Baseline survey of fishes and large mobile invertebrate assemblages at the Rogues Point native shellfish reef restoration site and nearby areas, South Australia – April 2017

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Department of Environment, Water and Natural Resources

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1 Introduction

1.1 Background

Historical fishing records indicate native oyster reefs (*Ostrea angasi*) were common along approximately 1500 kms of South Australia's coastline creating a rich ecosystem high in diversity and productivity. The economic value of these reefs and unsustainable fishing practices resulted in the removal of these once extensive systems and their existence was nearly forgotten (Alleway and Connell, 2015).

The restoration of approximately 20 ha of shellfish reef habitat, modelled on similar sized projects in the USA (e.g. Half Moon Reef), is being led by the Nature Conservancy and partnered by the Government of South Australia, Yorke Peninsula Council and recreational fishers. The new reef is being constructed at a depth between 8-12 m and 1 km offshore in Gulf St Vincent, 7 km south of Ardrossan on Yorke Peninsula, South Australia, and is the first shellfish restoration project of its kind in South Australia.

The reef substrate is being constructed of a bed of limestone rubble and inoculated with juvenile native oysters pre-seeded onto recycled oyster shells placed on top (Yorke Peninsula shellfish restoration – Monitoring Plan 2017-2022. *in prep*). Custom-made concrete structures will also be placed alongside the reef beds.

The before and after effects of construction on the local populations of fishes and large mobile invertebrates is being monitored using, among other techniques, baited remote underwater video systems (BRUVS). BRUVS are currently being used to assess the effectiveness of the South Australian Marine park network and are commonly used worldwide to monitor changes in fish assemblages (Langlois et al. 2006; Malcolm et al. 2007; Kleczkowski et al. 2008). Advances in underwater videometric measurement can provide more accurate and precise length measurements than diver underwater visual census (Harvey et al. 2004; Watson et al. 2005; Shortis et al. 2007). Furthermore, BRUVS is a non-extractive, non-destructive, repeatable method for quickly gathering data and building a permanent record.

This document summarises the initial (baseline) survey using BRUVS to assess the relative abundance and size of fishes within, and to the north and south of, the impact site. This dataset will provide a baseline against which to assess change at the constructed reef site relative to the surrounding area.

2 Methods and data summary

2.1 Methods

Three monitoring sites were selected for BRUVS deployments: one impact site (the reef construction site) and two control sites (seagrass dominated site to the north and a more sediment dominated site to the south, Figure 1).

At each site four replicate BRUVS drops were undertaken in water depths that varied from 5–9 m. The North control site is predominantly dense seagrass *(Posidonia)* habitat, while the South Control and Impact sites are soft sediment with medium/sparse *Halophila australis* and some *Pinna bicolor*. The BRUVS locations were verified for suitable habitat using a high-definition towed video camera with GPS overlay. Sampling was conducted on 13 April 2017 during daylight hours.

