b$, which has to be deducted from the m fishers' bags. To do this, we generate a vector $k = \{f_1, f_1, \dots, f_1, f_2, \dots, f_2, f_m, \dots, f_m\}$, in which the numbers of f_1, f_2, \dots, f_m are respectively c_1, c_2, \dots, c_m . Then we randomly sample the vector k c^o times and calculate the subtotal for 1, 2, ..., m , i.e., $c_1^o, c_2^o, \dots, c_m^o$. The bags after applying the bag limit will be $c'_1 = c_1 - c_1^o, c'_2 = c_2 - c_2^o, \dots, c'_m = c_m - c_m^o, c'_{m+1} = c_{m+1}, \dots, c'_n = c_n$.

An example of this uncaught bag reallocation process is given in Figure 15.

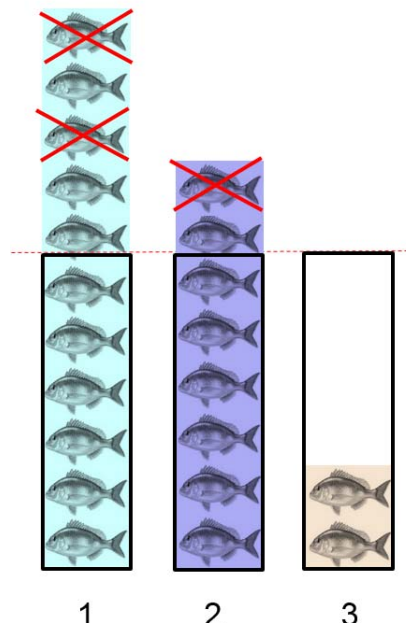


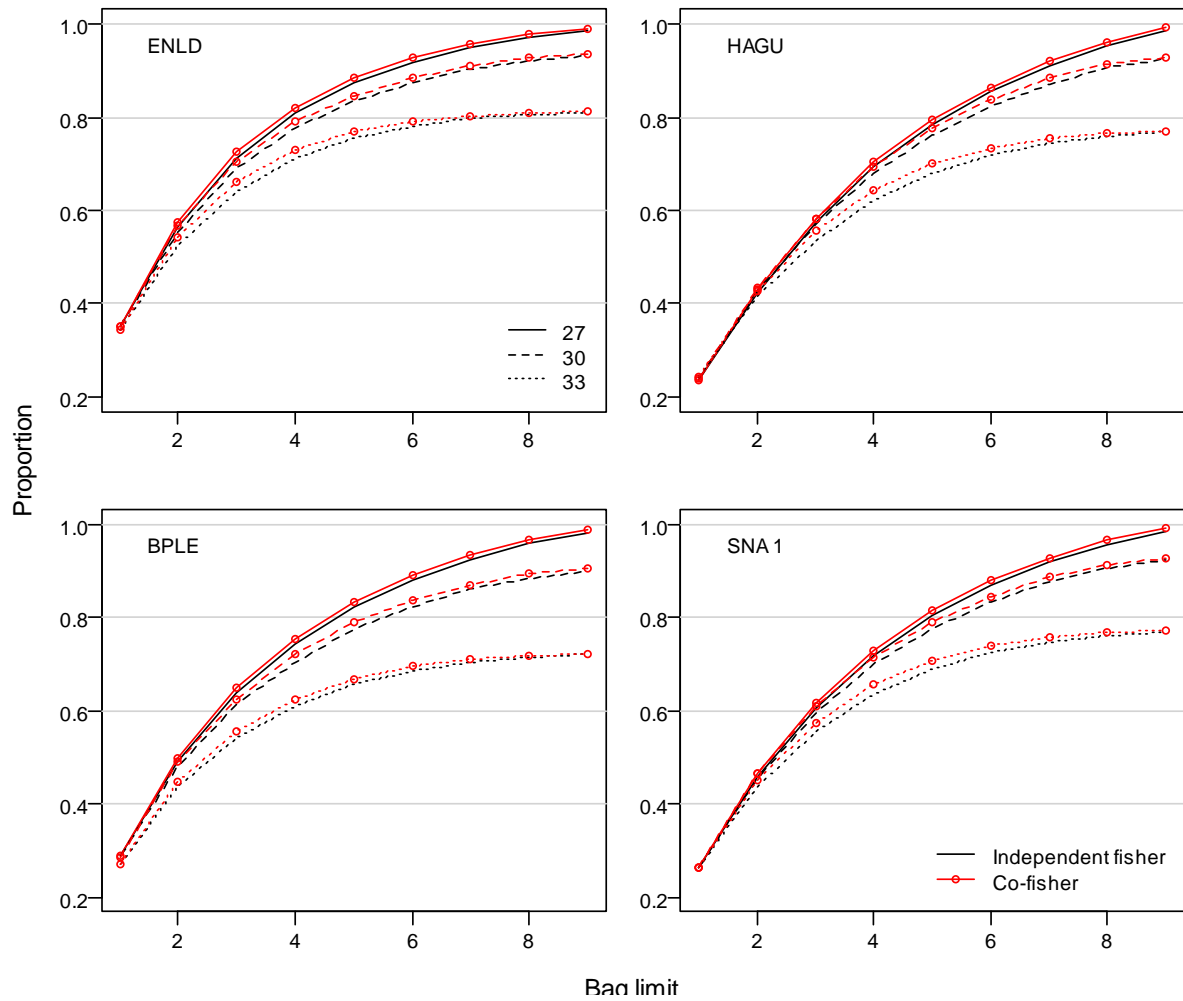
Figure 15: Schematic representation of the reallocation of an uncaught daily bag allowance to other fishers in the same party whose catch would have been constrained by a bag limit of six fish. In this scenario, fisher 3 under caught their daily bag limit by 4 fish, and this uncaught allowance was randomly allocated to fishers 1 and 2, who only had to discard part of their over catch of the daily bag limit.

The interview data collected in 2011–12 were reconfigured in this manner, for alternative combinations of increasing minimum legal size limit and decreasing daily bag limit. This reallocation process followed the initial removal of snapper smaller than the candidate minimum legal size, as before, when independent harvesting behaviour was assumed.

Tables and figures of regional changes in harvest tonnage and proportion of total catch landed under alternative combinations of minimum legal size limits and daily bag limits, assuming co-fisher harvesting behaviour, are given in Appendix 2. Predicted catches under this scenario are very similar but higher than those initially derived from unaltered boat ramp interview data collected in 2011–12, when independent harvesting behaviour was assumed. Estimates of the proportional change in total harvest tonnage assuming independent and co-fishing behaviour are compared for three different minimum legal size limits in Figure 16. These plots suggest that alternative interpretations of fisher harvesting behaviour would have little influence on the predicted impact of

any combination of the two management controls assessed here, given the manner in which interviewed fishers reported the apportioning of their catch in 2011–12.

Figure 16: Comparison of estimates of proportional change in the total weight of snapper landed in 2011–12, given 27 cm, 30 cm and 33 cm minimum legal size limits and daily bag limits ranging from 1 to 9 fish, when fishers are assumed to harvest independently of each other, and when they pool their daily bag limits with co-fishers.



Evaluation of bag and size limit options based on interview data collected in 2004–05

All of the analyses of data collected in 2011–12 were repeated using data collected in 2004–05, to give some indication of how alternative management controls might affect levels of recreational harvesting when the availability of snapper to recreational fishers in SNA 1 is lower, and smaller snapper were more commonly landed (Figure 17; see Figures 4 and 5 also).

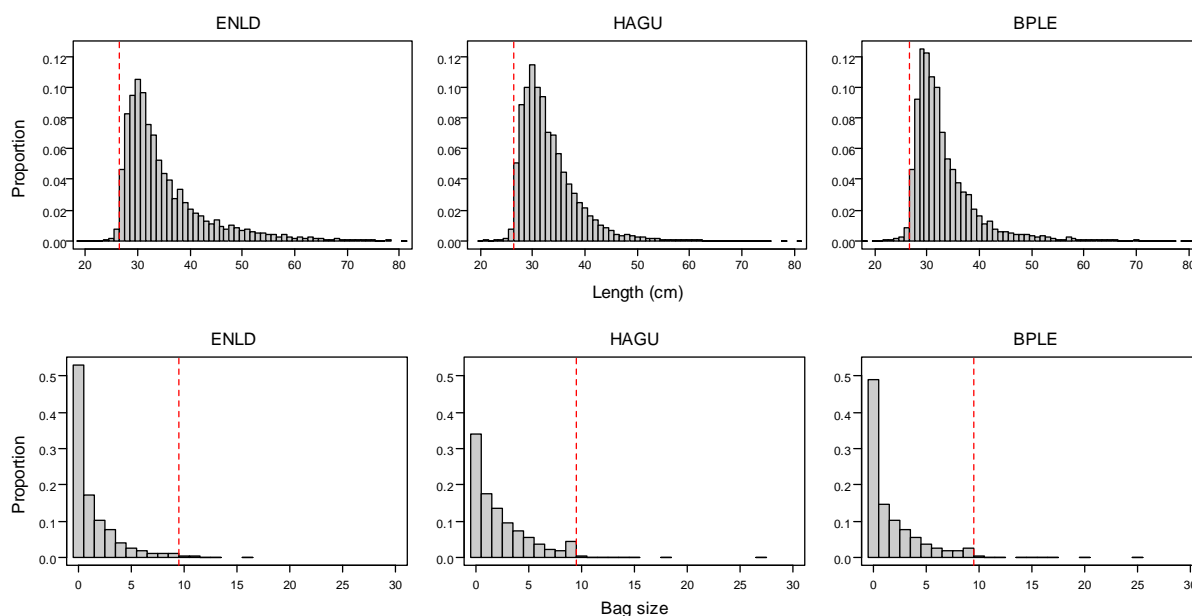


Figure 17: The length composition of snapper landed by fishers interviewed in each region of SNA 1 during the 2004–05 fishing year (top panels) and associated distributions of the number of snapper landed by these fishers (bottom panel).

Interview data are available for a continuous twelve month period in 2004–05, although the aerial-access survey at that time ran from 1 December 2004 to 30 November 2005, which did not conform to the standard fishing year. Only slight seasonal differences in catch composition were apparent in all three sub-areas, where larger fish were more evident during the winter months of June to January (Figure 18), and larger bag sizes were more likely during autumn, between February and May (Figure 19).

Tables and figures of regional changes in harvest tonnage and proportion of total catch landed under alternative combinations of minimum legal size limits and daily bag limits, based on data collected in 2004–05 are given in Appendices 3 (when independent fisher harvesting behaviour is assumed) and Appendix 4 (when co-fisher fisher harvesting behaviour is assumed). As in 2011–12, assumed harvesting behaviour appears to have little influence on predictions of relative change in harvesting levels under different regulatory scenarios (Figure 20).

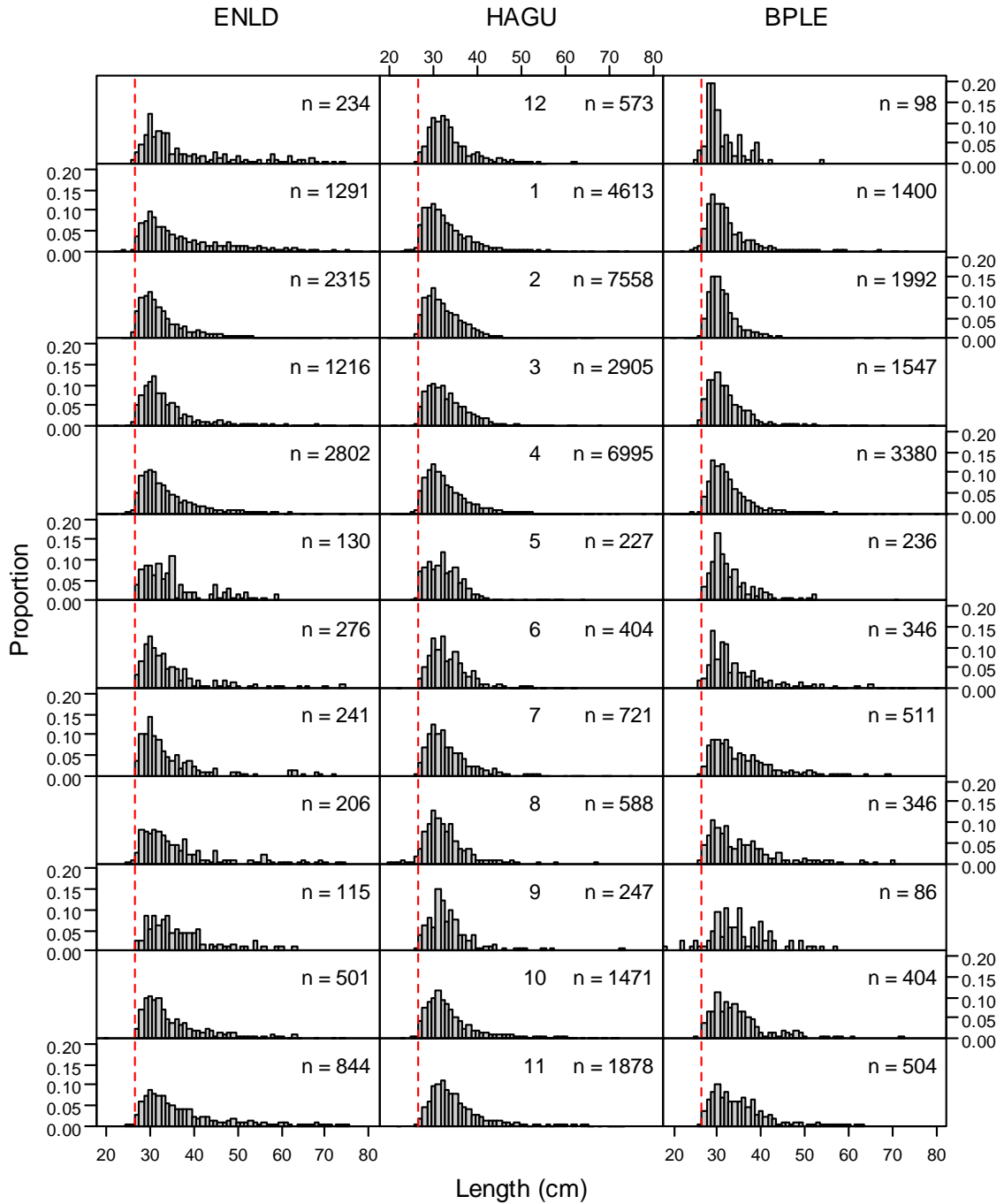


Figure 18: Length frequencies of snapper landed by recreational fishers in three sub-areas of SNA 1 in 2004–05, by month.

