

Table S1. Summary of all fish species observed by BRUVS, including common name and functional feeding group.

Family	Species Name	Common Name	Functional Feeding Group
Alopiidae	<i>Alopias vulpinus</i>	Common Thresher Shark	Carnivore
Aplodactylidae	<i>Aplodactylus arctidens</i>	Marblefish	Herbivore
Arripidae	<i>Arripis trutta</i>	Australian salmon	Carnivore
Aulopidae	<i>Latropiscis purpurissatus</i>	Sergeant Baker	Carnivore
Berycidae	<i>Centroberyx affinis</i>	Redfish	Carnivore
	<i>Centroberyx lineatus</i>	Swallowtail	Carnivore
Callionymidae	<i>Pseudocallionymus goodladi</i>	Longspine Dragonet	Invertivore
Callorhynchidae	<i>Callorhynchus milii</i>	Elephantfish	Invertivore
Carangidae	<i>Pseudocaranx</i> sp.	Trevally	Invertivore
	<i>Seriola lalandi</i>	Yellowtail Kingfish	Carnivore
	<i>Trachurus</i> sp.	Jack mackerel	Carnivore
Carcharhinidae	<i>Carcharhinus brachyurus</i>	Bronze Whaler Shark	Carnivore
Cheilodactylidae	<i>Cheilodactylus nigripes</i>	Maggie Perch	Invertivore
	<i>Cheilodactylus</i> sp.	Morwong	Invertivore
	<i>Dactylophora nigricans</i>	Dusky Morwong	Invertivore
	<i>Nemadactylus macropterus</i>	Jackass Morwong	Invertivore
	<i>Nemadactylus valenciennesi</i>	Blue Morwong	Invertivore
Clupeidae	<i>Nematalosa vlaminghi</i>	Perth Herring	Planktivore
Cyttidae	<i>Cyttus australis</i>	Silver Dory	Carnivore
Dasyatidae	<i>Dasyatis</i> sp.	Common stingray	Invertivore
Dinolestidae	<i>Dinolestes lewini</i>	Longfin Pike	Carnivore
	<i>Diodon nictemerus</i>	Globefish	Invertivore
Enoplosidae	<i>Enoplosus armatus</i>	Old Wife	Invertivore
Gempylidae	<i>Thyrsites atun</i>	Barracouta	Carnivore
Gerreidae	<i>Parequula melbournensis</i>	Silverbelly	Invertivore
Heterodontidae	<i>Heterodontus portusjacksoni</i>	Port Jackson Shark	Invertivore
Hexanchidae	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Carnivore
Kyphosidae	<i>Girella zebra</i>	Zebrafish	Herbivore
Labridae	<i>Achoerodus</i> sp.	Blue Groper	Invertivore
	<i>Eupetrichthys angustipes</i>	Snakeskin Wrasse	Invertivore
	<i>Notolabrus fucicola</i>	Purple Wrasse	Invertivore
	<i>Notolabrus tetricus</i>	Bluethroat Wrasse	Invertivore
	<i>Pictilabrus laticlavus</i>	Senator Wrasse	Invertivore
	<i>Pseudolabrus rubicundus</i>	Rosy Wrasse	Invertivore
Monacanthidae	<i>Acanthaluteres vittiger</i>	Toothbrush Leatherjacket	Herbivore
	<i>Eubalichthys gunnii</i>	Gunn's Leatherjacket	Herbivore
	<i>Eubalichthys mosaicus</i>	Mosaic Leatherjacket	Herbivore
	<i>Meuschenia australis</i>	Brownstriped Leatherjacket	Herbivore
	<i>Meuschenia flavolineata</i>	Yellowstriped Leatherjacket	Herbivore
	<i>Meuschenia freycineti</i>	Sixspine Leatherjacket	Herbivore
	<i>Meuschenia galii</i>	Bluelined Leatherjacket	Herbivore
	<i>Meuschenia hippocrepis</i>	Horseshoe Leatherjacket	Herbivore
	<i>Meuschenia scaber</i>	Velvet Leatherjacket	Invertivore