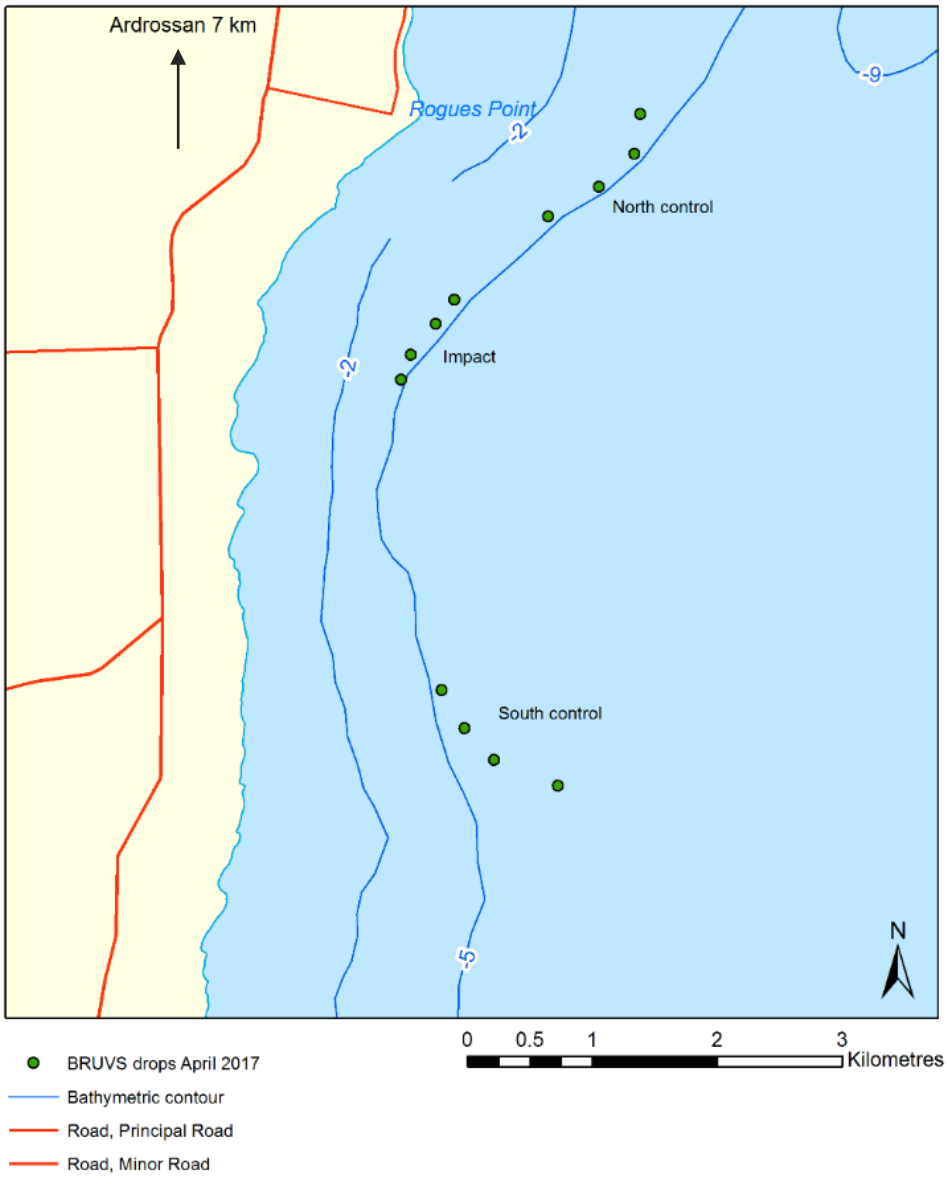

Figure 1. Map showing the location and orientation of the BRUVS deployments

The BRUVS units consist of a pair of GoPro Hero 4 cameras inside custom-made underwater housings mounted to a steel frame fitted with ballast. A plastic mesh bait bag filled with approximately 600 grams of minced pilchards (*Sardinops sp*.) is mounted on a pole 1.5 m in the front of the cameras to attract fish into the view of the cameras. Four replicate sample videos were collected at each site with BRUVS units being deployed in sets of two to spread temporal variability across the three sites. The BRUVS were left on the seabed to record for 60 minutes before being retrieved and redeployed. The video footage was interrogated to extract relative abundance (*MaxN*) and fish length data using EventMeasure software by SeaGIS. For a full description of BRUVS, use and data management, please refer to Miller et.al. 2017.

2.2 Data summary

A total of 20 species and a further 1 genera were identified. Many individual Monocanthids were only identified to family level. Overall, 16 families were represented, 305 individuals counted and 81 measured (Table 1, Table 2 and Appendix A).

Table 1. Taxonomic groups identified across all sites

South control (n=4)	Impact site (n=4)	North control (n=4)
Species = 14	Species = 8	Species = 12
Genus only = 1	Family only = 1	Family only = 1
Family only = 1		
Total count = 82	**Total count** = 55	**Total count** = 168

Bony fish were the most common taxonomic group across all sites, followed by sharks of which there were two species (Table 2 and Appendix A). Leatherjackets, rock whiting (*Neodax balteatus*) and the Port Jackson shark (*Heterodontus portusjacksoni*) were the most common species across all sites. The blue swimmer crab (*Portunus armatus*) was the most common invertebrate recorded across all sites

Table 2. Number of taxa per broad taxonomic grouping

Broad taxonomic group	No.
Sharks	2
Rays	1
Bony fishes	11
Crabs	1
Cephalopods	1

The level of identification was dictated by the water clarity and the similarity of species within their genus. Individuals identified to genus level only were from *Aracana,* and many individuals belonging to the family Monacanthidae could not be identified further than family level.

The North control site had higher mean relative abundance than the South control and Impact sites, which were similar (Figure 2). Overall, fishes belonging to the family Monacanthidae showed the highest abundances in the North control and Impact sites. *Neodax balteatus* was the most abundant species in the South control site (Appendix A).

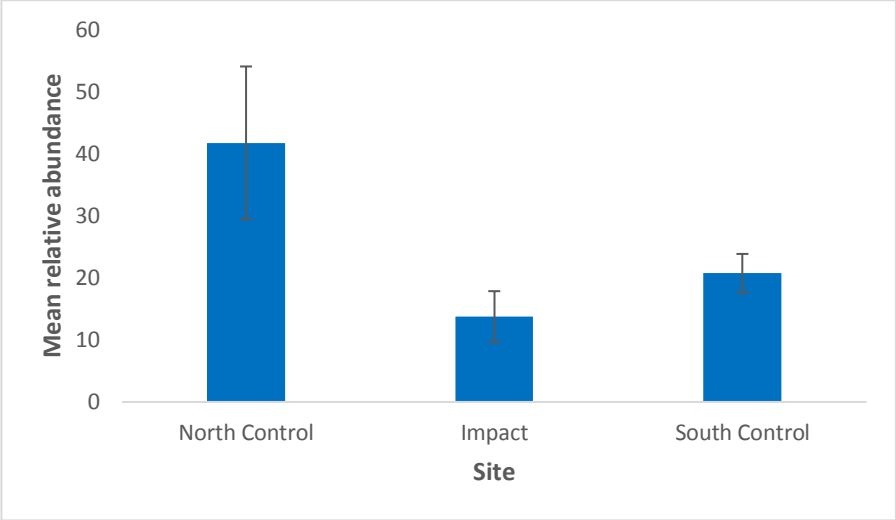

Figure 2. Mean relative abundance (MaxN) of all fishes and invertebrates across sites (mean ± standard error).