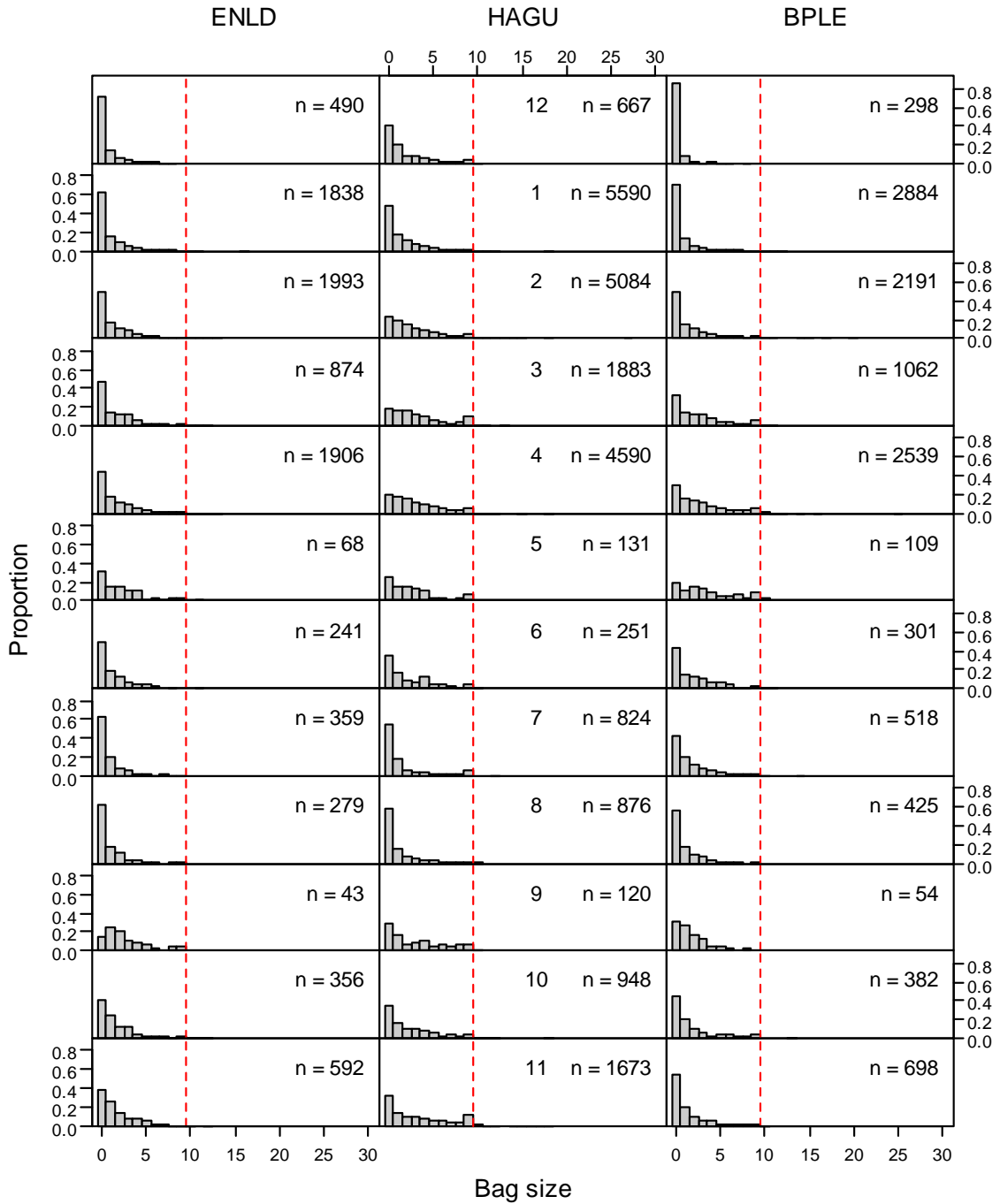


Figure 19: Number of snapper landed per trip by recreational fishers in three sub-areas of SNA 1 in 2004-05, by month.

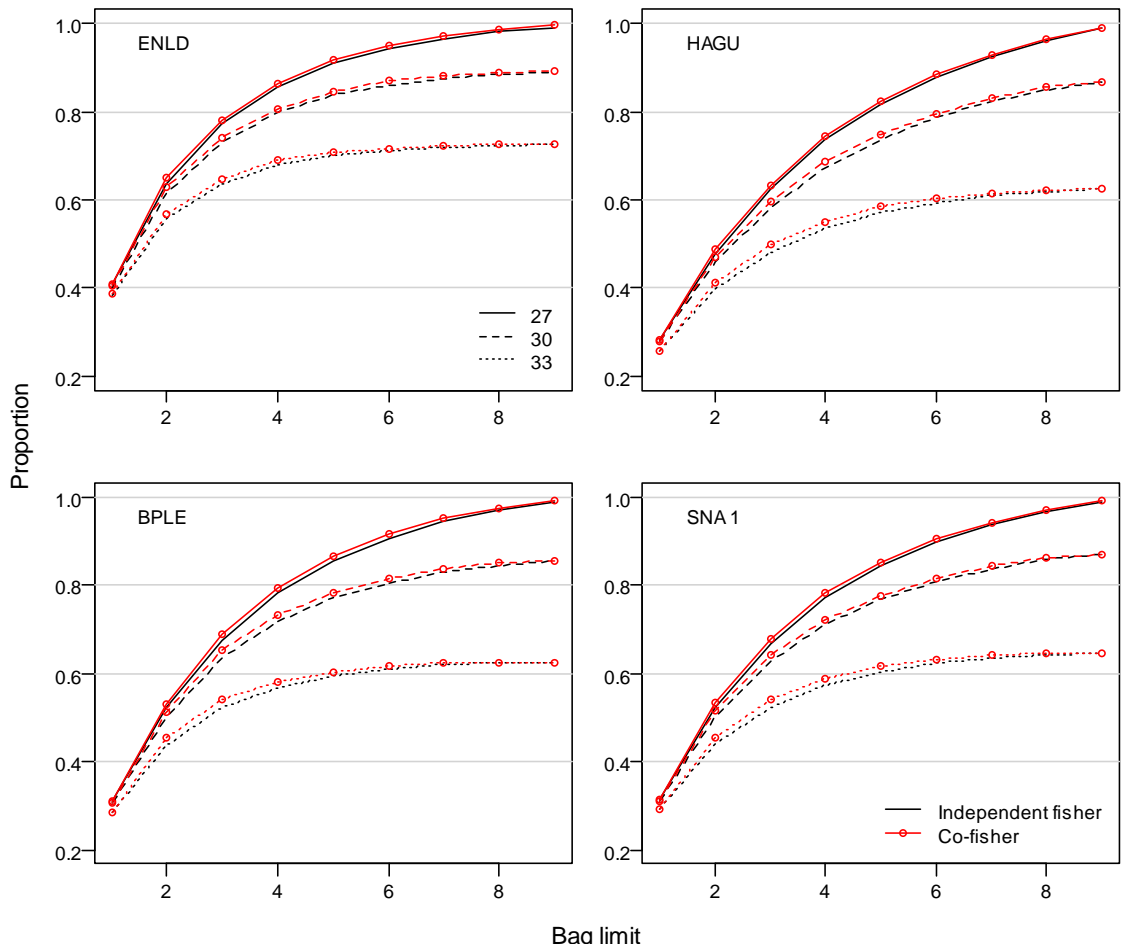


Figure 20: Comparison of estimates of proportional change in the total weight of snapper landed in 2004–05, given 27 cm, 30 cm and 33 cm minimum legal size limits and daily bag limits ranging from 1 to 9 fish, when fishers are assumed to harvest independently of each other, and when they pool their daily bag limits with co-fishers.

Although the harvest tonnages predicted under differing management regimes in 2004–05 probably underestimate the likely level of landings taken by recreational fishers in the immediate future, they do give some insight into the influence of changes to daily bag limits relative to changes in minimum legal size limits (Figure 21).

The most evident difference is that changes in minimum legal size limits in 2004–05 have a far greater influence on levels of recreational harvesting than they do in 2011–12, i.e. the spread between predictions for minimum size limits ranging from 27 cm to 33 cm was much greater in 2004–05. This is because fish in the smaller length classes accounted for a greater proportion of recreational landings in 2004–05.

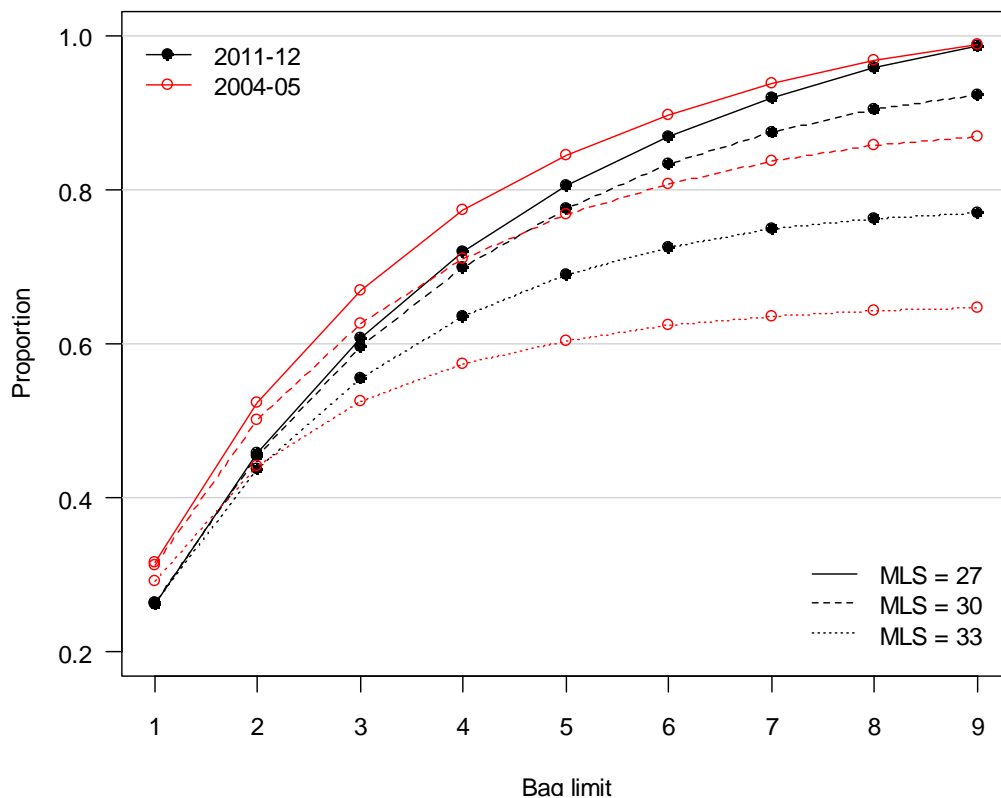


Figure 21: Comparison of estimates of proportional change in the total weight of snapper landed in 2004–05 and in 2011–12, given 27 cm, 30 cm and 33 cm minimum legal size limits and daily bag limits ranging from 1 to 9 fish. Independent fisher behaviour was assumed in both years.

The relative efficacy of size and bag limits also differed by year. There was a greater interannual degree of discrepancy between estimates of change at lower daily bag sizes when the MLS was set to 27 cm, and at higher bag sizes when the MLS was set to 33 cm. Predicting the future influence of differing combinations of size and bag limit controls on levels of recreational harvesting is therefore limited by the extent to which we can accurately predict the availability of snapper and the size structure of recreational landings in the future.

Distribution of fishing effort

The results of the recent SNA 1 stock assessment and the public reaction to proposed changes in recreational fishing regulations has led to considerable speculation about the relative and spatial impact of recreational and commercial fishers on the SNA 1 stock. The spatial distribution of the four main methods of harvesting in SNA 1 is provided here, to help assess the degree of overlap between the recreational and commercial sectors.

Vessel location data from aerial surveys provides high resolution information on the spatial distribution of recreational fishing effort. The most recent information on recreational fishing effort comes from an aerial overflight survey conducted in 2011–12 (Hartill et al. 2013). Flights were scheduled to take place during the late morning, which broadly corresponds to the period of peak fishing effort. Aerial observers recorded the approximate location of each vessel, and assigned each boat to a vessel category (trailer boats, launches, yachts, kayaks, and jet skis). Only stationary boats considered to be fishing were counted, as snapper are only very rarely caught from mobile vessels.

The spatial distribution of recreational fishing effort in 2011–12 in the Hauraki Gulf is shown in the top left panel of Figure 22, and for the whole of SNA 1, in the top left panel of Figure 23. Recreational fishing boats were observed along the entire coastal margin of north-eastern New Zealand, with most effort concentrated close to large population centres, especially Auckland, Tauranga and Whangarei. Densities of fishing vessels were particularly high in the Motuihie Channel, Rangitoto Channel, within large mussel farms off the western Coromandel coast, and in the inner Waitemata Harbour.

