Supplementary material

Costs and benefits of towed videos and remotely operated vehicles for sampling shallow reef habitats and fish

T. R. Davis[A,B,E]*, G. Cadiou*[C]*, J. Williams*[C] *and M. A. Coleman*[A,B,D]

[A]Fisheries Research, Marine Ecosystems, NSW Department of Primary Industries,

PO Box 4321, Coffs Harbour, NSW 2450, Australia.

[B]National Marine Science Centre, Southern Cross University, 2 Bay Drive,

Coffs Harbour, NSW 2450, Australia.

[C]Fisheries Research, Marine Ecosystems, NSW Department of Primary Industries,

Locked Bag 1, Nelson Bay, NSW 2315, Australia.

[D]University of Western Australia, Oceans Institute and School of Biological Sciences,

35 Stirling Highway, Crawley, WA 6009, Australia.

[E]Corresponding author. Email: tom.davis@dpi.nsw.gov.au

Table S1.   Sites, system type, location and survey date for 200-m transects

ROV, remotely operated vehicle; ToV, towed video

Transect	Site	System	Latitude	Longitude	Date
1–1	Broughton Island	ToV	–32.63249	152.30636	31-Jan-19
1–3	Broughton Island	ROV	–32.62912	152.30621	31-Jan-19
1–5	Broughton Island	ToV	–32.62203	152.32637	31-Jan-19
1–6	Broughton Island	ToV	–32.61470	152.30378	31-Jan-19
1–7	Broughton Island	ROV	–32.61915	152.30429	31-Jan-19
1–9	Broughton Island	ROV	–32.62297	152.33125	31-Jan-19
2–1	Fingal Island	ToV	–32.75120	152.19442	4-Feb-19
2–2	Fingal Island	ROV	–32.76498	152.16355	29-Jan-19
2–3	Fingal Island	ROV	–32.74906	152.19900	30-Jan-19
2–5	Fingal Island	ROV	–32.75087	152.19654	30-Jan-19
2–8	Fingal Island	ToV	–32.76367	152.17169	4-Feb-19
2–9	Fingal Island	ToV	–32.76345	152.17417	4-Feb-19
3–3	Anna Bay	ToV	–32.78648	152.12504	4-Feb-19
3–4	Anna Bay	ToV	–32.79834	152.09948	4-Feb-19
3–6	Anna Bay	ROV	–32.79543	152.10554	29-Jan-19
3–7	Anna Bay	ToV	–32.79343	152.11407	4-Feb-19
3–8	Anna Bay	ROV	–32.80084	152.08980	29-Jan-19
3–9	Anna Bay	ROV	–32.79423	152.09535	29-Jan-19

Table S2. Data on abundance of fish species, on 200-m transects, collected by remotely operated vehicles (ROV) and towed videos (ToV) at study sites (Site) in Port Stephens

