Current status of western blue groper at selected locations in South Australia: results of the 2014 survey and comparison with historical surveys

Report to the Conservation Council of South Australia

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Cover photo: Male western blue groper (*Achoerodus gouldii*) at the Investigator Group, 2006. Photo credit: James Brook.

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Contents

Non-technical summary

The western blue groper (*Achoerodus gouldii*) is the largest resident reef fish in southern Australian coastal waters. The species is long-lived (up to 70 years), slow-growing, sex-changing and site-attached with a small home range.

These life history traits of western blue groper (WBG) render the species highly vulnerable to the effects of localised over-fishing and the species has been fully protected in the central part of South Australia (SA) since the 1980s. The WBG is currently included on the Reef Watch 'Feral or In Peril' species list as a species of conservation interest.

Historical diver surveys for WBG showed that the species is more abundant in the western parts of SA, which may have been due to a combination of natural distribution patterns and fishing effects.

During 2013 a new set of surveys was undertaken by community divers at 25 sites across SA specifically targeting WBG. The surveys were funded by a State Community NRM Grant administered through the Conservation Council of South Australia. A further grant allowed the surveys to be repeated at 12 of these sites, and three additional sites, in 2014. The current report presents the results of the 2014 surveys and comparisons with the previous surveys.

The overall patterns of abundance recorded in 2014 were very similar to those of 2013, except at Groper Bay, where the lower abundance in 2014 was likely due to poor visibility, and at Cape Jervis and Fishery Bay, where no groper had been recorded in 2013. With regard to size classes, the most noticeable difference between 2013 and 2014 was the lack of adult WBG recorded at the three Yorke Peninsula sites (Groper Bay, Chinaman's Hat and Edithburgh) where they had been recorded in 2013.

A degree of caution is required when interpreting the status of WBG in SA or comparing the recent surveys with historical surveys, due to inherent limitations in the survey method. Nonetheless, the results showed that the abundances from recent surveys on Eyre and Yorke Peninsula were generally lower than the historical surveys, with the exception of Golden Island Point. Regional abundances of both juveniles and sub-adults declined, with the former most likely linked to variable recruitment associated with the strength of the Leeuwin Current, but the latter unlikely to be solely due to variable recruitment. The results show that the protection zone is not having a positive influence on populations of sub-adult or adult groper.

Future surveys should focus on long-term monitoring of the effect of the increased protection afforded by marine park Sanctuary Zones. This would require an increase in survey effort at Chinaman's Hat and nearby sites, including Groper Bay, as controls. Another zone suitable for monitoring groper populations may be SZ-3 in the Sir Joseph Banks Group Marine Park, where sub-adults have previously been recorded at sites within the zone and nearby.

In addition, further monitoring with increased effort (number of replicate transects) is desirable at sites where there were relatively few transects in 2013 or 2014 and discrepancies between those results. These sites include Point Westall, Groper Bay, Chinaman's Hat, Edithburgh, Cape Jervis and Fishery Bay.

Some adjustments to the information recorded during the surveys are also suggested.

Introduction

The western blue groper (*Achoerodus gouldii*) is the largest resident reef fish in southern Australian coastal waters (Bryars et al. 2012). The life history traits of western blue groper (WBG) renders the species highly vulnerable to the effects of localised over-fishing as they are long-lived, slow-growing, sex-changing (Coulson et al. 2009), and site-attached with a small home range (Bryars et al. 2012). The aspect of WBG ecology most relevant to visual surveys of abundance is the shift in habitat of the species with size and age. After a late winter-to-spring spawning, groper larvae drift in the sea for 1-2 months in the easterly flowing Leeuwin Current. On settlement in lagoons or back reefs, which is more prevalent when the Leeuwin Current is weak, they have a cryptic brownish-green colour and feed on tiny mussels and crustaceans. Over the next 15 or so years they become greener in appearance, gradually move into slightly deeper water and, at sexual maturity (~60 cm), males change colour from greenish to the more familiar blue. Most then move offshore to reefs 30–50 m deep, where they feed on crustaceans, molluscs, sea-urchins, and worms. At a size of 10 cm they are aged ~1 year, at 20 cm ~2 years, and at 60 cm ~15 years (Shepherd and Edgar 2013; Coulson et al. 2009).

Numbers of large WBG declined in parts of South Australia (SA) due to intense fishing during the 1950–70s and this led to their total protection within central SA in the 1980s. Outside of central SA there are recreational and commercial catch limits. Nonetheless, the species is still of conservation concern due to ongoing fishing interactions (Baker 2012) and because it has poor post-release survival rates (McLeay et al. 2002; Bryars et al. 2012). The WBG is currently included on the Reef Watch 'Feral or In Peril' species list as a species of conservation interest.

Shepherd and Brook (2007) reported on a spatially-comprehensive set of underwater visual census (UVC) surveys for WBG across SA. Since that time, additional UVC surveys for reef fish (including WBG) have been conducted at some of the same sites, but a more spatially-comprehensive survey specifically for WBG had not been undertaken until 2013. The Conservation Council of South Australia (CCSA) received a State Community NRM Grant for community volunteers to undertake a targeted survey for WBG at selected sites around SA. Bryars and Brook (2013) reported on the status of WBG based on this survey, compared the 2013 survey data with historical data, and examined whether the protection zone in central SA was having a measurable positive effect on the abundance of adult WBG in that region.

CCSA received an Australian Government Community Environment Grant for community volunteers to continue surveys in 2014. Due to a reduced budget these surveys focussed on previously surveyed West Coast, Yorke Peninsula and Fleurieu Peninsula sites, and two new sites at the northern end of the Fleurieu Peninsula (off the metropolitan coast) due to recent observations of WBG in the area, including footage near the Adelaide Desalination Plant (Dr S. Bryars, pers. comm.). This report presents the results of the 2014 surveys and compares with previous results using a similar reporting framework to Bryars and Brook (2013). The surveys are also examined in the context of marine park Sanctuary Zones that were recently established across the State and will have effect from October 2014.