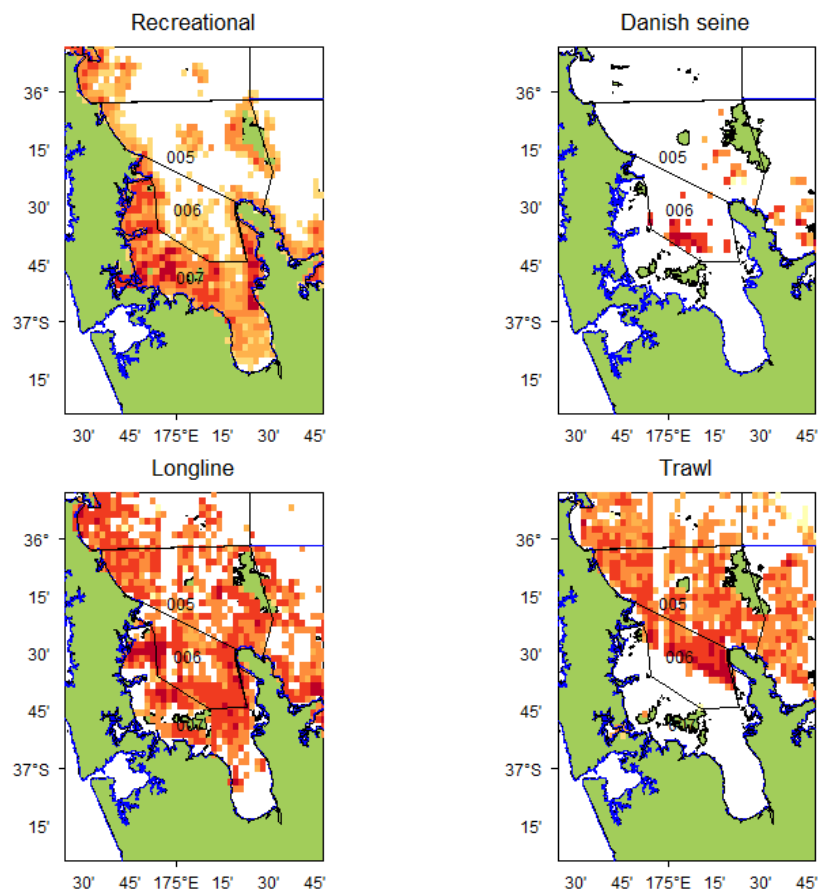


Figure 22: The spatial distribution of recreational fishing boats observed in the Hauraki Gulf from the air in 2011–12 (top left panel) compared to the spatial distribution of snapper catches taken by three commercial fishing methods during the same fishing year. Yellow squares denote areas that are lightly fished, whereas dark red squares denote the areas that were most intensively fished by that method.

The range of values associated with each colour differs by panel, as data ranges differ by fishing method.

Smaller scale seasonal shifts in the distribution of effort were also evident from the air. Large numbers of boats launched in Auckland, for example, were seen in open waters north of Rangitoto Island in the spring of 2011–12, with effort shifting further inshore during the warmer months. Fishing effort in the inner Waitematā Harbour was very intense in February and early March. The spatial distribution of fishing effort in 2011–12 was very similar to that seen in 2004–05, although less effort was observed in the inner Waitematā Harbour and in the large mussel farm in the north-eastern Firth of Thames in the earlier survey.

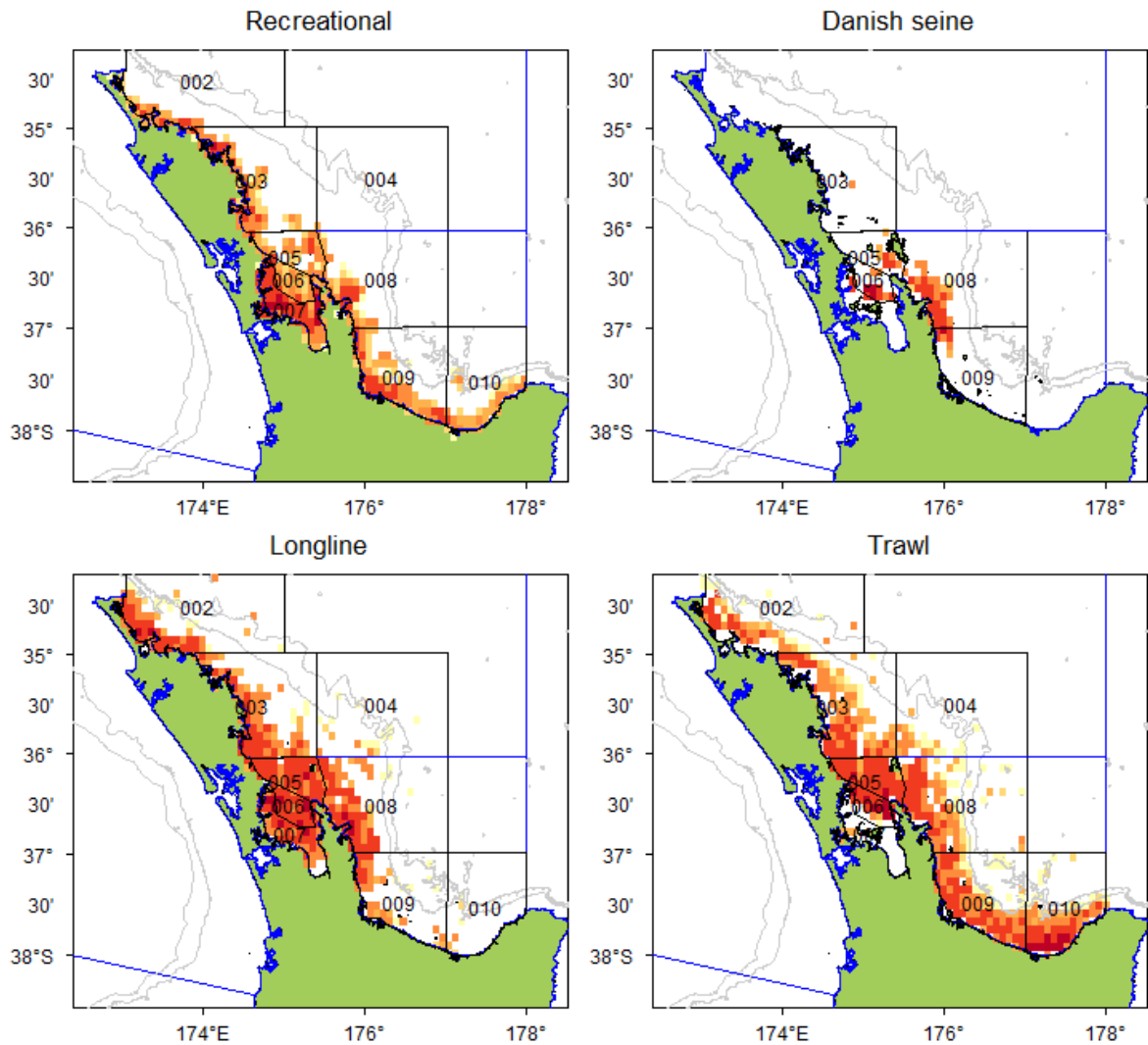


Figure 23: The spatial distribution of recreational fishing boats observed in SNA 1 from the air in 2011–12 (top left panel) compared to the spatial distribution of snapper catches taken by three commercial fishing methods during the same fishing year. Yellow squares denote areas that are lightly fished, whereas dark red squares denote the areas that were most intensively fished by that method. The range of values associated with each colour differs by panel, as data ranges differ by fishing method.

Figures 22 and 23 also given an indication of the degree of spatial overlap between the recreational fishery and the main snapper harvesting components of the commercial fishery. The greatest degree of overlap occurs with the longline fishery, although the seasonal closure of waters inside the inner

Hauraki Gulf Islands to commercial fishing during summer months reduces the extent of any spatial conflict with the recreational fleet. Danish seiners are not permitted to fish in statistical reporting area 007 (the inner Hauraki Gulf) but the seine fleet fishes as close as it can to Auckland in the southern waters of area 006. The only area of appreciable overlap with the commercial fishery occurs on the north-eastern Coromandel coast. Most of the area fished by both recreational fishers and trawlers falls outside of the Hauraki Gulf because only smaller trawlers can fish the outer waters of area 006 and most trawling in the Gulf occurs in the deeper waters of statistical reporting area 005.

DISCUSSION

The availability and size of snapper caught by recreational fishers in parts of SNA 1 has increased substantially in recent years, and current daily bag and minimum legal size limits no longer constrain recreational landings within the sector's current catch allocation of 2300 t. Creel survey data collected throughout 2004–05 and 2011–12 have been used to estimate the harvest that would have been expected in those years, if alternative combinations of reduced daily bag limits and increased minimum legal size limits had been in force at that time. The estimates of projected change in harvest tonnage based on 2011–12 data should be far more relevant to fisheries managers at this time, as these data are more likely to reflect the state of the SNA 1 fishery in the near future. Anecdotal reports suggest that the fishing in the Hauraki Gulf during the summer of 2012–13 was not as good as in 2011–12, but the weather last summer was more conducive to fishing, and any resulting increase in effort will have at least partially offset any reduction in the average catch landed per trip.

Almost all of the recent increase in the harvest has occurred in the Hauraki Gulf, where a large proportion of fishers now land several snapper per trip and many catch their daily bag limit of 9 fish. Consequently, any decrease in the daily bag limit will have the greatest effect on fishers in the Gulf, as a far smaller proportion of East Northland and Bay of Plenty fishers land bags approaching 9 fish. Modest decreases to the daily bag limit will have a limited impact on levels of recreational harvesting throughout SNA 1, because most fishes land a fraction of the current bag limit and those who currently land 9 fish from a trip will still be able to land most of their catch if the daily limit is reduced.

A modest increase in the minimum legal size limit would also have only a limited impact on levels of recreational harvesting, for two reasons. Firstly, because the weight of a snapper increases exponentially with increasing length, and fish that are only slightly larger than the current minimum legal size limit account for a relatively low proportion of the total weight harvested. Secondly, because the length distribution of snapper landed in all three regions in 2011–12 peaked several cm higher than the current minimum legal size limit of 27 cm, which suggests that many fishers already release smaller legal sized fish.

A simplistic yield-per-recruit model with a single method knife-edge selectivity ogive was completed many years ago, which suggested that the maximum yield occurred somewhere in the region of 27 cm to 30 cm (Jeremy McKenzie, NIWA Fisheries Scientist, pers. comm.). Any attempt to assess yield-per-recruit trends should be implemented in CASAL, however, to properly account for all forms of fishing selectivity, given our current knowledge of snapper biology. The current minimum legal size limit of 27cm is well above the size at which the onset of sexual maturity occurs, at about 23 cm.

Multiple combinations of bag and size limit settings could be used to achieve a given reduction in levels of recreational harvesting, but the best options are not immediately apparent. There are also other potential issues to consider when choosing regulation settings. Any increase in the minimum legal size limit will result in more fish being caught and released, which will lead to increased levels of incidental discard mortality. Conversely, decreasing the daily bag limit should decrease discard

mortality levels, as some fishers will catch their limit sooner, and stop fishing. Some fishers may change their selectivity, however, to maximise the weight of fish landed given a reduced bag limit. Any attempt to quantify the implications of assumed fisher behaviour in response to future changes in size and bag limits would be speculative, however, as fisher responses will vary to an unknown and unpredictable degree.

The current level of release mortality attributable to the recreational fishery is likely to be relatively low. Holdsworth and Boyd (2008a and 2008b) used data on release fish length, hook location and condition reported by boat based fishers and independently observed on charter boats to estimate the level of release mortality occurring in all three regions of SNA 1, in 2004–05, 2005–06, and in 2006–07. Estimates of the additional mortality associated with released snapper in 2006–07 ranged from 2.7% by weight (if all floating, gut hooked and floating fish died after their release) to 8.2% (if the potential effects of barotrauma given capture depth were also taken into account). Corresponding estimates for 2005–06 were 3.6% and 7.5% respectively.

This report therefore provides indicative estimates of the potential level of recreational harvesting that could occur in the near future given alternative daily bag and minimum legal size limit settings. These estimates are based on extensive volumes of survey data collected throughout the most recent fishing year, which have also been used to generate regional harvest estimates that are considered to be reasonably accurate and unbiased. Recreational harvests will probably continue to exceed their current annual allocation of 2300 t for some time, if changes are not made to current daily bag and minimum size limit settings, such as those considered here.

ACKNOWLEDGEMENTS

This work was funded by the Ministry of Fisheries as part of MAF201102. The authors wish to thank members of the Marine Amateur Fisheries Working Group who reviewed these analyses and Ian Tuck who reviewed this report.

REFERENCES

- Hartill, B.; Bian, R.; Armiger, H.; Vaughan, M.; Rush, N. (2007). Recreational marine harvest estimates of snapper, kahawai and kingfish in QMA 1 in 2004–05. *New Zealand Fisheries Assessment Report 2007/26*. 44 p.
- Hartill, B.; Bian, R.; Rush, N.; and Armiger, H. (2013). Aerial-access recreational harvest estimates for snapper, kahawai, red gurnard, tarakihi and trevally in FMA 1 in 2011–12. Final Research Report for MAF201102. 45 p.
- Holdsworth, J.C.; Boyd, R. O. (2008a). Size, condition, and estimated release mortality of snapper (*Pagrus auratus*) caught in the SNA 1 recreational fishery, 2004–05 and 2005–06. *New Zealand Fisheries Assessment Report 2008/45*. 45 p.
- Holdsworth, J.C.; Boyd, R. O. (2008b). Size, condition, and estimated release mortality of snapper (*Pagrus auratus*) caught in the SNA 1 recreational fishery, 2006–07. *New Zealand Fisheries Assessment Report 2008/53*. 37 p.
- McKenzie, J.R.; Parsons, D.M. (in press). Fishery characterisations and catch-per-unit-effort indices for three sub-stocks of snapper SNA 1, 1989–90 to 2009–10. Draft *Fisheries Assessment Report*. 113 p.
- Paul, L. J. (1976). A study on age, growth and population structure of the snapper, *Chrysophrys auratus* (Foster), in the Hauraki Gulf, New Zealand. *Fisheries Research Bulletin No. 13*. 62 p.
- Wynne-Jones, J.; Heinemann, A.; Gray, A.; Hill, L. (2013). NZ recreational marine fishing survey 2011-2012. Final Research Report for MAF201001. 63 p.