System	ROV									ToV								
Site	1			2			3			1			2			3		
Transect	3	7	9	2	3	5	6	8	9	1	5	6	1	8	9	3	4	7
Acanthaluteres vittiger	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	2	1	0
Acanthistius ocellatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Acanthopagrus australis	0	0	0	6	0	1	0	0	2	0	0	0	0	0	0	4	0	1
Achoerodus viridis	12	2	2	3	0	7	0	1	5	0	0	2	7	4	5	6	0	0
Anoplocapros inermis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Aplodactylus lophodon	1	0	0	0	2	1	0	0	2	0	0	0	2	2	0	1	0	1
Atypichthys strigatus	232	5	28	22	240	57	2	7	10	0	9	287	2	71	4	109	74	0
Austrolabrus maculatus	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Cheilodactylus fuscus	6	0	0	24	0	14	4	9	9	16	0	0	5	2	13	6	4	3
Cheilodactylus vestitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironemus marmoratus	2	0	0	0	0	0	0	0	1	0	0	0	0	3	1	3	0	0
Chromis hypsilepis	0	0	1	0	0	53	0	0	0	24	0	0	0	0	0	0	0	0
Cirrhitichthys aprinus	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coris picta	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	5	0	0
Coris sandeyeri	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Dinolestes lewini	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	1	40	0
Enoplosus armatus	0	0	0	0	0	0	0	2	0	1	0	0	0	0	28	2	0	0
Eubalichthys bucephalus	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0
Eubalichthys mosaicus	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Gerres subfasciatus	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	0
Girella elevata	4	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Hypoplectrodes maccullochi	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	0
Latridopsis forsteri	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meuschenia flavolineata	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meuschenia freycineti	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meuschenia trachylepis	6	0	0	0	0	0	0	1	0	0	0	0	0	1	1	3	1	1
Myliobatis australis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Nemadactylus douglasii	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Notolabrus gymnogenis	15	1	14	6	2	4	5	5	9	7	6	7	4	3	12	16	0	3
Odax cyanomelas	19	3	0	5	15	8	7	0	9	5	3	2	10	5	2	10	4	1
Ophthalmolepis lineolatus	3	9	7	6	13	1	6	9	11	0	6	3	4	0	12	9	2	0
Orectolobus maculatus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Parma microlepis	0	1	0	23	4	5	0	10	10	16	2	15	6	8	17	11	3	5
Parma unifasciata	25	8	31	0	3	0	0	0	31	1	0	0	1	0	0	0	0	0
Parupeneus spilurus	0	1	0	0	1	1	0	1	15	0	0	0	7	0	0	1	0	0
Pempheris compressa	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Pictilabrus laticlavius	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Prionurus microlepidotus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocaranx georgianus	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Pseudolabrus luculentus	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Schuettea scalaripinnis	0	1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scorpis lineolata	1	1	0	0	0	2	0	0	8	7	0	0	2	1	1	13	1	0
Trachinops taeniatus	0	100	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Trachurus novaezelandiae	0	20	0	2	0	0	2	0	0	0	0	0	0	1	40	139	0	0
Trygonoptera testacea	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Trygonorrhina fasciata	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Upeneichthys lineatus	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0

Table S3.   Two factor permutational multivariate analysis of variance analysis results examining similarities (as Euclidean distance) in multivariate habitat data, average altitude, and useable images

Data collected by remotely operated vehicles and towed videos (System, $n = 2$) at study sites (Site, $n = 3$) in Port Stephens. Data analysed as percentage coverage of habitat types, average altitude of systems above the seabed, and proportion of images collected within the target depth range (1–3 m). Data from 200-m transects ($n = 3$) for each system at each site

Test	Factor	d.f.	SS	MS	Pseudo-*F*	*P*(perm)
Habitat data	Site	2	0.48232	0.24116	1.1373	0.363
	System	1	0.09680	0.09680	1.0015	0.378
	Site × System	2	0.19331	0.09666	0.4558	0.849
Average altitude	Site	2	0.49776	0.24888	3.8769	0.054
	System	1	0.10876	0.10876	1.3903	0.276
	Site × System	2	0.15647	0.07823	1.2186	0.333
Useable images	Site	2	0.06143	0.03071	3.2852	0.067
	System	1	0.00156	0.00156	0.0450	0.892
	Site × System	2	0.06947	0.03474	3.7156	0.052

Table S4.   Two factor permutational multivariate analysis of variance analysis results examining Bray–Curtis similarity in multivariate fish data and univariate data on fish species richness and total abundance

Data collected by remotely operated vehicles and towed videos (System, $n = 2$) at study sites (Site, $n = 3$) in Port Stephens. Data analysed as square-root transformed abundance of fish, excluding schooling and pelagic species. Data from 200-m transects ($n = 3$) for each system at each site

Test	Factor	d.f.	SS	MS	Pseudo-*F*	*P*(perm)
Fish assemblages	Site	2	3245.4	1622.7	1.0391	0.406
	System	1	2394.9	2394.9	1.5037	0.211
	Site × System	2	3185.2	1592.6	1.0199	0.440
Species richness	Site	2	27.00	13.50	0.6864	0.509
	System	1	1.39	1.39	0.1534	0.774
	Site × System	2	18.11	9.06	0.4605	0.637
Fish abundance	Site	2	3267.1	1633.6	0.1328	0.864
	System	1	2812.5	2812.5	0.8285	0.407
	Site × System	2	6789.3	3394.7	0.2759	0.757