The lengths of 81 fishes, comprised of 17 individual species and 1 family, were measured using paired stereo imagery. A large number of unidentified Monacanthids, which appeared to be of the same species, representing a significant proportion of the fish, were also measured (Appendix B). Typically with BRUVS, not all fishes can be measured because they may not be simultaneously and clearly visible in both left and right camera images at a given time (a requirement for successful length measurements). The largest fish measured was a bronze whaler (*Carcharhinus brachyurus),* while the smallest was a pygmy leatherjacket (*Brachaluteres jacksonianus*).

Appendix C contains a common name to species name look up table.

Table 3. Largest fish measured at each site.

Site	Species	Length
Impact	*Heterodontus portusjacksoni* Port Jackson shark	810 mm
North control	*Heterodontus portusjacksoni* Port Jackson shark	635 mm
South control	*Trygonorrhina dumerilii* Southern fiddler ray	825 mm

3 Appendices

A. Combined species list and relative abundance of individuals across all sites

Species	North control (*n*=4)	South control (*n*=4)	Impact (*n*=4)
Acanthaluteres spilomelanurus	27		4
Aracana sp		2	
Arripis georgianus	17		
Brachaluteres jacksonianus		1	2
Carcharhinus brachyurus		1	
Heterodontus portusjacksoni	9	4	2
Meuschenia freycineti	2		
Monacanthidae sp	60	8	26
Neoodax balteatus	4	19	4
Omegophora armilla		1	
Parapercis haackei		5	2
Parequula melbournensis		6	
Pelates octolineatus	13	4	
Platycephalus speculator		1	
Portunus armatus	11	15	10
Pseudocaranx wrighti			2
Scobinichthys granulatus	1		
Sepioteuthis australis	2		
Siphonognathus attenuatus	1	2	3
Torquigener pleurogramma	18	2	
Trygonorrhina dumerilii		2	
Upeneichthys vlamingii	3	9	
Total number of individuals	**168**	**82**	**55**

B. Average fish length measurements across sites

Note: Measurements in **Bold** indicate an individual length and is not an average

Site	Name	Average length (mm)
Impact	*Acanthaluteres spilomelanurus*	105
	Brachaluteres jacksonianus	31
	Heterodontus portusjacksoni	810
	Monacanthidae sp	94
	Neoodax balteatus	71
	Parapercis haackei	109
	Pseudocaranx wrighti	162
	Siphonognathus attenuatus	85
North Control	*Acanthaluteres spilomelanurus*	89
	Arripis georgianus	128
	Heterodontus portusjacksoni	541
	Monacanthidae sp	95
	Neoodax balteatus	90
	Pelates octolineatus	121
	Scobinichthys granulatus	**144**
	Sepioteuthis australis	**134**
	Siphonognathus attenuatus	84
	Torquigener pleurogramma	205
	Upeneichthys vlamingii	136
South Control	*Carcharhinus brachyurus*	**768**
	Heterodontus portusjacksoni	456
	Monacanthidae sp	108
	Neoodax balteatus	91
	Omegophora armilla	**188**
	Parapercis haackei	83
	Parequula melbournensis	**82**
	Pelates octolineatus	167
	Torquigener pleurogramma	222
	Trygonorrhina dumerilii	**825**
	Upeneichthys vlamingii	125

C. Species common names

Species	Common name
Acanthaluteres spilomelanurus	Bridled leatherjacket
Aracana sp	Cowfish
Arripis georgianus	Australian herring
Brachaluteres jacksonianus	Southern pygmy leatherjacket
Carcharhinus brachyurus	Bronze whaler
Heterodontus portusjacksoni	Port Jackson shark
Meuschenia freycineti	Six-spined Leatherjacket
Monacanthidae sp	Leatherjacket
Neoodax balteatus	Little weed whiting
Omegophora armilla	Ringed toadfish
Parapercis haackei	Wavy grubfish
Parequula melbournensis	Southern silverbelly
Pelates octolineatus	Striped trumpeter
Platycephalus speculator	Southern blue-spotted flathead
Portunus armatus	Blue swimmer crab
Pseudocaranx wrighti	Skipjack trevally
Scobinichthys granulatus	Rough leatherjacket
Sepioteuthis australis	Southern calamary
Siphonognathus attenuatus	Slender weed whiting
Torquigener pleurogramma	Banded toadfish
Trygonorrhina dumerilii	Southern fiddler ray
Upeneichthys vlamingii	Red mullet

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