DATA MANAGEMENT

No data have been generated as part of this programme.

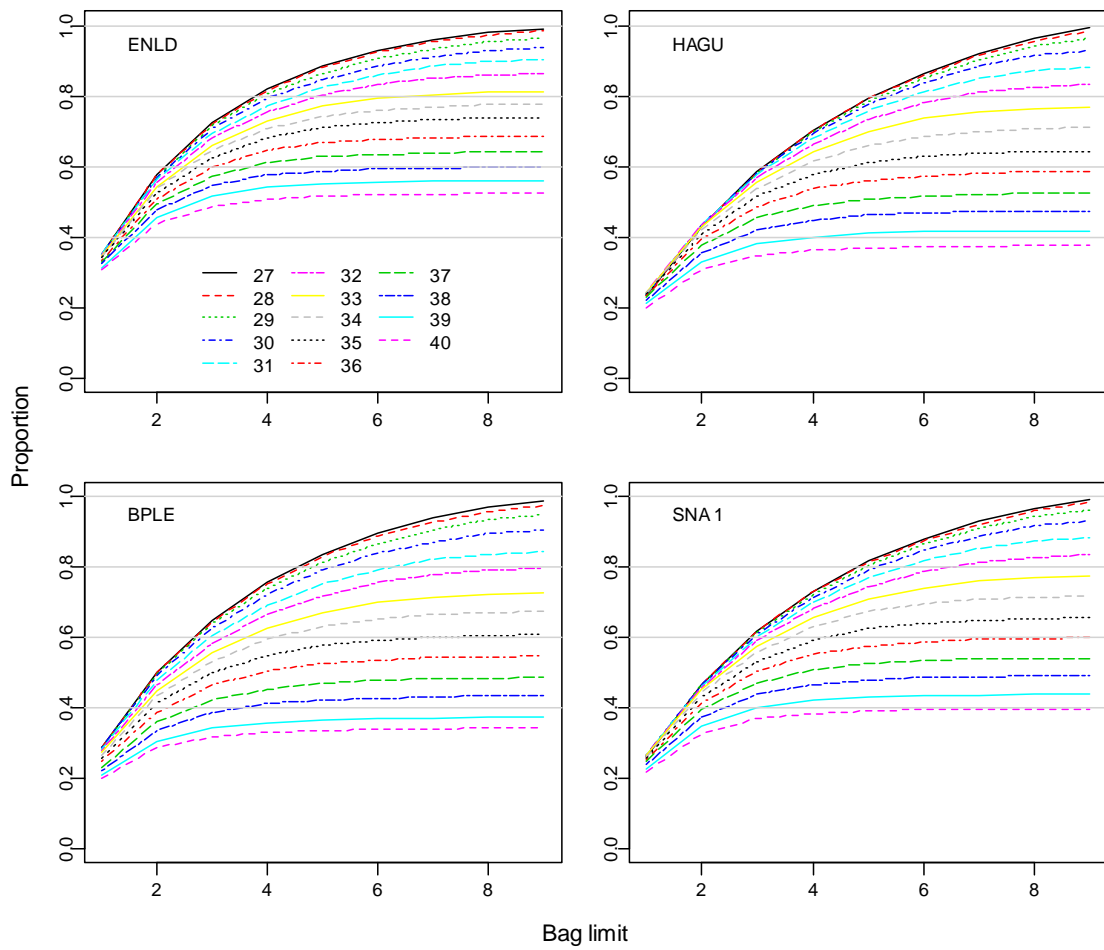
Appendix 1: Questions routinely asked by interviewers during boat ramp surveys conducted by NIWA to date

- *"Hello, my name is and I am doing a recreational fishing scientific research survey for NIWA on behalf of the Ministry of Fisheries. Can I ask you a few questions about your fishing today? "*
- *"How many people were fishing today?"*
- *"Roughly, where did you do most of your fishing today?"*
A laminated map (with codes) defining each fishing location is provided.
- *"What was the main fishing method used today?" "Was it with bait, soft plastic bait, lures?"*
- *"Were you fishing for any particular species of fish today?"*
- *"At what time did you put your fishing lines in the water and start to fish today?"*
- *"At what time did you finish fishing today?"*
- *"Were you all fishing for approximately the same amount of time today?"*
- *"In between the time you first put your lines in the water, and last took them out, were there times that you were not fishing eg, water skiing, gone ashore for lunch"*
- *"How many days have you been fishing in the last year, a year being the previous 12 months?"*
- *"Can I please measure your fish?"*
- *"As best you can remember, can you please divide this catch up amongst each of you who caught the fish?"*
- *"Did your group catch today any fish that
... were filleted (including headed fish)?"
... were used for bait?"
... were thrown back?"*

... were they undersized or legal sized?"
... if undersized, how many where thrown back dead or alive?

Appendix 2: Evaluation of the impact alternative combinations of minimum legal size limits and daily bag limits on the recreational harvest from SNA 1, based on interview data collected in 2011–12, assuming co-fisher harvesting behaviour.

Appendix 2a: Estimates of the proportional change in the total weight of snapper landed in each region of SNA 1 in 2011–12 for alternative minimum legal size limits ranging from 27 to 40 cm, for daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates.



Appendix 2: continued –based on interview data collected in 2011–12, assuming co-fisher harvesting behaviour.

Appendix 2b: Estimates of the proportion by which the regional recreational harvest from SNA 1 in 2011–12 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.67	0.67	0.68	0.69
ENLD	2	0.42	0.42	0.43	0.43	0.43	0.44	0.45	0.46	0.47	0.49	0.50	0.52	0.54	0.56
ENLD	3	0.27	0.27	0.28	0.29	0.30	0.32	0.33	0.35	0.37	0.39	0.42	0.45	0.47	0.51
ENLD	4	0.17	0.17	0.19	0.20	0.22	0.24	0.26	0.28	0.31	0.34	0.38	0.42	0.45	0.49
ENLD	5	0.11	0.11	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.32	0.36	0.40	0.44	0.48
ENLD	6	0.06	0.07	0.09	0.11	0.13	0.16	0.20	0.23	0.27	0.31	0.36	0.40	0.43	0.47
ENLD	7	0.03	0.04	0.06	0.08	0.11	0.14	0.19	0.22	0.26	0.31	0.35	0.40	0.43	0.47
ENLD	8	0.01	0.02	0.04	0.06	0.10	0.13	0.18	0.22	0.26	0.31	0.35	0.39	0.43	0.47
ENLD	9	0.00	0.01	0.03	0.06	0.09	0.13	0.18	0.22	0.26	0.31	0.35	0.39	0.43	0.47
HAGU	1	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.78	0.79	0.80	
HAGU	2	0.57	0.57	0.57	0.56	0.56	0.56	0.57	0.58	0.59	0.60	0.62	0.64	0.67	0.69
HAGU	3	0.41	0.41	0.41	0.41	0.42	0.43	0.44	0.46	0.48	0.51	0.54	0.58	0.62	0.65
HAGU	4	0.29	0.29	0.30	0.30	0.31	0.33	0.35	0.38	0.42	0.46	0.50	0.55	0.60	0.63
HAGU	5	0.20	0.20	0.21	0.22	0.24	0.26	0.30	0.33	0.39	0.43	0.49	0.53	0.59	0.63
HAGU	6	0.13	0.13	0.14	0.16	0.18	0.21	0.26	0.31	0.37	0.42	0.48	0.53	0.58	0.62
HAGU	7	0.07	0.08	0.09	0.11	0.14	0.18	0.24	0.30	0.36	0.41	0.47	0.52	0.58	0.62
HAGU	8	0.03	0.04	0.05	0.08	0.12	0.17	0.23	0.29	0.35	0.41	0.47	0.52	0.58	0.62
HAGU	9	0.00	0.01	0.03	0.06	0.11	0.16	0.22	0.29	0.35	0.41	0.47	0.52	0.58	0.62
BPLE	1	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.74	0.75	0.76	0.78	0.79	0.80
BPLE	2	0.49	0.50	0.50	0.50	0.52	0.53	0.55	0.56	0.58	0.61	0.64	0.66	0.69	0.71
BPLE	3	0.34	0.35	0.35	0.37	0.39	0.41	0.44	0.46	0.50	0.53	0.57	0.61	0.65	0.68
BPLE	4	0.24	0.24	0.25	0.27	0.30	0.33	0.37	0.40	0.45	0.49	0.54	0.58	0.64	0.67
BPLE	5	0.16	0.16	0.18	0.20	0.24	0.27	0.32	0.36	0.42	0.47	0.53	0.57	0.63	0.66
BPLE	6	0.10	0.10	0.12	0.15	0.20	0.24	0.30	0.34	0.40	0.46	0.52	0.57	0.63	0.66
BPLE	7	0.05	0.06	0.08	0.12	0.17	0.21	0.28	0.33	0.39	0.45	0.51	0.56	0.63	0.66
BPLE	8	0.02	0.03	0.06	0.10	0.15	0.20	0.27	0.32	0.39	0.45	0.51	0.56	0.62	0.66
BPLE	9	0.00	0.02	0.04	0.08	0.15	0.20	0.27	0.32	0.39	0.45	0.51	0.56	0.62	0.66
SNA 1	1	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.75	0.76	0.77	0.78
SNA 1	2	0.53	0.53	0.53	0.53	0.53	0.54	0.55	0.55	0.57	0.58	0.60	0.62	0.65	0.67
SNA 1	3	0.38	0.38	0.38	0.39	0.40	0.41	0.42	0.44	0.46	0.49	0.52	0.56	0.60	0.63
SNA 1	4	0.26	0.27	0.27	0.28	0.30	0.31	0.34	0.37	0.40	0.44	0.49	0.53	0.58	0.61
SNA 1	5	0.18	0.18	0.19	0.20	0.23	0.25	0.29	0.32	0.37	0.42	0.47	0.52	0.57	0.61
SNA 1	6	0.11	0.12	0.13	0.15	0.17	0.21	0.25	0.30	0.35	0.41	0.46	0.51	0.56	0.60
SNA 1	7	0.06	0.07	0.08	0.11	0.14	0.18	0.24	0.29	0.35	0.40	0.46	0.51	0.56	0.60
SNA 1	8	0.03	0.03	0.05	0.08	0.12	0.17	0.23	0.28	0.34	0.40	0.46	0.51	0.56	0.60
SNA 1	9	0.00	0.01	0.03	0.06	0.11	0.16	0.22	0.28	0.34	0.40	0.45	0.51	0.56	0.60

Appendix 2: continued –based on interview data collected in 2011–12, assuming co-fisher harvesting behaviour.

Appendix 2c: Estimates of the regional tonnage of snapper landed by boat based fishers in SNA 1 in 2011–12 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2011–12, and the same harvest estimates have been used to weight together regional estimates. These harvest estimates do not include any provision for harvest taken by shore based fishers, which are included in the estimates given in Appendix 2d.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	214	214	214	214	213	212	211	211	207	204	200	198	191	187
ENLD	2	352	351	349	347	343	338	332	328	320	312	303	293	281	269
ENLD	3	444	442	437	431	423	415	404	396	383	368	351	336	318	300
ENLD	4	503	501	492	484	472	461	447	434	418	398	375	354	333	312
ENLD	5	541	538	529	518	504	491	472	454	435	411	385	361	339	317
ENLD	6	568	565	554	542	525	509	485	465	444	416	390	364	343	320
ENLD	7	587	583	571	557	539	520	492	471	449	419	392	366	344	321
ENLD	8	599	596	583	568	547	525	496	474	451	420	393	367	345	322
ENLD	9	606	603	589	573	550	528	497	475	451	421	393	367	345	322
HAGU	1	564	565	569	574	578	581	580	579	571	562	550	531	506	483
HAGU	2	1031	1033	1036	1040	1041	1036	1027	1012	984	949	906	857	793	738
HAGU	3	1400	1400	1397	1394	1381	1363	1332	1293	1233	1167	1091	1009	912	833
HAGU	4	1687	1683	1674	1661	1634	1597	1540	1473	1383	1286	1179	1077	960	871
HAGU	5	1907	1900	1884	1861	1818	1761	1679	1584	1465	1347	1221	1108	983	887
HAGU	6	2076	2066	2043	2010	1951	1873	1763	1646	1508	1378	1243	1124	993	895
HAGU	7	2207	2195	2166	2121	2042	1943	1812	1679	1529	1394	1254	1132	999	899
HAGU	8	2308	2293	2256	2195	2094	1980	1836	1695	1539	1401	1259	1135	1001	900
HAGU	9	2382	2361	2310	2231	2118	1996	1848	1702	1544	1404	1261	1136	1002	901
BPLE	1	128	128	128	127	125	123	121	119	114	109	103	98	91	88
BPLE	2	222	221	220	218	212	206	199	193	182	171	160	149	135	126
BPLE	3	288	286	283	277	267	259	246	236	221	205	188	173	152	140
BPLE	4	335	333	328	320	306	295	277	264	243	223	201	182	158	145
BPLE	5	371	367	361	350	333	319	297	280	255	232	208	187	161	147
BPLE	6	397	393	385	372	351	334	309	289	262	237	211	189	163	149
BPLE	7	416	411	402	387	364	345	316	294	266	240	213	191	164	150
BPLE	8	429	424	414	397	371	350	319	297	269	241	214	192	165	151
BPLE	9	439	432	420	402	374	353	321	299	270	242	215	193	165	151
SNA 1	1	906	908	911	915	916	916	912	909	892	875	854	828	789	758
SNA 1	2	1605	1606	1604	1604	1595	1581	1558	1532	1487	1433	1369	1298	1209	1133
SNA 1	3	2132	2129	2117	2103	2072	2036	1982	1925	1837	1741	1629	1518	1383	1274
SNA 1	4	2525	2517	2494	2465	2412	2353	2264	2171	2043	1907	1755	1613	1452	1327
SNA 1	5	2819	2806	2774	2729	2655	2571	2447	2319	2156	1989	1814	1656	1483	1351
SNA 1	6	3040	3023	2982	2924	2827	2717	2557	2401	2214	2031	1844	1678	1499	1364
SNA 1	7	3209	3189	3139	3065	2945	2808	2620	2444	2243	2052	1859	1688	1507	1370
SNA 1	8	3337	3312	3253	3160	3013	2855	2652	2466	2258	2062	1866	1694	1511	1373
SNA 1	9	3427	3396	3319	3205	3042	2877	2666	2476	2265	2066	1869	1696	1512	1374

Appendix 2: continued –based on interview data collected in 2011–12, assuming co-fisher harvesting behaviour.