Methods

2014 survey

Fifteen sites were surveyed in SA during 2014, and grouped into three regions: Eyre Peninsula; Yorke Peninsula and Fleurieu Peninsula (Shepherd and Brook 2007; Bryars and Brook 2013) (Figure 1, Table 1). Surveys were undertaken according to the method described by Shepherd and Brook (2007) to collect data on the size and abundance of WBG. The surveys were undertaken by snorkel with the exception of the deeper sites at Seacliff and Mac's Reef. A varying number of replicate transects were undertaken at each site (Table 1). While size and abundance data were collected on other fish species, the present report is concerned only with WBG. Size data on WBG were scored into size classes consistent with those used in previous surveys, and then reclassified into three categories: juvenile <20 cm total length (TL); sub-adult 20–60 cm TL; and adult >60 cm TL (after Shepherd and Brook 2007). Groper abundances within the 50–70 cm size class (used on all previous surveys) were split equally between the sub-adult and adult categories.

Abundance data were analysed using PRIMER 6 with PERMANOVA to test for differences in assemblages (juveniles, sub-adults, adults) and total abundance across sites (15 sites) and regions (three regions).

Historical surveys

Of the 15 sites surveyed in 2014, previous surveys had been undertaken at or near to 12 of them both in 2013 (Bryars and Brook 2013) and during the previous decade (Shepherd and Brook 2007) (Table 1). Previous data for Point Drummond were available from Shepherd and Brook (2007) but not for the 2013 surveys. The Seacliff and Macs Reef sites had not previously been specifically surveyed for blue groper, although fish surveys were undertaken for the Reef Health program at Seacliff in 2005 and 2007, with no groper being recorded (Dr S. Bryars, pers. comm.).

As WBG are site-attached, slow-growing and long-lived, comparisons of surveys that are temporally separated by many years are considered to be valid (see Shepherd and Brook 2007). Nonetheless, the time period between the 2013 survey and historical surveys is sufficient for juveniles and sub-adults to have grown into larger size classes. This may become evident in comparisons with historical data analysis, and to some extent even between the 2013 and 2014 surveys

Comparisons with historical surveys may be confounded by spatial variation in the survey locations due to habitat preferences (including ontogenetic changes) of WBG (Shepherd and Brook 2007). To minimise such influence, only historical surveys from similar depth ranges and exposures to the more recent surveys were used in the comparison.

A PERMANOVA test was used to investigate change to the total abundance between the previous baseline and compatible data from the 2013 and 2014 surveys.

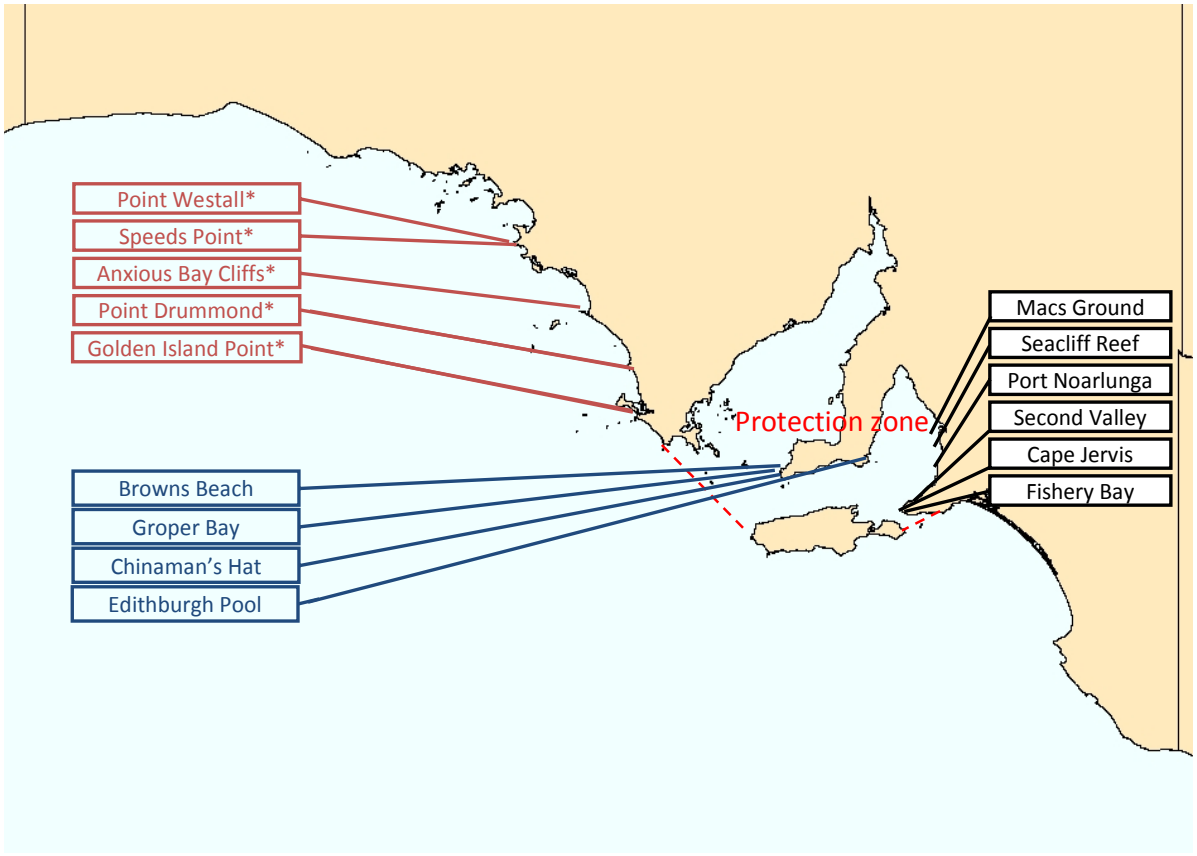

Figure 1. Map of sites surveyed in 2014. * indicates site is located outside of the protection zone.

Table 1. Sites surveyed in 2014. Data on exposure, rock type and relief were unavailable and have been mainly derived from site notes with historical surveys. Note: reps = number of replicates; vis = visibility; prot = whether inside protection zone; shore = whether there is shore-based access to the site.