	<i>Meuschenia venusta</i>	Stars-and-stripes Leatherjacket	Herbivore
	<i>Nelusetta ayraud</i>	Ocean Leatherjacket	Herbivore
	<i>Scobinichthys granulatus</i>	Rough Leatherjacket	Herbivore
	<i>Thamnaconus degeni</i>	Blue-finned Leatherjacket	Herbivore
Moridae	<i>Lotella rhacina</i>	Large-tooth Beardie	Carnivore
	<i>Pseudophycis</i> sp.	Rock Cod	Invertivore
Mullidae	<i>Upeneichthys vlamingii</i>	Bluespotted Goatfish	Invertivore
Myliobatidae	<i>Myliobatis australis</i>	Southern Eagle Ray	Invertivore
Neosebastidae	<i>Neosebastes scorpaenoides</i>	Common Gurnard Perch	Invertivore
Odacidae	<i>Heteroscarus acroptilus</i>	Rainbow Cale	Herbivore
	<i>Olisthops cyanomelas</i>	Herring Cale	Herbivore
	<i>Siphonognathus</i> sp.	Weed Whiting	Herbivore
Orectolobidae	<i>Orectolobus maculatus</i>	Spotted Wobbegong	Carnivore
Ostraciidae	<i>Aracana aurita</i>	Shaw's Cowfish	Invertivore
	<i>Aracana ornata</i>	Ornate Boxfish	Invertivore
Parascylliidae	<i>Parascyllium</i> sp.	Carpetshark	Carnivore
Pempheridae	<i>Pempheris multiradiata</i>	Bigscale Bullseye	Invertivore
Pentacerotidae	<i>Pentaceropsis recurvirostris</i>	Longsnout Boarfish	Invertivore
Platycephalidae	<i>Platycephalus</i> sp.	Flathead	Carnivore
Pomacentridae	<i>Parma</i> sp.	Scalyfin	Herbivore
Pristiophoridae	<i>Pristiophorus cirratus</i>	Common Sawshark	Carnivore
	<i>Pristiophorus nudipinnis</i>	Southern Sawshark	Carnivore
Rajidae	<i>Dipturus whitleyi</i>	Melbourne Skate	Carnivore
Rhinobatidae	<i>Trygonorrhina fasciata</i>	Eastern Fiddler Ray	Invertivore
Scorpididae	<i>Atypichthys strigatus</i>	Australian Mado	Planktivore
	<i>Scorpiis</i> sp.	Sweep	Herbivore
	<i>Tilodon sexfasciatus</i>	Moonlighter	Invertivore
Scyliorhinidae	<i>Cephaloscyllium laticeps</i>	Draughtboard Shark	Carnivore
Sebastidae	<i>Helicolenus percoides</i>	Reef Ocean Perch	Carnivore
Serranidae	<i>Caesioperca</i> sp.	Butterfly Perch	Planktivore
	<i>Hypoplectrodes nigroruber</i>	Banded Seaperch	Invertivore
Sillaginidae	<i>Sillaginodes punctatus</i>	King George Whiting	Invertivore
Sparidae	<i>Chrysophrys auratus</i>	Snapper	Invertivore
Sphyraenidae	<i>Sphyraena novaehollandiae</i>	Snook	Carnivore
Tetraodontidae	<i>Contusus brevicaudus</i>	Prickly Toadfish	Invertivore
	<i>Tetractenos glaber</i>	Smooth Toadfish	Invertivore
Trachichthyidae	<i>Paratrachichthys macleayi</i>	Sandpaper Fish	Planktivore
Triakidae	<i>Galeorhinus galeus</i>	School Shark	Carnivore
	<i>Mustelus antarcticus</i>	Gummy Shark	Carnivore
Urolophidae	<i>Urolophus</i> sp.	Stingaree	Invertivore

Table S2. Summary statistics of all best performing (Δ AIC less than 2) generalized additive models (GAMs) completed at spatial scales of 5 m, 10 m, 25 m, 50 m, 75 m, 100 m, 150 m, 200 m, 300 m, 400 m and 500 m. Descriptor variables used are identified by (+). Summary statistics presented include degrees of freedom, second-order Akaike Information Criterion (AICc) (measure of model performance), Δ AIC (difference in AIC between lowest AIC and this), deviance explained (%) (indication of model goodness-of-fit) and test data correlation (Pearson correlation between test data and corresponding predictions).