Appendix 2d: Estimates of the regional tonnage of snapper landed by boat and shore based fishers in SNA 1 in 2011–12 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

		Minimum legal size														
region		27	28	29	30	31	32	33	34	35	36	37	38	39	40	
ENLD	ENLD	1	320	320	320	320	319	318	317	317	313	310	306	304	297	293
ENLD		2	458	457	454	452	449	444	438	434	426	418	409	399	387	375
ENLD		3	550	548	542	537	529	521	510	502	489	474	457	442	424	405
ENLD		4	609	606	598	590	578	567	553	539	523	504	481	460	439	417
ENLD		5	647	644	635	623	610	597	578	560	541	516	491	467	445	423
ENLD		6	674	671	660	648	631	615	591	571	550	522	496	470	448	426
ENLD		7	692	689	677	663	645	625	598	577	554	525	498	472	450	427
ENLD		8	705	702	689	674	653	631	602	580	557	526	499	473	451	427
ENLD		9	712	708	695	679	656	633	603	581	557	527	499	473	451	428
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
HAGU		1	654	656	659	664	668	671	671	670	661	653	641	622	597	574
HAGU		2	1121	1124	1126	1130	1132	1127	1117	1103	1075	1040	997	947	884	828
HAGU		3	1491	1490	1488	1484	1472	1454	1422	1383	1323	1258	1181	1100	1003	924
HAGU		4	1778	1773	1765	1751	1724	1687	1630	1564	1473	1377	1270	1167	1051	961
HAGU		5	1998	1990	1975	1952	1908	1852	1769	1675	1555	1437	1312	1199	1073	978
HAGU		6	2166	2156	2133	2101	2041	1964	1854	1737	1598	1469	1333	1215	1084	986
HAGU		7	2298	2286	2256	2211	2133	2034	1903	1770	1619	1484	1344	1222	1089	989
HAGU		8	2399	2383	2346	2286	2185	2070	1927	1786	1629	1492	1349	1225	1092	991
HAGU		9	2473	2452	2400	2321	2208	2087	1938	1793	1634	1495	1351	1227	1093	992
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
BPLE		1	229	230	229	229	227	225	222	220	216	210	205	200	193	189
BPLE		2	323	323	322	319	313	308	300	294	284	272	261	250	237	227
BPLE		3	389	388	385	379	369	360	348	338	323	307	289	274	254	242
BPLE		4	437	434	430	421	408	396	379	365	344	324	303	284	260	247
BPLE		5	472	469	462	452	435	420	398	381	357	333	309	288	262	249
BPLE		6	498	494	486	473	452	436	410	391	364	338	313	291	264	250
BPLE		7	517	512	503	488	465	446	417	396	367	341	315	292	265	251
BPLE		8	531	526	515	498	473	452	421	399	370	342	316	293	266	252
BPLE		9	540	533	522	503	476	454	422	400	371	343	316	294	266	252
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
SNA 1		1	1204	1206	1209	1213	1214	1214	1210	1207	1190	1173	1151	1126	1087	1056
SNA 1		2	1902	1904	1902	1902	1893	1879	1856	1830	1785	1730	1667	1596	1507	1431
SNA 1		3	2430	2426	2415	2400	2370	2334	2280	2223	2135	2039	1927	1816	1681	1571
SNA 1		4	2823	2814	2792	2763	2710	2650	2562	2468	2341	2205	2053	1911	1750	1625
SNA 1		5	3117	3103	3071	3027	2953	2869	2745	2616	2453	2287	2112	1954	1781	1649
SNA 1		6	3338	3321	3279	3221	3125	3015	2855	2699	2511	2329	2142	1975	1796	1661
SNA 1		7	3507	3487	3436	3363	3243	3105	2917	2742	2541	2350	2157	1986	1805	1667
SNA 1		8	3635	3610	3550	3458	3310	3153	2949	2764	2556	2360	2164	1992	1808	1670
SNA 1		9	3725	3694	3617	3503	3340	3175	2963	2773	2562	2364	2167	1993	1810	1671

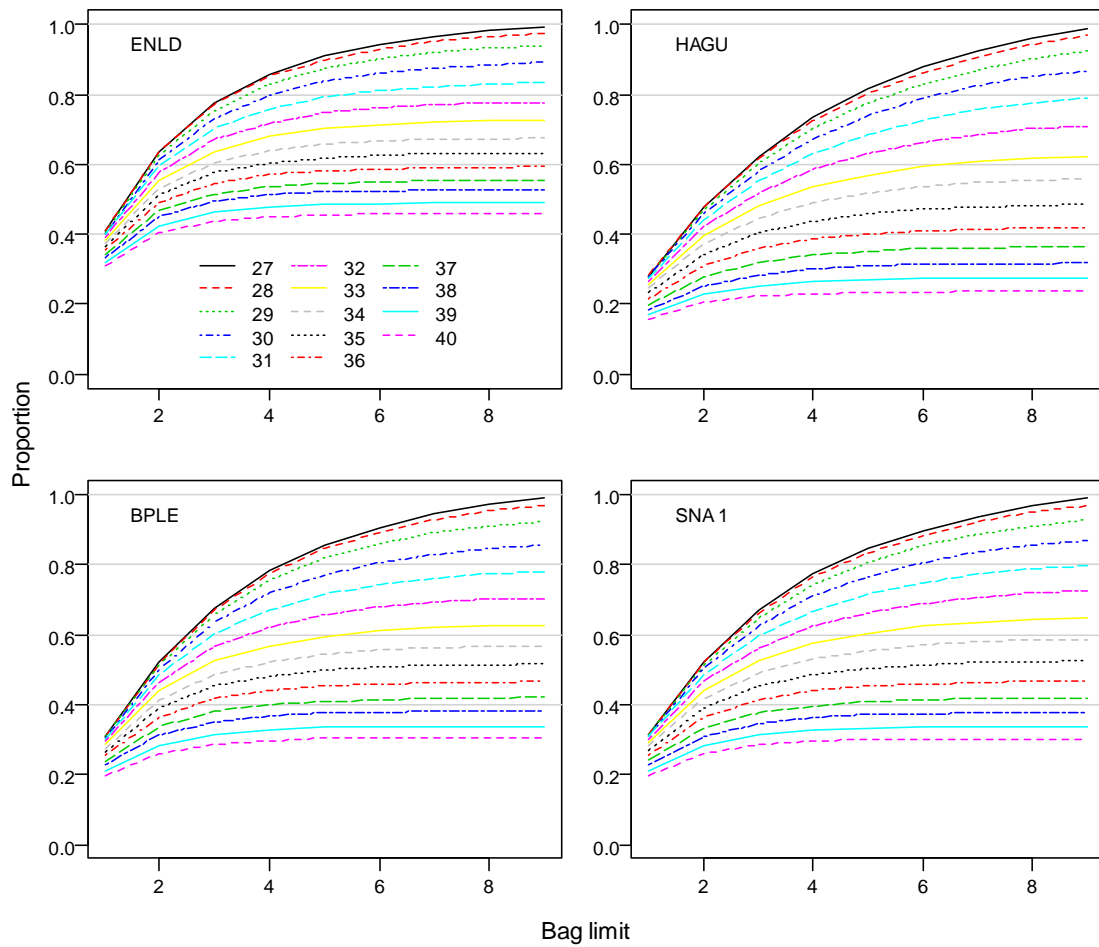
Appendix 2: continued –based on interview data collected in 2011–12, assuming co-fisher harvesting behaviour.

Appendix 2e: Estimates of the proportion by which the regional recreational harvest landed by boat and shore based fishers in SNA 1 in 2011–12 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

region	ENLD	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.56	0.57	0.57	0.57	0.58	0.59
ENLD	2	0.36	0.36	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.41	0.43	0.44	0.46	0.47
ENLD	3	0.23	0.23	0.24	0.25	0.26	0.27	0.28	0.30	0.31	0.33	0.36	0.38	0.40	0.43
ENLD	4	0.15	0.15	0.16	0.17	0.19	0.20	0.22	0.24	0.26	0.29	0.32	0.35	0.38	0.41
ENLD	5	0.09	0.10	0.11	0.12	0.14	0.16	0.19	0.21	0.24	0.27	0.31	0.34	0.37	0.41
ENLD	6	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.20	0.23	0.27	0.30	0.34	0.37	0.40
ENLD	7	0.03	0.03	0.05	0.07	0.09	0.12	0.16	0.19	0.22	0.26	0.30	0.34	0.37	0.40
ENLD	8	0.01	0.01	0.03	0.05	0.08	0.11	0.15	0.19	0.22	0.26	0.30	0.34	0.37	0.40
ENLD	9	0.00	0.00	0.02	0.05	0.08	0.11	0.15	0.18	0.22	0.26	0.30	0.34	0.37	0.40
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	0.74	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.75	0.76	0.77
HAGU	2	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.57	0.58	0.60	0.62	0.64	0.66
HAGU	3	0.40	0.40	0.40	0.40	0.40	0.41	0.42	0.44	0.46	0.49	0.52	0.56	0.59	0.63
HAGU	4	0.28	0.28	0.29	0.29	0.30	0.32	0.34	0.37	0.40	0.44	0.49	0.53	0.57	0.61
HAGU	5	0.19	0.19	0.20	0.21	0.23	0.25	0.28	0.32	0.37	0.42	0.47	0.52	0.57	0.60
HAGU	6	0.12	0.13	0.14	0.15	0.17	0.21	0.25	0.30	0.35	0.41	0.46	0.51	0.56	0.60
HAGU	7	0.07	0.08	0.09	0.11	0.14	0.18	0.23	0.28	0.35	0.40	0.46	0.51	0.56	0.60
HAGU	8	0.03	0.04	0.05	0.08	0.12	0.16	0.22	0.28	0.34	0.40	0.45	0.50	0.56	0.60
HAGU	9	0.00	0.01	0.03	0.06	0.11	0.16	0.22	0.27	0.34	0.40	0.45	0.50	0.56	0.60
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	0.58	0.57	0.58	0.58	0.58	0.58	0.59	0.59	0.60	0.61	0.62	0.63	0.64	0.65
BPLE	2	0.40	0.40	0.40	0.41	0.42	0.43	0.44	0.46	0.47	0.50	0.52	0.54	0.56	0.58
BPLE	3	0.28	0.28	0.29	0.30	0.32	0.33	0.36	0.37	0.40	0.43	0.46	0.49	0.53	0.55
BPLE	4	0.19	0.20	0.20	0.22	0.25	0.27	0.30	0.32	0.36	0.40	0.44	0.47	0.52	0.54
BPLE	5	0.13	0.13	0.14	0.16	0.20	0.22	0.26	0.29	0.34	0.38	0.43	0.47	0.51	0.54
BPLE	6	0.08	0.09	0.10	0.12	0.16	0.19	0.24	0.28	0.33	0.37	0.42	0.46	0.51	0.54
BPLE	7	0.04	0.05	0.07	0.10	0.14	0.17	0.23	0.27	0.32	0.37	0.42	0.46	0.51	0.53
BPLE	8	0.02	0.03	0.05	0.08	0.12	0.16	0.22	0.26	0.32	0.37	0.42	0.46	0.51	0.53
BPLE	9	0.00	0.01	0.03	0.07	0.12	0.16	0.22	0.26	0.31	0.36	0.41	0.46	0.51	0.53
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	0.68	0.68	0.68	0.67	0.67	0.67	0.68	0.68	0.68	0.69	0.69	0.70	0.71	0.72
SNA 1	2	0.49	0.49	0.49	0.49	0.49	0.50	0.50	0.51	0.52	0.54	0.55	0.57	0.60	0.62
SNA 1	3	0.35	0.35	0.35	0.36	0.36	0.37	0.39	0.40	0.43	0.45	0.48	0.51	0.55	0.58
SNA 1	4	0.24	0.24	0.25	0.26	0.27	0.29	0.31	0.34	0.37	0.41	0.45	0.49	0.53	0.56
SNA 1	5	0.16	0.17	0.18	0.19	0.21	0.23	0.26	0.30	0.34	0.39	0.43	0.48	0.52	0.56
SNA 1	6	0.10	0.11	0.12	0.14	0.16	0.19	0.23	0.28	0.33	0.37	0.43	0.47	0.52	0.55
SNA 1	7	0.06	0.06	0.08	0.10	0.13	0.17	0.22	0.26	0.32	0.37	0.42	0.47	0.52	0.55
SNA 1	8	0.02	0.03	0.05	0.07	0.11	0.15	0.21	0.26	0.31	0.37	0.42	0.47	0.51	0.55
SNA 1	9	0.00	0.01	0.03	0.06	0.10	0.15	0.20	0.26	0.31	0.37	0.42	0.46	0.51	0.55

Appendix 3: Evaluation of the impact alternative combinations of minimum legal size limits and daily bag limits on the recreational harvest from SNA 1, based on interview data collected in 2004–05, assuming independent fisher harvesting behaviour.