Site name	Region	Reps.	Depth (m)	Vis. (m)	Exposure	Prot.	Rock type	Relief (m)	Shore	2013 data?	Historical data?
Point Westall	Eyre Peninsula	8	1-4	5	Moderate	No	Granite	1	Yes	Yes	Dec 2003
Speeds Point	Eyre Peninsula	17	1-4	5	Sheltered/ Moderate	No	Calcrete	0.5-2	Yes	Yes	Dec 2003
Anxious Bay Cliffs	Eyre Peninsula	10	1-4	8	Sheltered/ Moderate	No	Calcrete	0-2	Yes	Yes	Dec 2003
Point Drummond	Eyre Peninsula	4	1-3	3	Moderate	No	Granite	1-2	Yes	No	Dec 2004
Golden Island Point	Eyre Peninsula	6	1-3	6	Moderate	No	Calcrete	1-1.5	Yes	Yes	Dec 2004
Browns Beach	Yorke Peninsula	8	1-3	5	Sheltered	Yes	Calcrete	0.5-1	Yes	Yes	Dec 2002
Groper Bay	Yorke Peninsula	8	1-4	2	Moderate	Yes	Calcrete	1.5-2	Yes	Yes	Dec 2002
Chinaman's Hat	Yorke Peninsula	7	1-3	7	Moderate	Yes	Calcrete	1-1.5	Yes	Yes	Oct 2002
Edithburgh Pool	Yorke Peninsula	8	1-4	6	Sheltered	Yes	Calcrete	0.5	Yes	Yes	Jan 2005
Macs Ground	Fleurieu Peninsula	8	10	12	Moderate	Yes	Calcrete	0-1	No	No	No
Seacliff Reef	Fleurieu Peninsula	8	12	12	Moderate	Yes	Calcrete	0-1	No	No	No
Port Noarlunga	Fleurieu Peninsula	20	2-8	3-10	Sheltered/ Moderate	Yes	Calcrete	3-4	Yes	Yes	Mar 2003
Second Valley	Fleurieu Peninsula	8	2-6	6	Moderate	Yes	Schist	1-1.5	Yes	Yes	Nov 2003 Apr 2007
Cape Jervis	Fleurieu Peninsula	4	1-3	8	Moderate	Yes	Schist	0.5-2	Yes	Yes	Dec 2003 July 2004
Fishery Bay	Fleurieu Peninsula	4	1-3	5	Moderate	Yes	Schist	1-1.5	Yes	Yes	Dec 2003

Results

2014 survey

Total abundance of WBG (juveniles, sub-adults and adults) was highly variable across the 15 sites surveyed (Figure 2; see Appendix 1 for raw data).

WBG were recorded at all of the Eyre Peninsula sites (Point Westall, Speeds Point, Anxious Bay Cliffs, Point Drummond and Golden Island Point) and all of the Yorke Peninsula sites (Browns Beach, Groper Bay, Chinaman's Hat, Edithburgh Pool) but were recorded at only two sites (Cape Jervis and Fishery Bay) on the Fleurieu Peninsula (Figure 2). There were significant differences between the three regions ($F=18.97$, $P=0.001$), and between sites ($F=6.77$, $P=0.001$). Golden Island Point had a significantly higher abundance than all other sites, but there were no other pairs of non-zero sites where the differences shown in Figure 2 were statistically significant.

Abundances of the three separate size classes were also variable across the 15 sites and there were no sites with observations of all three size classes (Figure 3). Juveniles were recorded at all sites where WBG were recorded except Point Westall and Cape Jervis, and were most abundant at Golden Island Point. Sub-adults were found at all Eyre Peninsula sites and Cape Jervis and Fishery Bay on the Fleurieu Peninsula, with the highest abundance at Speeds Point (Figure 3). Adults were recorded only at Point Westall (Eyre Peninsula).

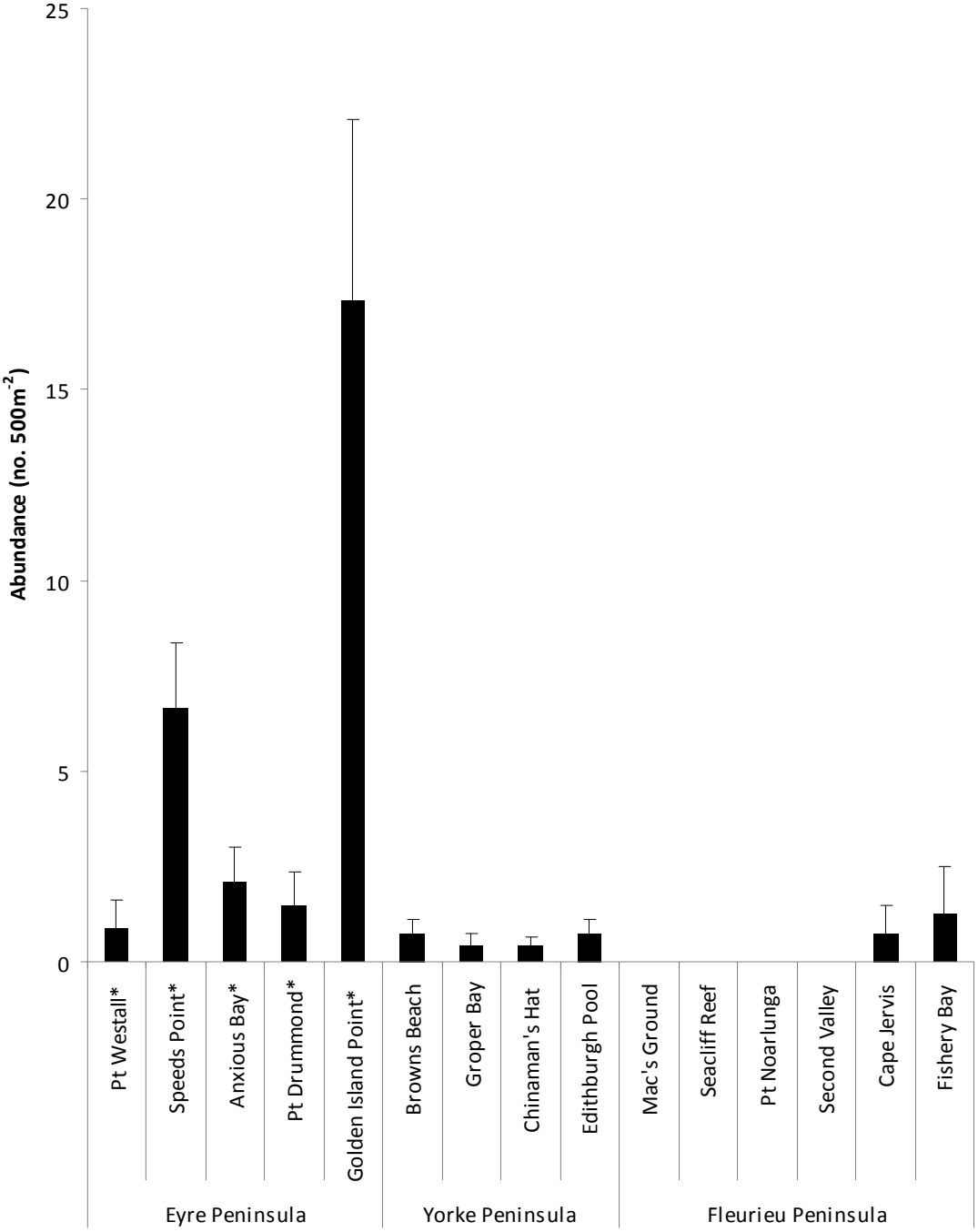

Figure 2. Total abundance (mean + standard error) of western blue groper across the 15 sites surveyed in 2014. See Figure 1 for site locations and Table 1 for site details. * indicates site is located outside of the protection zone.