Subset	Optimal Scale	Year	MPA Status	Depth	Distance to Reef	Rugosity	Curvature	Fine BPI	Eastness	Northness	Degrees of Freedom	Second-order Akaike Information Criterion (AICc)	Δ AIC	Deviance Explained (%)	Test Data Correlation
Entire Dataset	10	+	+	+	+	+					16	692	0.17	57.03	0.392
Entire Dataset	25	+	+	+	+	+					12	691.83	0	54.26	0.494
All Reef	10	+	+	+	+	+					14	547.99	0	47.78	0.313
Sediment	50	+	+	+	+	+			+		15	304.19	0	83.37	0.559
Circalittoral Reef	400				+		+	+			5	216.66	0	49.66	0.009
Infralittoral Reef	5	+		+	+	+			+		12	442.69	0.48	44.30	0.556
Infralittoral Reef	25	+		+	+	+		+		+	14	443.44	1.23	47.91	0.272
Infralittoral Reef	50	+			+		+	+		+	12	442.21	0	46.20	0.086
Carnivores	10	+		+							4	271.46	1.31	20.29	0.292
Carnivores	25	+		+							4	271.67	1.52	20.11	0.291
Carnivores	50	+		+							4	271.87	1.72	19.93	0.291
Carnivores	75	+		+							4	271.92	1.77	19.88	0.292
Carnivores	100	+		+			+	+			6	270.15	0	24.36	0.342
Carnivores	150	+		+							4	272.01	1.86	19.78	0.291
Carnivores	200	+		+							4	272.05	1.9	19.73	0.291
Carnivores	250	+	+	+		+			+		6	271.07	0.92	22.56	0.234
Carnivores	300	+		+							4	272.15	2	19.60	0.292
Carnivores	400	+	+	+				+	+		6	271.28	1.13	22.41	0.333
Carnivores	500	+		+				+	+		6	271.12	0.97	22.99	0.342
Herbivores	10	+	+	+	+	+					8	446.97	0.5	35.01	0.433
Herbivores	25	+	+	+	+	+	+			+	10	446.47	0	38.97	0.422
Herbivores	50	+	+	+	+	+					8	447.46	0.99	34.57	0.091

Invertivores	50	+		+	+		+	+	+	15	561.05	0	48.80	0.460
<i>Chrysophrys auratus</i>	25	+	+	+	+				+	12	869.27	0	46.23	0.307
<i>Chrysophrys auratus</i>	150	+	+	+	+		+	+		20	870.09	0.82	53.89	0.283
<i>Notolabrus tetricus</i>	5	+		+	+		+	+		16	497.06	0	68.43	0.787
<i>Notolabrus tetricus</i>	25	+		+	+		+	+		11	497.94	0.88	64.67	0.765
<i>Notolabrus tetricus</i>	75	+		+	+		+	+	+	16	498.65	1.59	67.64	0.786
<i>Notolabrus tetricus</i>	100	+		+	+		+			15	497.39	0.33	67.12	0.763
<i>Notolabrus tetricus</i>	150	+		+	+		+	+		14	498.19	1.13	66.86	0.682
<i>Meuschenia hippocrepis</i>	100	+		+		+	+	+	+	22	582.79	1.57	67.06	0.006
<i>Meuschenia hippocrepis</i>	150	+	+			+	+		+	16	581.22	0	63.15	0.352

Table S3. Summary statistics of total biomass generalized additive models (GAMs) completed at spatial scales of 5 m, 10 m, 25 m, 50 m, 75 m, 100 m, 150 m, 200 m, 300 m, 400 m and 500 m. Descriptor variables used are identified by (+). Summary statistics presented include degrees of freedom, second-order Akaike Information Criterion (AICc) (measure of model performance), Δ AIC (difference in AIC between lowest AIC and this), deviance explained (%) (indication of model goodness-of-fit) and test data correlation (Pearson correlation between test data and corresponding predictions). These models were not included in analysis due to low performance.

Subset	Scale	Year	MPA Status	Depth	Distance to Reef	Rugosity	Curvature	Fine BPI	Eastness	Northness	Degrees of Freedom	Second-order Akaike Information Criterion (AICc)	Δ AIC	Deviance Explained (%)	Test Data Correlation
Total Biomass	5	+	+	+		+				+	9	3121.59	7.78	24.03	0.594
Total Biomass	10	+	+	+		+				+	9	3122.71	8.9	23.45	0.503
Total Biomass	25	+				+	+		+	+	19	3115.72	1.91	40.43	0.030
Total Biomass	50	+		+			+		+		15	3113.81	0	35.95	0.190
Total Biomass	75	+		+				+	+		17	3116.78	2.97	38.10	0.172
Total Biomass	100	+		+		+	+	+	+		18	3120.51	6.7	36.91	0.088
Total Biomass	150	+	+	+			+		+		16	3123.12	9.31	32.91	0.097
Total Biomass	200	+		+					+		7	3123.66	9.85	20.28	0.257
Total Biomass	250	+	+	+				+			8	3123.72	9.91	22.01	0.413
Total Biomass	300	+	+	+				+			8	3123.27	9.46	22.09	0.423
Total Biomass	400	+	+	+				+			8	3122.5	8.69	22.42	0.407
Total Biomass	500	+		+				+	+		12	3122.61	8.8	27.70	0.372