Appendix 3a: Estimates of the proportional change in the total weight of snapper landed in each region of SNA 1 in 2011–12 for alternative minimum legal size limits ranging from 27 to 40 cm, for daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates.



Appendix 3: continued –based on interview data collected in 2004–05, assuming independent fisher harvesting behaviour.

Appendix 3b: Estimates of the proportion by which the regional recreational harvest from SNA 1 in 2004–05 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.68	0.69
ENLD	2	0.36	0.36	0.37	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.53	0.55	0.57	0.59
ENLD	3	0.22	0.22	0.24	0.26	0.29	0.32	0.36	0.39	0.42	0.45	0.48	0.50	0.53	0.56
ENLD	4	0.13	0.14	0.16	0.19	0.23	0.27	0.31	0.35	0.39	0.42	0.46	0.48	0.52	0.54
ENLD	5	0.08	0.09	0.12	0.15	0.20	0.25	0.29	0.34	0.37	0.41	0.45	0.47	0.51	0.54
ENLD	6	0.05	0.06	0.09	0.13	0.18	0.23	0.28	0.33	0.37	0.41	0.44	0.47	0.51	0.54
ENLD	7	0.03	0.04	0.07	0.12	0.17	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.51	0.54
ENLD	8	0.01	0.02	0.06	0.11	0.16	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.51	0.54
ENLD	9	0.00	0.02	0.05	0.10	0.16	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.50	0.53
HAGU	1	0.72	0.72	0.72	0.72	0.72	0.73	0.74	0.75	0.77	0.78	0.80	0.81	0.83	0.84
HAGU	2	0.52	0.52	0.53	0.54	0.55	0.57	0.60	0.62	0.65	0.68	0.72	0.74	0.77	0.79
HAGU	3	0.37	0.38	0.39	0.41	0.44	0.48	0.51	0.55	0.59	0.64	0.68	0.71	0.74	0.77
HAGU	4	0.26	0.27	0.29	0.32	0.36	0.41	0.46	0.50	0.56	0.61	0.66	0.70	0.73	0.77
HAGU	5	0.17	0.19	0.22	0.25	0.31	0.36	0.42	0.48	0.54	0.59	0.65	0.69	0.73	0.76
HAGU	6	0.11	0.13	0.16	0.20	0.26	0.33	0.40	0.46	0.52	0.59	0.64	0.68	0.72	0.76
HAGU	7	0.07	0.08	0.12	0.17	0.23	0.31	0.38	0.45	0.52	0.58	0.63	0.68	0.72	0.76
HAGU	8	0.03	0.05	0.09	0.14	0.21	0.29	0.37	0.44	0.51	0.58	0.63	0.68	0.72	0.76
HAGU	9	0.00	0.02	0.07	0.13	0.20	0.28	0.37	0.44	0.51	0.58	0.63	0.68	0.72	0.76
BPLE	1	0.69	0.69	0.69	0.69	0.70	0.70	0.71	0.72	0.73	0.74	0.76	0.77	0.79	0.80
BPLE	2	0.47	0.48	0.48	0.49	0.51	0.53	0.56	0.58	0.61	0.63	0.66	0.68	0.71	0.74
BPLE	3	0.32	0.32	0.34	0.36	0.39	0.43	0.47	0.51	0.54	0.58	0.61	0.64	0.68	0.71
BPLE	4	0.21	0.22	0.24	0.27	0.32	0.37	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.70
BPLE	5	0.13	0.15	0.17	0.22	0.28	0.34	0.40	0.45	0.50	0.54	0.58	0.62	0.66	0.69
BPLE	6	0.08	0.10	0.13	0.18	0.25	0.31	0.38	0.44	0.49	0.54	0.58	0.62	0.66	0.69
BPLE	7	0.05	0.06	0.10	0.16	0.23	0.30	0.37	0.43	0.48	0.53	0.58	0.61	0.66	0.69
BPLE	8	0.02	0.04	0.08	0.14	0.22	0.29	0.37	0.43	0.48	0.53	0.58	0.61	0.66	0.69
BPLE	9	0.00	0.02	0.07	0.14	0.21	0.29	0.37	0.43	0.48	0.53	0.57	0.61	0.66	0.69
SNA 1	1	0.68	0.68	0.68	0.68	0.69	0.70	0.70	0.72	0.73	0.74	0.76	0.77	0.79	0.80
SNA 1	2	0.47	0.47	0.48	0.49	0.51	0.53	0.55	0.58	0.61	0.63	0.66	0.69	0.71	0.74
SNA 1	3	0.32	0.33	0.34	0.37	0.40	0.43	0.47	0.50	0.54	0.58	0.62	0.65	0.68	0.71
SNA 1	4	0.22	0.23	0.25	0.28	0.33	0.37	0.42	0.46	0.51	0.56	0.60	0.63	0.67	0.70
SNA 1	5	0.15	0.16	0.18	0.22	0.28	0.33	0.39	0.44	0.49	0.54	0.59	0.62	0.66	0.70
SNA 1	6	0.09	0.11	0.14	0.18	0.24	0.30	0.37	0.42	0.48	0.53	0.58	0.62	0.66	0.70
SNA 1	7	0.05	0.07	0.10	0.15	0.22	0.29	0.36	0.41	0.47	0.53	0.58	0.62	0.66	0.70
SNA 1	8	0.02	0.04	0.08	0.13	0.20	0.27	0.35	0.41	0.47	0.53	0.58	0.62	0.66	0.70
SNA 1	9	0.00	0.02	0.06	0.12	0.20	0.27	0.35	0.41	0.47	0.53	0.58	0.62	0.66	0.69

Appendix 3: continued –based on interview data collected in 2004–05, assuming independent fisher harvesting behaviour.

Appendix 3c: Estimates of the regional tonnage of snapper landed by boat based fishers in SNA 1 in 2004–05 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates. These harvest estimates do not include any provision for harvest taken by shore based fishers, which are included in the estimates given in Appendix 3d.

		Minimum legal size													
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	209	208	207	205	204	201	197	190	187	182	175	170	164	158
ENLD	2	325	324	320	313	304	294	284	271	262	251	238	230	217	206
ENLD	3	395	393	386	373	358	342	325	308	294	278	263	252	236	224
ENLD	4	438	434	424	408	387	367	347	327	309	292	275	263	245	231
ENLD	5	464	459	447	429	405	381	358	336	316	297	279	266	248	233
ENLD	6	481	475	461	440	414	388	364	341	320	300	282	268	249	234
ENLD	7	493	486	470	447	420	393	368	343	322	301	283	269	250	234
ENLD	8	501	494	476	452	424	396	370	344	323	302	284	270	250	235
ENLD	9	506	498	479	455	426	397	371	345	323	303	284	270	251	235
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	360	361	360	356	351	342	330	318	297	278	255	236	218	200
HAGU	2	613	610	602	587	566	541	509	480	439	400	359	326	293	262
HAGU	3	800	792	774	747	708	665	617	574	517	461	408	366	325	286
HAGU	4	943	930	903	861	807	751	686	629	561	495	436	387	341	297
HAGU	5	1047	1029	995	946	880	810	730	665	587	515	450	397	347	301
HAGU	6	1125	1106	1066	1009	932	852	761	689	604	526	459	402	350	302
HAGU	7	1185	1164	1118	1056	971	881	781	703	614	533	464	405	351	303
HAGU	8	1233	1210	1159	1090	996	899	793	712	620	536	467	406	352	304
HAGU	9	1268	1242	1185	1110	1009	909	800	716	623	538	468	407	352	304
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	140	139	139	138	136	133	129	124	120	115	108	102	95	88
BPLE	2	236	234	231	226	219	209	198	187	176	164	152	141	128	118
BPLE	3	306	303	297	287	272	256	237	220	205	188	173	159	142	129
BPLE	4	354	349	341	324	304	281	257	236	218	200	181	166	148	135
BPLE	5	387	382	369	348	323	297	269	245	225	205	185	170	151	137
BPLE	6	410	403	388	364	335	307	275	251	229	207	188	171	152	138
BPLE	7	426	419	402	375	344	313	280	254	231	209	189	172	153	138
BPLE	8	439	431	412	382	349	317	282	255	232	210	190	173	153	138
BPLE	9	447	438	418	386	352	318	282	256	233	210	190	173	153	138
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	709	709	706	700	690	676	655	632	604	575	539	508	476	446
SNA 1	2	1174	1168	1152	1126	1088	1044	991	937	877	815	749	696	638	586
SNA 1	3	1501	1488	1457	1406	1339	1264	1179	1102	1015	928	844	777	704	639
SNA 1	4	1735	1713	1667	1594	1498	1399	1290	1193	1088	987	892	816	734	662
SNA 1	5	1898	1870	1811	1722	1608	1488	1357	1246	1128	1017	915	833	746	671
SNA 1	6	2016	1983	1915	1813	1682	1547	1400	1280	1153	1033	928	841	751	674
SNA 1	7	2104	2068	1990	1878	1734	1587	1429	1300	1167	1044	936	847	754	676
SNA 1	8	2173	2134	2047	1924	1769	1612	1445	1311	1175	1049	940	849	755	677
SNA 1	9	2221	2177	2082	1951	1787	1624	1453	1316	1179	1051	942	850	756	678

Appendix 3: continued –based on interview data collected in 2004–05, assuming independent fisher harvesting behaviour.

Appendix 3d: Estimates of the regional tonnage of snapper landed by boat and shore based fishers in SNA 1 in 2004–05 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

		Minimum legal size													
region		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	73	74	75	76	77	78	79	80	81	82	83	84	85	86
ENLD	2	255	254	253	252	250	247	243	236	233	228	221	216	210	204
ENLD	3	371	370	366	359	350	340	330	317	308	297	285	276	263	252
ENLD	4	442	439	432	420	404	389	372	354	340	325	309	298	282	270
ENLD	5	484	480	470	455	434	413	393	373	356	338	321	309	291	277
ENLD	6	510	505	493	475	451	427	404	382	362	343	325	313	294	279
ENLD	7	527	521	507	486	460	435	410	387	366	346	328	314	295	280
ENLD	8	539	532	516	494	466	440	414	389	368	348	329	315	296	280
ENLD	9	547	540	522	499	470	442	416	390	369	348	330	316	297	281
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	90	91	92	93	94	95	96	97	98	99	100	101	102	103
HAGU	2	424	425	423	420	414	406	393	381	360	341	319	299	281	263
HAGU	3	676	673	665	650	629	604	572	543	502	463	422	389	356	326
HAGU	4	863	855	837	810	771	729	680	637	580	524	471	429	389	349
HAGU	5	1007	993	966	925	870	814	750	693	624	558	499	450	404	360
HAGU	6	1110	1093	1058	1009	943	873	794	728	650	578	513	460	410	364
HAGU	7	1188	1169	1129	1072	996	915	824	752	667	589	522	465	413	366
HAGU	8	1248	1227	1182	1119	1034	944	844	766	678	596	528	468	414	367
HAGU	9	1296	1273	1222	1153	1059	963	857	775	684	600	530	469	415	367
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	92	93	94	95	96	97	98	99	100	101	102	103	104	105
BPLE	2	205	204	204	203	201	198	194	189	185	180	173	167	160	153
BPLE	3	301	299	296	291	284	274	263	252	241	229	217	206	193	183
BPLE	4	371	368	362	352	337	321	302	285	270	253	238	224	207	194
BPLE	5	419	414	406	389	369	346	322	301	283	265	246	231	213	200
BPLE	6	452	447	434	413	388	362	334	310	290	270	250	235	216	202
BPLE	7	475	468	453	429	400	372	340	316	294	272	253	236	217	203
BPLE	8	491	484	467	440	409	378	345	319	296	274	254	237	218	203
BPLE	9	504	496	477	447	414	382	347	320	297	275	255	238	218	203
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	255	258	261	264	267	270	273	276	279	282	285	288	291	294
SNA 1	2	883	884	881	874	864	850	830	807	778	749	713	683	650	621
SNA 1	3	1348	1343	1327	1300	1263	1219	1165	1112	1051	989	924	871	812	761
SNA 1	4	1675	1662	1631	1581	1513	1439	1353	1276	1189	1102	1019	951	878	813
SNA 1	5	1909	1888	1842	1768	1673	1573	1465	1367	1262	1161	1066	990	908	836
SNA 1	6	2072	2044	1986	1897	1782	1662	1532	1421	1303	1191	1089	1007	921	845
SNA 1	7	2190	2158	2090	1987	1856	1721	1575	1454	1327	1208	1103	1016	926	848
SNA 1	8	2279	2243	2165	2052	1909	1762	1603	1474	1342	1218	1111	1021	928	850
SNA 1	9	2347	2308	2221	2099	1943	1786	1619	1486	1350	1223	1114	1023	929	851