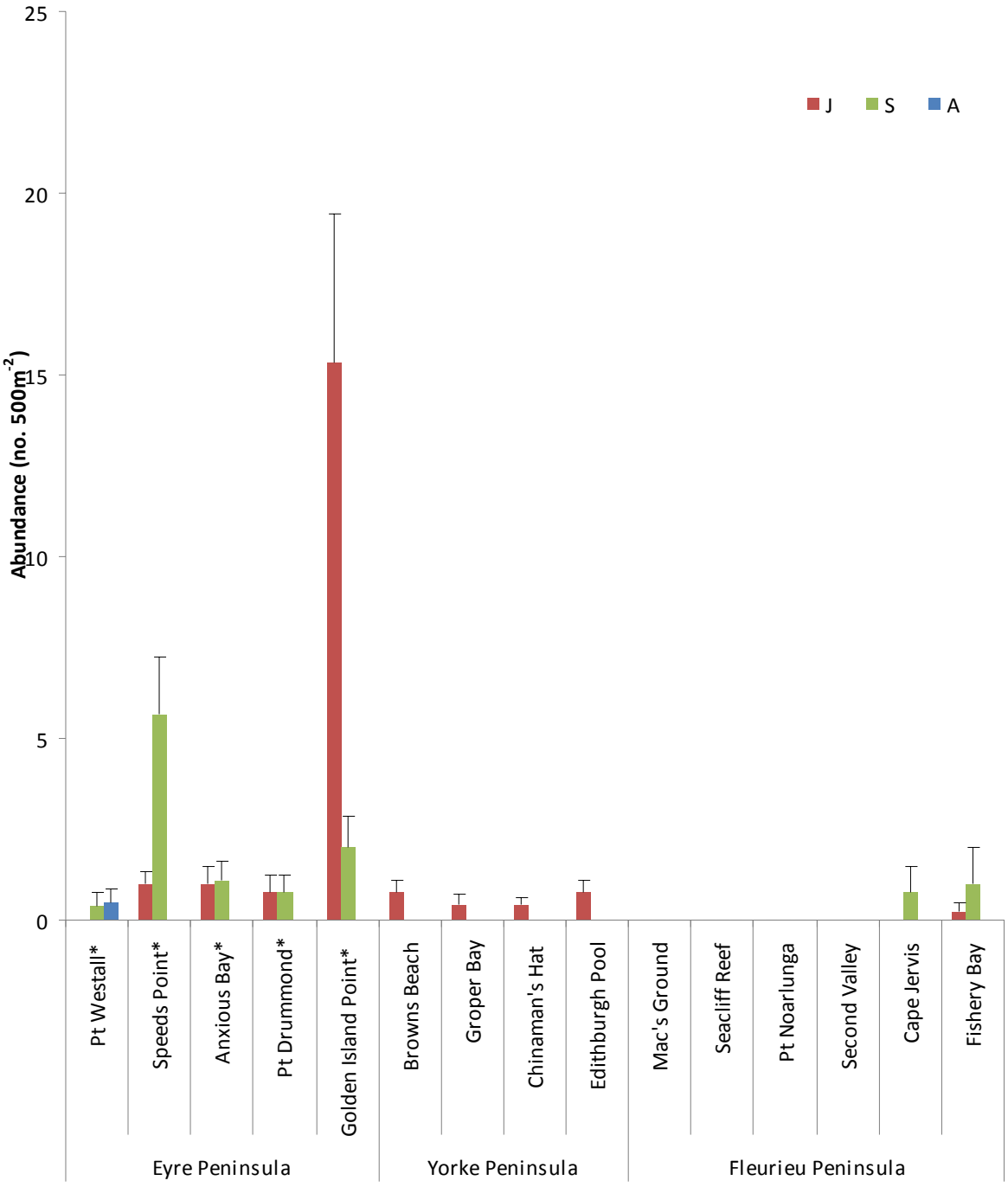

Figure 3. Abundance (mean + standard error) of juvenile, sub-adult and adult western blue groper across the 15 sites surveyed in 2014. See Figure 1 for site locations and Table 1 for site details.
* indicates site is located outside of the protection zone.

2014 survey compared with previous surveys

The overall patterns of abundance recorded in 2014 were very similar to those of 2013 (Figure 4). Exceptions were at:

- Groper Bay, where the abundance was lower than 2013. This would almost certainly have been the result of the lower visibility (2 m compared with 8 m in 2013)
- Cape Jervis and Fishery Bay, where no groper had been recorded in 2013.

The abundances for 2014 (and 2013) were in general lower than the historical surveys, with exceptions being Fishery Bay (where no groper were recorded during historical surveys) and Golden Island Point.

A two-way PERMANOVA (site X survey event) confirmed that there was a significant difference in abundance across the three survey events (F=18.51,*P*=0.001), with no significant interaction with site (F=1.50,*P*=0.09) and no pair-wise difference between 2013 and 2014 (F=0.058,*P*=0.95).