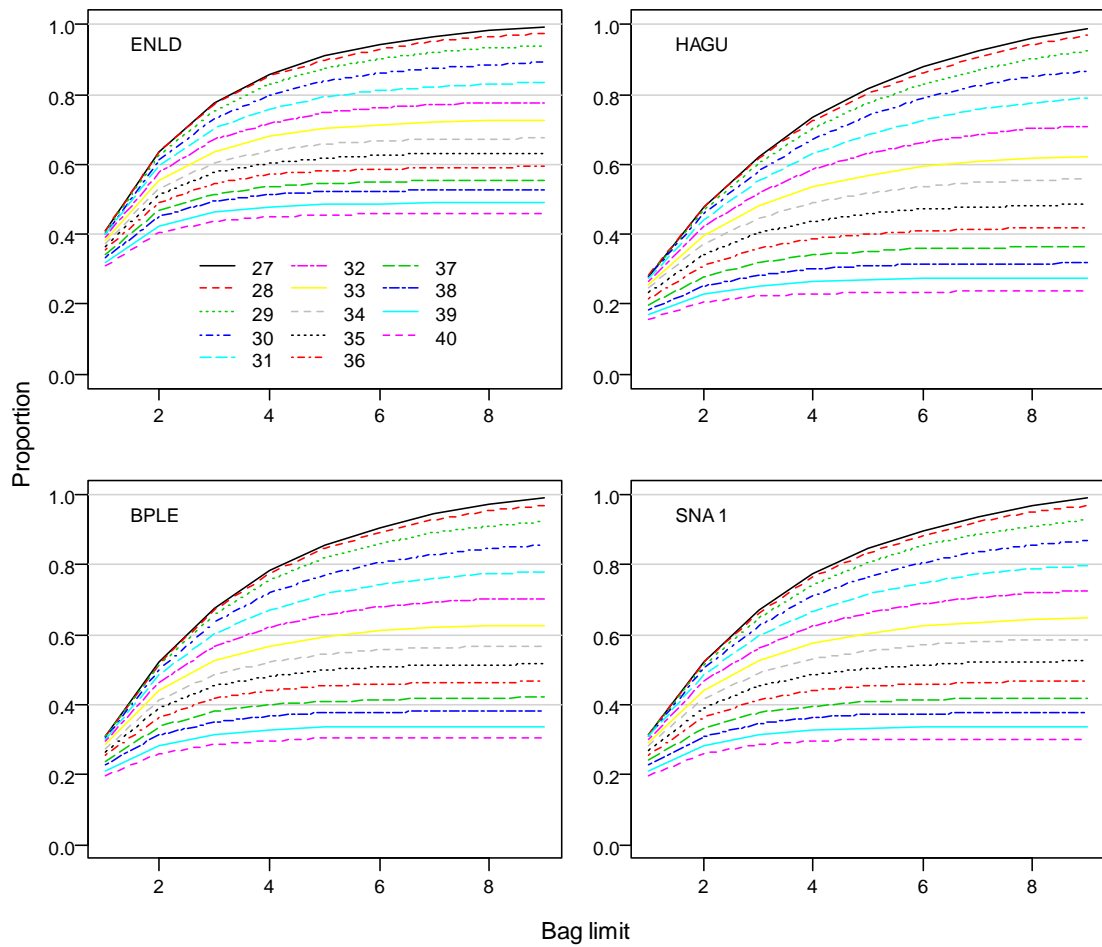
Appendix 3: continued –based on interview data collected in 2004–05, assuming independent fisher harvesting behaviour.

Appendix 3e: Estimates of the proportion by which the regional recreational harvest landed by boat and shore based fishers in SNA 1 in 2004–05 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

		Minimum legal size														
region		27	28	29	30	31	32	33	34	35	36	37	38	39	40	
ENLD	ENLD	1	0.87	0.86	0.86	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.85	0.84	0.84	
ENLD		2	0.53	0.54	0.54	0.54	0.54	0.55	0.56	0.57	0.57	0.58	0.60	0.60	0.62	0.63
ENLD		3	0.32	0.32	0.33	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54
ENLD		4	0.19	0.20	0.21	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.43	0.45	0.48	0.51
ENLD		5	0.12	0.12	0.14	0.17	0.21	0.25	0.28	0.32	0.35	0.38	0.41	0.44	0.47	0.49
ENLD		6	0.07	0.08	0.10	0.13	0.18	0.22	0.26	0.30	0.34	0.37	0.41	0.43	0.46	0.49
ENLD		7	0.04	0.05	0.07	0.11	0.16	0.21	0.25	0.29	0.33	0.37	0.40	0.43	0.46	0.49
ENLD		8	0.02	0.03	0.06	0.10	0.15	0.20	0.24	0.29	0.33	0.36	0.40	0.42	0.46	0.49
ENLD		9	0.00	0.01	0.05	0.09	0.14	0.19	0.24	0.29	0.33	0.36	0.40	0.42	0.46	0.49
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
HAGU		1	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	
HAGU		2	0.67	0.67	0.67	0.68	0.68	0.69	0.70	0.71	0.72	0.74	0.75	0.77	0.78	0.80
HAGU		3	0.48	0.48	0.49	0.50	0.51	0.53	0.56	0.58	0.61	0.64	0.67	0.70	0.73	0.75
HAGU		4	0.33	0.34	0.35	0.38	0.41	0.44	0.48	0.51	0.55	0.60	0.64	0.67	0.70	0.73
HAGU		5	0.22	0.23	0.26	0.29	0.33	0.37	0.42	0.47	0.52	0.57	0.62	0.65	0.69	0.72
HAGU		6	0.14	0.16	0.18	0.22	0.27	0.33	0.39	0.44	0.50	0.55	0.60	0.65	0.68	0.72
HAGU		7	0.08	0.10	0.13	0.17	0.23	0.29	0.36	0.42	0.49	0.55	0.60	0.64	0.68	0.72
HAGU		8	0.04	0.05	0.09	0.14	0.20	0.27	0.35	0.41	0.48	0.54	0.59	0.64	0.68	0.72
HAGU		9	0.00	0.02	0.06	0.11	0.18	0.26	0.34	0.40	0.47	0.54	0.59	0.64	0.68	0.72
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
BPLE		1	0.82	0.82	0.81	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.79	0.79	
BPLE		2	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.63	0.63	0.64	0.66	0.67	0.68	0.70
BPLE		3	0.40	0.41	0.41	0.42	0.44	0.45	0.48	0.50	0.52	0.55	0.57	0.59	0.62	0.64
BPLE		4	0.26	0.27	0.28	0.30	0.33	0.36	0.40	0.43	0.46	0.50	0.53	0.56	0.59	0.61
BPLE		5	0.17	0.18	0.19	0.23	0.27	0.31	0.36	0.40	0.44	0.47	0.51	0.54	0.58	0.60
BPLE		6	0.10	0.11	0.14	0.18	0.23	0.28	0.34	0.38	0.42	0.46	0.50	0.53	0.57	0.60
BPLE		7	0.06	0.07	0.10	0.15	0.20	0.26	0.32	0.37	0.42	0.46	0.50	0.53	0.57	0.60
BPLE		8	0.02	0.04	0.07	0.13	0.19	0.25	0.32	0.37	0.41	0.46	0.50	0.53	0.57	0.60
BPLE		9	0.00	0.02	0.05	0.11	0.18	0.24	0.31	0.36	0.41	0.45	0.49	0.53	0.57	0.60
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
SNA 1		1	0.89	0.89	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.87	
SNA 1		2	0.62	0.62	0.62	0.63	0.63	0.64	0.65	0.66	0.67	0.68	0.70	0.71	0.72	0.74
SNA 1		3	0.43	0.43	0.43	0.45	0.46	0.48	0.50	0.53	0.55	0.58	0.61	0.63	0.65	0.68
SNA 1		4	0.29	0.29	0.31	0.33	0.36	0.39	0.42	0.46	0.49	0.53	0.57	0.59	0.63	0.65
SNA 1		5	0.19	0.20	0.22	0.25	0.29	0.33	0.38	0.42	0.46	0.51	0.55	0.58	0.61	0.64
SNA 1		6	0.12	0.13	0.15	0.19	0.24	0.29	0.35	0.39	0.44	0.49	0.54	0.57	0.61	0.64
SNA 1		7	0.07	0.08	0.11	0.15	0.21	0.27	0.33	0.38	0.43	0.49	0.53	0.57	0.61	0.64
SNA 1		8	0.03	0.04	0.08	0.13	0.19	0.25	0.32	0.37	0.43	0.48	0.53	0.57	0.60	0.64
SNA 1		9	0.00	0.02	0.05	0.11	0.17	0.24	0.31	0.37	0.43	0.48	0.53	0.56	0.60	0.64

Appendix 4: Evaluation of the impact alternative combinations of minimum legal size limits and daily bag limits on the recreational harvest from SNA 1, based on interview data collected in 2004–05, assuming co-fisher harvesting behaviour.

Appendix 4a: Estimates of the proportional change in the total weight of snapper landed in each region of SNA 1 in 2004–05 for alternative minimum legal size limits ranging from 27 to 40 cm, for daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates.



Appendix 4: continued –based on interview data collected in 2004–05, assuming co-fisher harvesting behaviour.

Appendix 4b: Estimates of the proportion by which the regional recreational harvest from SNA 1 in 2004–05 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates.

region	baglimit	Minimum legal size													
		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.59	0.59	0.59	0.59	0.60	0.61	0.61	0.63	0.63	0.64	0.66	0.67	0.68	0.69
ENLD	2	0.35	0.35	0.36	0.37	0.39	0.41	0.43	0.46	0.47	0.49	0.52	0.54	0.56	0.58
ENLD	3	0.21	0.22	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.48	0.50	0.53	0.56
ENLD	4	0.13	0.14	0.16	0.19	0.23	0.27	0.31	0.35	0.38	0.42	0.46	0.48	0.52	0.55
ENLD	5	0.08	0.09	0.11	0.15	0.20	0.24	0.29	0.34	0.38	0.41	0.45	0.48	0.51	0.54
ENLD	6	0.05	0.06	0.09	0.13	0.18	0.23	0.28	0.33	0.37	0.41	0.45	0.47	0.51	0.54
ENLD	7	0.02	0.04	0.07	0.11	0.17	0.22	0.28	0.32	0.37	0.41	0.44	0.47	0.51	0.54
ENLD	8	0.01	0.02	0.06	0.11	0.16	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.51	0.54
ENLD	9	0.00	0.02	0.05	0.10	0.16	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.51	0.54
HAGU	1	0.72	0.72	0.72	0.72	0.72	0.73	0.74	0.75	0.77	0.78	0.80	0.81	0.83	0.84
HAGU	2	0.51	0.51	0.52	0.53	0.54	0.56	0.58	0.61	0.64	0.67	0.70	0.73	0.76	0.79
HAGU	3	0.36	0.37	0.38	0.40	0.43	0.46	0.50	0.53	0.57	0.62	0.67	0.70	0.74	0.77
HAGU	4	0.25	0.26	0.28	0.31	0.35	0.39	0.44	0.49	0.54	0.60	0.65	0.69	0.73	0.76
HAGU	5	0.17	0.18	0.21	0.25	0.30	0.35	0.41	0.46	0.53	0.59	0.64	0.68	0.73	0.76
HAGU	6	0.11	0.12	0.15	0.20	0.26	0.32	0.39	0.45	0.52	0.58	0.64	0.68	0.72	0.76
HAGU	7	0.06	0.08	0.11	0.16	0.23	0.30	0.38	0.44	0.51	0.58	0.63	0.68	0.72	0.76
HAGU	8	0.03	0.04	0.08	0.14	0.21	0.29	0.37	0.44	0.51	0.58	0.63	0.68	0.72	0.76
HAGU	9	0.00	0.02	0.07	0.13	0.20	0.28	0.37	0.44	0.51	0.58	0.63	0.68	0.72	0.76
BPLE	1	0.69	0.69	0.69	0.69	0.70	0.70	0.71	0.72	0.73	0.74	0.76	0.77	0.79	0.80
BPLE	2	0.47	0.47	0.47	0.48	0.50	0.52	0.54	0.57	0.59	0.62	0.65	0.67	0.70	0.73
BPLE	3	0.31	0.31	0.32	0.34	0.37	0.41	0.45	0.49	0.53	0.57	0.61	0.64	0.67	0.70
BPLE	4	0.20	0.21	0.23	0.26	0.31	0.36	0.41	0.46	0.50	0.55	0.59	0.62	0.66	0.70
BPLE	5	0.13	0.14	0.16	0.21	0.27	0.33	0.39	0.44	0.49	0.54	0.58	0.62	0.66	0.69
BPLE	6	0.08	0.09	0.12	0.18	0.24	0.31	0.38	0.43	0.48	0.53	0.58	0.62	0.66	0.69
BPLE	7	0.04	0.06	0.09	0.16	0.23	0.30	0.37	0.43	0.48	0.53	0.58	0.61	0.66	0.69
BPLE	8	0.02	0.03	0.08	0.14	0.22	0.29	0.37	0.43	0.48	0.53	0.58	0.61	0.66	0.69
BPLE	9	0.00	0.02	0.07	0.14	0.21	0.29	0.37	0.43	0.48	0.53	0.58	0.61	0.66	0.69
SNA 1	1	0.68	0.68	0.68	0.69	0.69	0.70	0.71	0.72	0.73	0.74	0.76	0.77	0.79	0.80
SNA 1	2	0.46	0.47	0.47	0.48	0.50	0.52	0.54	0.56	0.59	0.62	0.65	0.68	0.70	0.73
SNA 1	3	0.32	0.32	0.33	0.35	0.38	0.42	0.46	0.49	0.53	0.57	0.61	0.64	0.68	0.71
SNA 1	4	0.21	0.22	0.24	0.27	0.31	0.36	0.41	0.45	0.50	0.55	0.59	0.63	0.67	0.70
SNA 1	5	0.14	0.15	0.18	0.22	0.27	0.32	0.38	0.43	0.49	0.54	0.58	0.62	0.66	0.70
SNA 1	6	0.09	0.10	0.13	0.18	0.23	0.30	0.36	0.42	0.48	0.53	0.58	0.62	0.66	0.70
SNA 1	7	0.05	0.06	0.10	0.15	0.21	0.28	0.35	0.41	0.47	0.53	0.58	0.62	0.66	0.70
SNA 1	8	0.02	0.04	0.08	0.13	0.20	0.27	0.35	0.41	0.47	0.53	0.58	0.62	0.66	0.70
SNA 1	9	0.00	0.02	0.06	0.12	0.20	0.27	0.35	0.41	0.47	0.53	0.58	0.62	0.66	0.70

Appendix 4: continued –based on interview data collected in 2004–05, assuming co-fisher harvesting behaviour.