With regard to size classes, the most noticeable difference between 2013 and 2014 was the lack of adult WBG (defined for this report as >60 cm) recorded at the three Yorke Peninsula sites (Groper Bay, Chinaman's Hat and Edithburgh) where they were recorded in 2013. This contrasted with Point Westall on Eyre Peninsula where adults had been recorded in 2003 and again in 2014 but not in 2013. In the context of the protection zone that includes the Yorke Peninsula sites but not the Eyre Peninsula sites, this result is counter-intuitive. Given this and the sparsity of the adult abundance data, it was not considered appropriate to undertake any statistical tests of the effect of the protection zone. It should also be noted that two groper in the 40-50 cm size class, including one (blue) male were recorded at Point Westall in 2013. Although groper of this size grow by less than 2 cm per year (Coulson et al. 2009), it is possible that these have progressed to the adult size class between the surveys, possibly also with some influence from size estimation errors. Similarly, the sub-adults observed at Golden Island Point in 2014 (compared with zero sub-adults in 2013) may be the result of some of the juveniles growing into a larger size class.

The most noticeable differences between the historical and recent (2013, 2014) surveys were:

- lower abundances during recent surveys on Eyre Peninsula (as above), but no consistent pattern with regard to juveniles and sub-adults
- the lack of sub-adults recorded on Yorke Peninsula during the recent surveys
- the lack of juveniles at Cape Jervis.
- observations of adult groper at Yorke Peninsula (2013 only).

The lack of groper observed at Port Noarlunga and Second Valley is consistent with the results of the historical surveys listed in Table 1. It should be noted that there have been additional fish surveys conducted at Port Noarlunga in most years over the past decade with sporadic records of groper (Shepherd, unpublished data; Reef Watch online databases for fish and 'Feral or In Peril' surveys with associated photos).

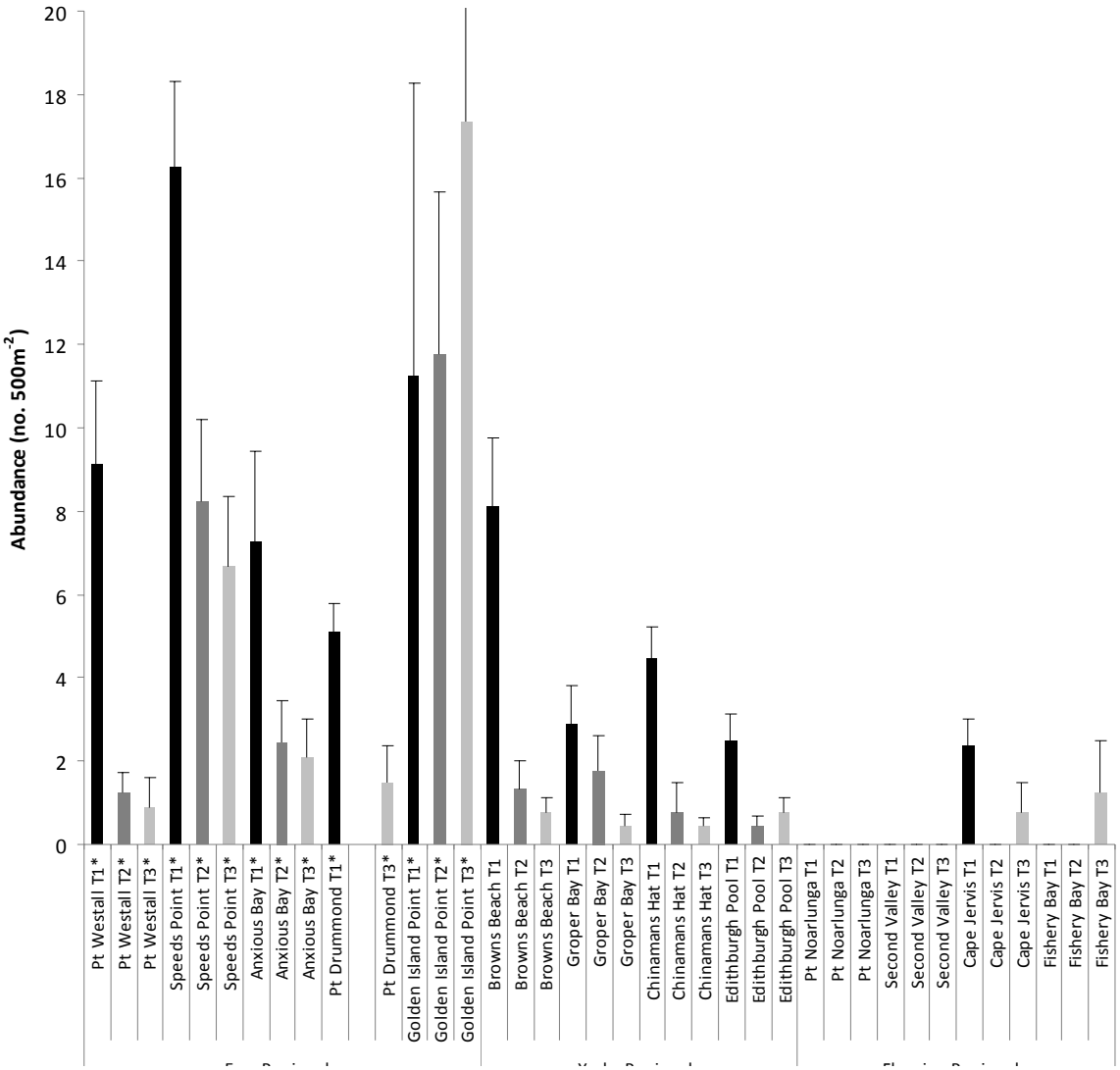

Figure 4. Total abundance (mean + standard error) of western blue groper across the 15 sites surveyed prior to 2013 (T1), in 2013 (T2) and 2014 (T3). Note that there was no survey conducted at Point Drummond in 2013 (T2). See Figure 1 for site locations and Table 1 for details of pre-2013 survey years. * indicates site is located outside of the protection zone.

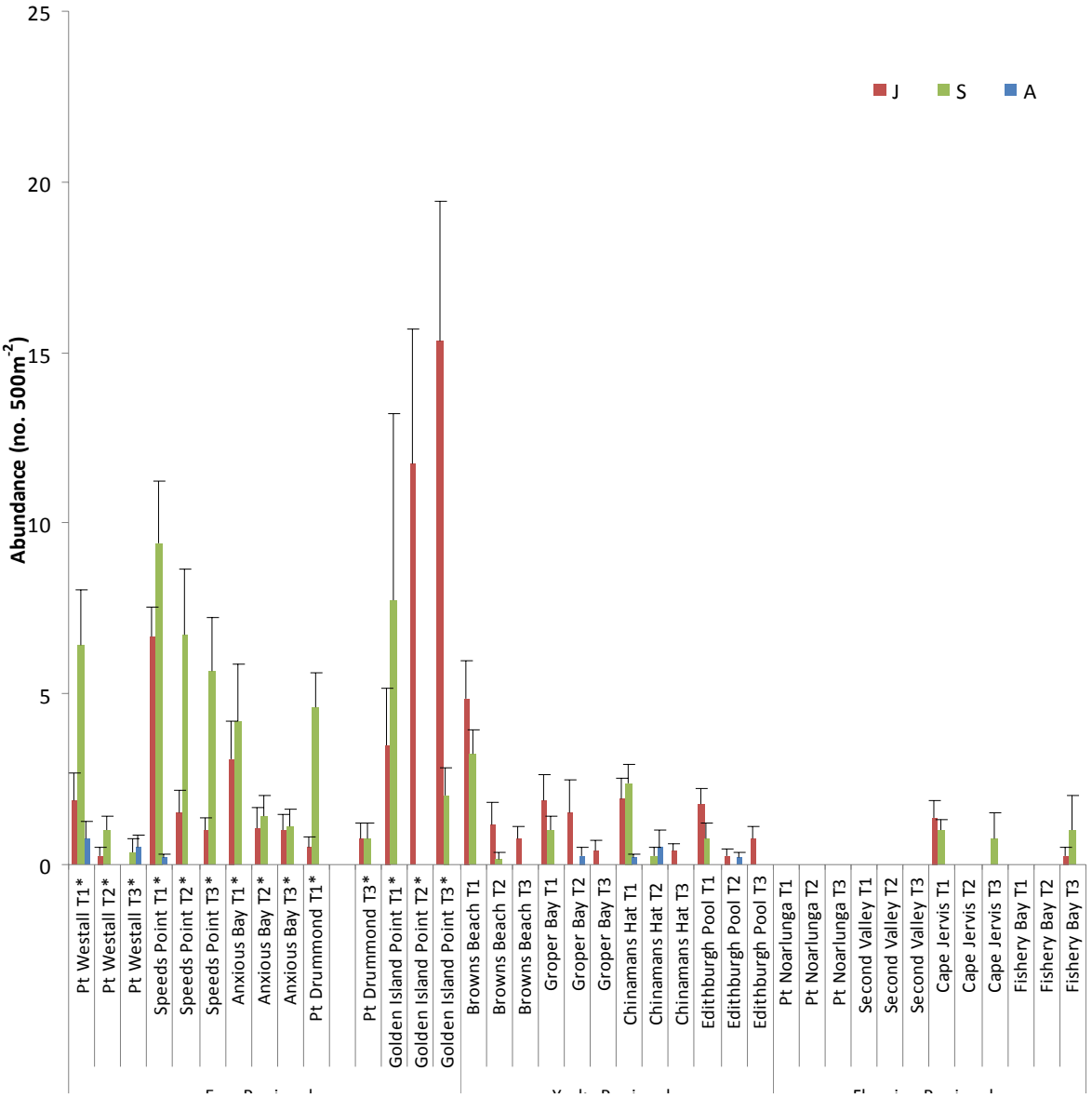

Figure 5. Abundance (mean + standard error) of juvenile, sub-adult and adult western blue groper across the 15 sites surveyed prior to 2013 (T1), in 2013 (T2) and 2014 (T3). Note that there was no survey conducted at Point Drummond in 2013 (T2). See Figure 1 for site locations and Table 1 for details of pre-2013 survey years. * indicates site is located outside of the protection zone.

Discussion

A number of limitations of the current and historical surveys were noted by Bryars and Brook (2013) and remain relevant to the current study, particularly regarding comparisons with historical data.

- Underwater visual census (UVC) surveys have inherent biases (e.g. Edgar et al. 2004) and thus some degree of caution should be used when interpreting the results of the surveys. For example, while all survey participants were trained in UVC techniques and the identification of WBG life stages, different surveys were conducted by different people. In addition, a few of the historical surveys were conducted by scuba, rather than snorkelling as

in the recent surveys, and this may have influenced the results to some degree. Poor visibility can also bias fish counts, as probably occurred at Groper Bay in 2014.

- Interpretation of possible temporal patterns should be treated with caution as the historical surveys were spread over several years but included only a single survey for each site. In contrast, the more recent surveys comprised repeated surveys in two consecutive years, with the similarity of the 2013 and 2014 results providing a level of confidence in the recent data.
- Although historical transects were generally excluded from the comparison if they had been undertaken in different depths or exposures, this task was made difficult by the absence of an estimated exposure index or species-level data on the macroalgal assemblage for the 2013 and 2014 surveys. Furthermore, there may have been subtle differences in the precise geographical location between historical and 2013/2014 surveys; an approximate site location may be inadequate where other physical conditions (and thus habitability for different WBG size classes) change dramatically over small distances, e.g. relief.

Nonetheless, in terms of conservation concerns for the WBG a number of key points have emerged from the analysis of the 2013 and 2014 survey data and the comparison with historical data:

- Populations of WBG appear to have declined across Eyre and Yorke Peninsulas over the past decade. The numbers of juveniles have decreased at all sites except Golden Island Point. WBG are prone to variable recruitment with recruitment generally strongest when the Leeuwin Current is weak (Coulson et al. 2009), which occurs during El Niño events (most recently 2006/7 and 2009/10). The decline in sub-adults at all sites (except possibly Speeds Point) is unlikely to be attributable solely to recruitment failure due to the number of juveniles recorded during the historical surveys and the likelihood of two strong recruitment pulses since then.
- The protection zone does not appear to be having any positive influence on populations of adult or sub-adult groper. Although the results of the 2013 survey suggested that protection may have had a positive impact on the abundance of adults (Bryars and Brook 2013), the results of the current survey for adults are more consistent with the historical data presented by Shepherd and Brook (2007). They described a pattern of declining adult abundance from west to east, suggesting it could be due to a combination of natural distribution patterns and fishing. They also hypothesized that some adults migrate to offshore islands, where they found groper to be more abundant. Nevertheless, Bryars and Brook (2013) noted anecdotal information suggesting that adult WBG did previously occur at many mainland Eyre Peninsula sites. The apparent decline of sub-adults on Yorke Peninsula, despite evidence of recruitment over the past decade, is a further indication that the protection zone does not provide adequate management of impacts on WBG. Although WBG are known to be susceptible to barotrauma in deep water (Coulson et al. 2009), the survival rate of released groper from shallower depths is not known. There may also be more direct fishing mortality as conversations with many rock fishers on Yorke Peninsula over several years revealed that many of them were unaware that the ‘greenish rock cod’ they caught were in fact WBG (Dr S. Shepherd, pers. comm.).
- Adults were recorded at one site only (Point Westall) across the three regions surveyed during the current study. As noted by Bryars and Brook (2013), a lack of adults at sites that are accessible to shore-based line fishers and spear fishers would not be surprising given the

life-history traits of the species, i.e. its vulnerability to localised depletions (Bryars et al. 2012). It should be noted that data on adult populations are sparse in comparison to sub-adults and juveniles and it is therefore possible that chance is playing a role in the lack of adults recorded.