Appendix 4c: Estimates of the regional tonnage of snapper landed by boat based fishers in SNA 1 in 2004–05 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish. Seasonal estimates of proportional change for each region have been weighted together given aerial-access estimates of the weight of fish landed in each season in 2004–05, and the same harvest estimates have been used to weight together regional estimates. These harvest estimates do not include any provision for harvest taken by shore based fishers, which are included in the estimates given in Appendix 4d.

		Minimum legal size													
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	209	208	207	206	204	201	197	190	188	181	175	170	164	158
ENLD	2	332	330	326	321	312	301	290	277	268	257	245	235	221	211
ENLD	3	399	397	390	378	363	346	331	313	299	282	266	255	239	226
ENLD	4	442	438	428	412	392	371	352	331	313	294	276	264	246	231
ENLD	5	468	463	451	432	409	385	362	338	318	298	280	267	248	233
ENLD	6	485	479	465	445	418	391	366	342	321	300	282	269	249	234
ENLD	7	497	490	474	451	423	394	369	344	322	302	283	270	251	235
ENLD	8	504	497	479	454	425	396	370	345	323	303	284	270	251	236
ENLD	9	509	500	481	456	426	398	371	346	324	303	285	271	251	236
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	360	361	360	356	350	342	330	319	297	278	255	236	218	200
HAGU	2	624	623	616	604	584	559	528	499	458	417	375	338	304	270
HAGU	3	812	806	791	766	728	686	638	597	541	481	423	377	332	291
HAGU	4	954	942	916	879	826	770	706	653	580	510	447	394	345	299
HAGU	5	1056	1040	1007	959	896	828	750	683	600	524	458	402	349	302
HAGU	6	1134	1116	1076	1021	947	869	776	700	613	532	464	405	351	303
HAGU	7	1192	1171	1128	1065	982	893	790	710	619	536	466	406	352	304
HAGU	8	1238	1215	1165	1097	1003	905	798	715	622	538	468	407	352	304
HAGU	9	1271	1244	1188	1112	1011	910	801	717	623	538	468	407	352	304
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	140	140	139	138	136	133	129	124	120	115	108	102	95	88
BPLE	2	240	238	235	232	225	217	205	194	184	171	157	146	132	121
BPLE	3	311	309	304	295	281	265	245	227	211	193	177	163	146	132
BPLE	4	359	355	347	331	311	288	263	241	222	203	185	169	151	136
BPLE	5	391	386	374	354	329	302	273	249	229	208	188	172	152	138
BPLE	6	414	407	393	368	340	310	278	253	231	210	189	172	153	138
BPLE	7	430	422	406	378	347	315	282	255	232	210	190	173	153	138
BPLE	8	441	433	414	384	351	318	282	255	233	210	190	173	153	138
BPLE	9	448	439	419	387	352	318	282	256	233	210	190	173	153	138
region	baglimit	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	708	709	706	700	690	676	656	633	605	574	539	508	476	447
SNA 1	2	1195	1191	1177	1156	1121	1077	1023	970	910	845	777	719	657	602
SNA 1	3	1523	1512	1485	1440	1373	1298	1214	1137	1051	957	866	794	717	649
SNA 1	4	1755	1735	1691	1622	1529	1429	1321	1225	1115	1006	908	827	741	667
SNA 1	5	1916	1888	1832	1745	1634	1515	1385	1271	1146	1030	926	841	750	673
SNA 1	6	2033	2002	1934	1834	1705	1571	1420	1295	1165	1042	935	846	753	676
SNA 1	7	2118	2083	2007	1894	1751	1603	1440	1309	1174	1048	939	848	755	677
SNA 1	8	2183	2145	2058	1936	1779	1619	1450	1315	1178	1051	942	850	756	678
SNA 1	9	2228	2184	2088	1955	1789	1626	1454	1318	1180	1052	942	851	757	678

Appendix 4: continued –based on interview data collected in 2004–05, assuming co-fisher harvesting behaviour.

Appendix 4d: Estimates of the regional tonnage of snapper landed by boat and shore based fishers in SNA 1 in 2004–05 given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

		Minimum legal size													
region		27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	73	74	75	76	77	78	79	80	81	82	83	84	85	86
ENLD	2	255	254	253	252	250	247	243	237	234	227	222	216	210	204
ENLD	3	378	376	372	367	358	347	336	323	314	303	291	281	268	257
ENLD	4	446	443	436	425	409	392	377	360	345	329	312	301	285	272
ENLD	5	488	485	475	458	438	417	398	377	359	340	322	310	292	278
ENLD	6	514	509	497	478	455	431	408	384	364	344	326	313	294	279
ENLD	7	531	525	511	491	465	438	412	388	367	347	328	315	296	281
ENLD	8	543	536	520	497	469	441	415	390	368	348	330	316	297	282
ENLD	9	550	543	525	501	471	443	416	391	369	349	330	317	298	282
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	90	91	92	93	94	95	96	97	98	99	100	101	102	103
HAGU	2	423	425	423	420	414	405	394	382	360	341	319	299	281	263
HAGU	3	687	686	679	667	647	622	591	562	521	480	438	402	367	333
HAGU	4	875	869	854	829	791	750	702	660	604	545	487	440	395	354
HAGU	5	1018	1005	979	942	889	833	770	716	643	573	510	457	408	362
HAGU	6	1120	1103	1070	1022	959	891	814	746	663	588	521	465	412	365
HAGU	7	1198	1179	1140	1084	1010	932	839	763	676	595	527	468	414	366
HAGU	8	1256	1235	1191	1129	1046	956	853	773	683	599	530	469	415	367
HAGU	9	1301	1278	1228	1160	1066	968	861	778	685	601	531	470	415	367
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	92	93	94	95	96	97	98	99	100	101	102	103	104	105
BPLE	2	205	205	204	203	201	198	194	189	185	180	173	167	160	153
BPLE	3	305	303	300	297	290	282	270	259	249	236	222	211	197	186
BPLE	4	376	374	369	360	346	330	310	292	276	258	242	228	211	197
BPLE	5	424	420	412	396	376	353	328	306	287	268	250	234	216	201
BPLE	6	456	451	439	419	394	367	338	314	294	273	253	237	217	203
BPLE	7	479	472	458	433	405	375	343	318	296	275	254	237	218	203
BPLE	8	495	487	471	443	412	380	347	320	297	275	255	238	218	203
BPLE	9	506	498	479	449	416	383	347	320	298	275	255	238	218	203
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	255	258	261	264	267	270	273	276	279	282	285	288	291	294
SNA 1	2	883	883	880	875	865	850	830	807	780	749	713	682	650	621
SNA 1	3	1370	1366	1352	1330	1296	1251	1198	1144	1084	1019	952	894	832	777
SNA 1	4	1697	1686	1659	1614	1547	1472	1388	1312	1225	1132	1041	969	891	823
SNA 1	5	1929	1909	1865	1796	1703	1603	1496	1399	1289	1181	1082	1002	916	841
SNA 1	6	2090	2063	2006	1919	1808	1689	1559	1445	1321	1205	1101	1015	924	848
SNA 1	7	2208	2177	2109	2008	1879	1745	1595	1470	1339	1217	1110	1020	928	850
SNA 1	8	2293	2258	2181	2069	1926	1777	1615	1483	1348	1222	1114	1023	930	852
SNA 1	9	2358	2319	2232	2110	1953	1794	1625	1490	1352	1225	1116	1024	931	852

Appendix 4: continued –based on interview data collected in 2004–05, assuming co-fisher harvesting behaviour.

Appendix 4e: Estimates of the proportion by which the regional recreational harvest landed by boat and shore based fishers in SNA 1 in 2004–05 would have been reduced given alternative minimum legal size limits ranging from 27 to 40 cm, and daily bag limits ranging from 1 to 9 fish.

		Minimum legal size													
region	ENLD	27	28	29	30	31	32	33	34	35	36	37	38	39	40
ENLD	1	0.87	0.87	0.86	0.86	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.85	0.85	0.84
ENLD	2	0.54	0.54	0.54	0.54	0.55	0.55	0.56	0.57	0.57	0.59	0.60	0.61	0.62	0.63
ENLD	3	0.31	0.32	0.32	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53
ENLD	4	0.19	0.19	0.21	0.23	0.26	0.29	0.32	0.35	0.37	0.40	0.43	0.45	0.48	0.51
ENLD	5	0.11	0.12	0.14	0.17	0.20	0.24	0.28	0.31	0.35	0.38	0.41	0.44	0.47	0.50
ENLD	6	0.07	0.08	0.10	0.13	0.17	0.22	0.26	0.30	0.34	0.38	0.41	0.43	0.47	0.49
ENLD	7	0.03	0.05	0.07	0.11	0.16	0.20	0.25	0.29	0.33	0.37	0.40	0.43	0.46	0.49
ENLD	8	0.01	0.03	0.06	0.10	0.15	0.20	0.25	0.29	0.33	0.37	0.40	0.43	0.46	0.49
ENLD	9	0.00	0.01	0.05	0.09	0.14	0.20	0.24	0.29	0.33	0.37	0.40	0.42	0.46	0.49
region	HAGU	27	28	29	30	31	32	33	34	35	36	37	38	39	40
HAGU	1	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92
HAGU	2	0.67	0.67	0.68	0.68	0.68	0.69	0.70	0.71	0.72	0.74	0.76	0.77	0.78	0.80
HAGU	3	0.47	0.47	0.48	0.49	0.50	0.52	0.55	0.57	0.60	0.63	0.66	0.69	0.72	0.74
HAGU	4	0.33	0.33	0.34	0.36	0.39	0.42	0.46	0.49	0.54	0.58	0.63	0.66	0.70	0.73
HAGU	5	0.22	0.23	0.25	0.28	0.32	0.36	0.41	0.45	0.51	0.56	0.61	0.65	0.69	0.72
HAGU	6	0.14	0.15	0.18	0.21	0.26	0.32	0.37	0.43	0.49	0.55	0.60	0.64	0.68	0.72
HAGU	7	0.08	0.09	0.12	0.17	0.22	0.28	0.36	0.41	0.48	0.54	0.60	0.64	0.68	0.72
HAGU	8	0.04	0.05	0.08	0.13	0.20	0.27	0.34	0.41	0.48	0.54	0.59	0.64	0.68	0.72
HAGU	9	0.00	0.02	0.06	0.11	0.18	0.26	0.34	0.40	0.47	0.54	0.59	0.64	0.68	0.72
region	BPLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40
BPLE	1	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.79	0.79
BPLE	2	0.60	0.60	0.60	0.60	0.60	0.61	0.62	0.63	0.63	0.64	0.66	0.67	0.68	0.70
BPLE	3	0.40	0.40	0.41	0.41	0.43	0.44	0.47	0.49	0.51	0.53	0.56	0.58	0.61	0.63
BPLE	4	0.26	0.26	0.27	0.29	0.32	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.58	0.61
BPLE	5	0.16	0.17	0.19	0.22	0.26	0.30	0.35	0.39	0.43	0.47	0.51	0.54	0.57	0.60
BPLE	6	0.10	0.11	0.13	0.17	0.22	0.28	0.33	0.38	0.42	0.46	0.50	0.53	0.57	0.60
BPLE	7	0.05	0.07	0.09	0.14	0.20	0.26	0.32	0.37	0.41	0.46	0.50	0.53	0.57	0.60
BPLE	8	0.02	0.04	0.07	0.12	0.19	0.25	0.31	0.37	0.41	0.46	0.50	0.53	0.57	0.60
BPLE	9	0.00	0.02	0.05	0.11	0.18	0.24	0.31	0.37	0.41	0.46	0.50	0.53	0.57	0.60
region	SNA 1	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SNA 1	1	0.89	0.89	0.89	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
SNA 1	2	0.63	0.63	0.63	0.63	0.63	0.64	0.65	0.66	0.67	0.68	0.70	0.71	0.72	0.74
SNA 1	3	0.42	0.42	0.43	0.44	0.45	0.47	0.49	0.51	0.54	0.57	0.60	0.62	0.65	0.67
SNA 1	4	0.28	0.28	0.30	0.32	0.34	0.38	0.41	0.44	0.48	0.52	0.56	0.59	0.62	0.65
SNA 1	5	0.18	0.19	0.21	0.24	0.28	0.32	0.37	0.41	0.45	0.50	0.54	0.58	0.61	0.64
SNA 1	6	0.11	0.13	0.15	0.19	0.23	0.28	0.34	0.39	0.44	0.49	0.53	0.57	0.61	0.64
SNA 1	7	0.06	0.08	0.11	0.15	0.20	0.26	0.32	0.38	0.43	0.48	0.53	0.57	0.61	0.64
SNA 1	8	0.03	0.04	0.07	0.12	0.18	0.25	0.32	0.37	0.43	0.48	0.53	0.57	0.61	0.64
SNA 1	9	0.00	0.02	0.05	0.11	0.17	0.24	0.31	0.37	0.43	0.48	0.53	0.57	0.61	0.64