- Bryars and Brook (2013) considered that the lack of WBG at Cape Jervis, where they have been recorded previously, was surprising and perhaps a result of the relatively low number of transects at that site during the 2013 surveys. This view is supported by the presence of groper recorded at Cape Jervis (and Fishery Bay) during the current survey. It should be noted that groper have been previously recorded in the vicinity of Fishery Bay (Shepherd and Brook 2007).
- Chinaman's Hat is one of only two sites surveyed within a marine park Sanctuary Zone during the current study. The other is Port Noarlunga, which has had protection as an Aquatic Reserve for several decades. There have been several sightings of groper (outside of the formal groper surveys) at Port Noarlunga in recent years (see Results section).

Recommendations

- To monitor the effect of increased protection afforded by marine park Sanctuary Zones, there should be an increase in survey effort at Chinaman's Hat and nearby sites, including Groper Bay, as controls. Another zone suitable for monitoring groper populations may be SZ-3 in the Sir Joseph Banks Group Marine Park, where sub-adults have previously been recorded at sites within the zone and nearby.
- Otherwise, future surveys should increase effort (number of replicate transects) at sites where there were relatively few transects in 2013 or 2014 and discrepancies between those results. These sites (in addition to Chinaman's Hat and Groper Bay) include Point Westall, Edithburgh, Cape Jervis and Fishery Bay.
- Long-term monitoring is important due to the variable recruitment of WBG.
- Future surveys should split the 50-70 cm size class into two size classes to allow a clearer delineation of adults (defined as >60 cm) while preserving backward compatibility with historical data.
- As recommended by Bryars and Brook (2013), all habitat data described by Shepherd and Brook (2007) should be recorded during future surveys. If the personnel involved are not able to identify canopy-forming macroalgae to species, then representative photos could be taken.
- Scuba transects should be considered at sites where adult WBG were not recorded in 2013 or 2014 but were previously recorded using scuba.
- The data from the current surveys should be collated with that from additional surveys by volunteers and professional scientists (including Shepherd, unpublished data; Edgar et al. 2005; Collings et al. 2008; DEH 2008; Friends of Sceale Bay 2010). Analysis of this larger dataset would ensure that our understanding of the status of WBG is based on the best available information.

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Appendix 1

Raw abundance data for western blue groper at the 15 sites surveyed in 2014. * denotes blue male.

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Eyre Peninsula	Pt Westall	4	1038	0										
Eyre Peninsula	Pt Westall	4	1039	1									1	
Eyre Peninsula	Pt Westall	2-4	1040	0										
Eyre Peninsula	Pt Westall	2-4	1041	0										
Eyre Peninsula	Pt Westall	3-4	1042	6					1		1	1	3	
Eyre Peninsula	Pt Westall	3-4	1043	0										
Eyre Peninsula	Pt Westall	2-4	1044	0										
Eyre Peninsula	Pt Westall	2-4	1045	0										
Eyre Peninsula	Speeds Point	2	1022	5				1			4			
Eyre Peninsula	Speeds Point	2	1023	2							2			
Eyre Peninsula	Speeds Point	2	1024	2				1	1					
Eyre Peninsula	Speeds Point	2	1025	1							1			
Eyre Peninsula	Speeds Point	2-3	1026	0										
Eyre Peninsula	Speeds Point	2-3	1027	0										
Eyre Peninsula	Speeds Point	2-3	1028	8		1	3	2	2					
Eyre Peninsula	Speeds Point	2-3	1029	3			1	1	1					
Eyre Peninsula	Speeds Point	2	1030	4				3	1					
Eyre Peninsula	Speeds Point	2	1031	10			3	6	1					
Eyre Peninsula	Speeds Point	2	1032	10			1	6	3					

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Eyre Peninsula	Speeds Point	2	1032	10			1	6	3					
Eyre Peninsula	Speeds Point	2	1033	5				2	2			1		
Eyre Peninsula	Speeds Point	2-3	1034	20				1	6		13			
Eyre Peninsula	Speeds Point	2-3	1035	7			1	1	1		4			
Eyre Peninsula	Speeds Point	2-3	1036	6		1	3	2						
Eyre Peninsula	Speeds Point	2-3	1037	0										
Eyre Peninsula	Anxious Bay	1-3	1006	3		1		1	1					
Eyre Peninsula	Anxious Bay	1-3	1007	3		1	1		1					
Eyre Peninsula	Anxious Bay	1-3	1008	0										
Eyre Peninsula	Anxious Bay	1-3	1009	6		2	2	1	1					
Eyre Peninsula	Anxious Bay	1-3	1010	8			3	3	2					
Eyre Peninsula	Anxious Bay	1-3	1011	1				1						
Eyre Peninsula	Anxious Bay	2-3	1012	0										
Eyre Peninsula	Anxious Bay	2-3	1013	0										
Eyre Peninsula	Anxious Bay	2-3	1014	0										
Eyre Peninsula	Anxious Bay	2-3	1015	0										
Eyre Peninsula	Pt Drummond	1-2	1002	1			1							
Eyre Peninsula	Pt Drummond	3	1003	0										
Eyre Peninsula	Pt Drummond	2-4	1004	1							1			
Eyre Peninsula	Pt Drummond	2	1005	4			2					2		
Eyre Peninsula	Golden Island Point	2-3	1016	39	5	16	12	4	2					
Eyre Peninsula	Golden Island Point	2-3	1017	12		4	8							

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Eyre Peninsula	Golden Island Point	2	1018	12	3	3	5	1						
Eyre Peninsula	Golden Island Point	2	1019	22	15	4	2	1						
Eyre Peninsula	Golden Island Point	4	1020	8	1	3	2	1	1					
Eyre Peninsula	Golden Island Point	4	1021	11	2	3	4	2						
Yorke Peninsula	Browns Beach	1-4	1050	0										
Yorke Peninsula	Browns Beach	1-4	1051	1		1								
Yorke Peninsula	Browns Beach	1-3	1052	1			1							
Yorke Peninsula	Browns Beach	1-3	1053	0										
Yorke Peninsula	Browns Beach	1-3	1058	1			1							
Yorke Peninsula	Browns Beach	1-3	1059	0										
Yorke Peninsula	Browns Beach	1-3	1060	0										
Yorke Peninsula	Browns Beach	1-3	1065	3		3								
Yorke Peninsula	Groper Bay	0-2	1047	0										
Yorke Peninsula	Groper Bay	1-5	1048	0										
Yorke Peninsula	Groper Bay	1-5	1049	0										
Yorke Peninsula	Groper Bay	1-3	1063	1		1								
Yorke Peninsula	Groper Bay	1-3	1064	2			2							
Yorke Peninsula	Groper Bay	2	1066	0										
Yorke Peninsula	Groper Bay	2	1067	0										
Yorke Peninsula	Chinamans Hat	1-5	1046	0										
Yorke Peninsula	Chinamans Hat	2-3	1054	0										
Yorke Peninsula	Chinamans Hat	2-3	1055	0										

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Yorke Peninsula	Chinamans Hat	2-3	1056	1		1								
Yorke Peninsula	Chinamans Hat	2-3	1057	1		1								
Yorke Peninsula	Chinamans Hat	4	1061	0										
Yorke Peninsula	Chinamans Hat	4	1062	1			1							
Yorke Peninsula	Edithburgh Pool	2-4	1072	0										
Yorke Peninsula	Edithburgh Pool	2-4	1073	0										
Yorke Peninsula	Edithburgh Pool	2-4	1074	3			3							
Yorke Peninsula	Edithburgh Pool	2-4	1075	1			1							
Yorke Peninsula	Edithburgh Pool	1-3	1076	0										
Yorke Peninsula	Edithburgh Pool	1-3	1077	0										
Yorke Peninsula	Edithburgh Pool	1-3	1078	1			1							
Yorke Peninsula	Edithburgh Pool	1-3	1079	1			1							
Fleurieu Peninsula	Macs Ground	10	1120	0										
Fleurieu Peninsula	Macs Ground	10	1121	0										
Fleurieu Peninsula	Macs Ground	10	1122	0										
Fleurieu Peninsula	Macs Ground	10	1123	0										
Fleurieu Peninsula	Macs Ground	10	1124	0										
Fleurieu Peninsula	Macs Ground	10	1125	0										
Fleurieu Peninsula	Macs Ground	10	1126	0										
Fleurieu Peninsula	Macs Ground	10	1127	0										
Fleurieu Peninsula	Seacliff Reef	12	1068	0										
Fleurieu Peninsula	Seacliff Reef	12	1069	0										

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Fleurieu Peninsula	Seacliff Reef	12	1070	0										
Fleurieu Peninsula	Seacliff Reef	12	1071	0										
Fleurieu Peninsula	Seacliff Reef	1-2	1108	0										
Fleurieu Peninsula	Seacliff Reef	1-2	1109	0										
Fleurieu Peninsula	Seacliff Reef	1-2	1110	0										
Fleurieu Peninsula	Seacliff Reef	1-2	1111	0										
Fleurieu Peninsula	Pt Noarlunga	3-5	1080	0										
Fleurieu Peninsula	Pt Noarlunga	3-5	1081	0										
Fleurieu Peninsula	Pt Noarlunga	1-5	1082	0										
Fleurieu Peninsula	Pt Noarlunga	1-5	1083	0										
Fleurieu Peninsula	Pt Noarlunga	1-2	1084	0										
Fleurieu Peninsula	Pt Noarlunga	1-2	1085	0										
Fleurieu Peninsula	Pt Noarlunga	2-4	1086	0										
Fleurieu Peninsula	Pt Noarlunga	2-4	1087	0										
Fleurieu Peninsula	Pt Noarlunga	3-4	1088	0										
Fleurieu Peninsula	Pt Noarlunga	3-4	1089	0										
Fleurieu Peninsula	Pt Noarlunga	1-3	1090	0										
Fleurieu Peninsula	Pt Noarlunga	1-3	1091	0										
Fleurieu Peninsula	Pt Noarlunga	1-3	1100	0										
Fleurieu Peninsula	Pt Noarlunga	1-3	1101	0										
Fleurieu Peninsula	Pt Noarlunga	1-4	1102	0										
Fleurieu Peninsula	Pt Noarlunga	1-4	1103	0										

Region	Site	Depth	Survey ID	Total	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-70	>70
Fleurieu Peninsula	Pt Noarlunga	1-3	1104	0										
Fleurieu Peninsula	Pt Noarlunga	1-3	1105	0										
Fleurieu Peninsula	Pt Noarlunga	2-4	1106	0										
Fleurieu Peninsula	Pt Noarlunga	2-4	1107	0										
Fleurieu Peninsula	Second Valley	2-5	1092	0										
Fleurieu Peninsula	Second Valley	2-5	1093	0										
Fleurieu Peninsula	Second Valley	2-4	1094	0										
Fleurieu Peninsula	Second Valley	2-4	1095	0										
Fleurieu Peninsula	Second Valley	2-4	1096	0										
Fleurieu Peninsula	Second Valley	2-4	1097	0										
Fleurieu Peninsula	Second Valley	1-4	1098	0										
Fleurieu Peninsula	Second Valley	1-4	1099	0										
Fleurieu Peninsula	Cape Jervis	1-3	1116	3				3						
Fleurieu Peninsula	Cape Jervis	1-3	1117	0										
Fleurieu Peninsula	Cape Jervis	1-3	1118	0										
Fleurieu Peninsula	Cape Jervis	1-3	1119	0										
Fleurieu Peninsula	Fishery Bay	2	1112	5		1		3	1					
Fleurieu Peninsula	Fishery Bay	2	1113	0										
Fleurieu Peninsula	Fishery Bay	1-3	1114	0										
Fleurieu Peninsula	Fishery Bayh	1-3	1115	0										