

Supplementary Figure captions:

Figure S1: Examples of multibeam bathymetry and backscatter raster datasets and their derivatives for the Northern Submerged Shoals indicate the range in bathymetry, backscatter and derivative values (see Table 1 for list of derivatives and their ecological contexts).

Figure S2: Comparing average epibenthic habitat measures in the field of view by reef. Percent cover of each category is estimated out of a total sum of 100 for each site. Four locations (Myrmidon Reef, Northern Submerged Shoals, Viper Reef and an inter-reefal transect) are included in this comparison, but there were no “Deep” sites at Viper Reef. Note: *n* varies per bar, 1-11 sites.

Figure S3: Comparing average substratum habitat measures in the field-of-view by reef. Percent cover of each category is estimated out of a total sum of 100 for each site. Four locations (Myrmidon Reef, Northern Submerged Shoals, Viper Reef and an inter-reefal transect) are included in this comparison, but there were no “Deep” sites at Viper Reef. Note: *n* varies per bar, 1-11 sites.

Figure S4: Nonmetric Multidimensional Scaling (nMDS) shows patterns between fish community composition and environmental variables, including epibenthic and substratum measured in the underwater camera field-of-view and multibeam echo sounder measured variables for four locations along the Great Barrier Reef shelf-edge with the fish species responsible for the variation among locations. Shallower sites nMDS (54-115 m) with ordination from Bray-Curtis dissimilarities in species abundance data, transformed using fourth-root transformation and standardised using Wisconsin-double standardisation.

Figure S5: Nonmetric Multidimensional Scaling (nMDS) shows patterns between fish community composition and environmental variables, including epibenthic and substratum measured in the underwater camera field-of-view and multibeam echo sounder measured variables for four locations along the Great Barrier Reef shelf-edge with the fish species responsible for the variation among locations. Middle sites nMDS (128-160 m) with ordination from Bray-Curtis dissimilarities in species abundance data, transformed using fourth-root transformation and standardised using Wisconsin-double standardisation.

Figure S6: Nonmetric Multidimensional Scaling (nMDS) shows patterns between fish community composition and environmental variables, including epibenthic and substratum measured in the underwater camera field-of-view and multibeam echo sounder measured variables for four locations along the Great Barrier Reef shelf-edge with the fish species responsible for the variation among locations. Deeper sites nMDS (179-260 m) with ordination from Bray-Curtis dissimilarities in species abundance data, transformed using fourth-root transformation and standardised using Wisconsin-double standardisation.

Table S1. Ecology of deep-reef fishes from Baited Remote Underwater Video Station videos. Only species identified to species-level are included, listed by family. CAAB codes refer to the Codes for Australian Aquatic Biota [119]. Australian Standard Names are provided, where there is no Australian Standard Name, the Fishbase common name is provided and noted with *. Trophic groups and known habitat information links from Fishbase database [115]. Trophic groups are divided as follows: BC = benthic-associated carnivores (e.g., benthic crustaceans and infauna, small fish may be a portion of diet), PL = planktivores, H=herbivores, PI= Piscivores, GC = Generalist carnivores (i.e., larger range of diet items, may include fish and benthic crustaceans). For some species, the trophic group of a species is inferred based on the known diet of close family members**. Known habitat is summarized from Fishbase, including original references. Fisheries species designation is also from Fishbase with the original references listed if provided. Fisheries status includes major or minor commercial, recreational or aquarium trade fisheries as these may pose a threat to general or local populations.

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
Carcharhinidae					
<i>Carcharhinus albimarginatus</i> (Rüppell, 1837)	37018027	Silvertip Shark	GC	Fishbase/Carcharhinus-albimarginatus	Yes
<i>Carcharhinus amblyrhynchos</i> (Bleeker, 1856)	37018030	Grey Reef Shark	GC	Fishbase/Carcharhinus-amblyrhynchos	Yes
<i>Carcharhinus plumbeus</i> (Nardo, 1827)	37018007	Sandbar Shark	GC	Fishbase/Carcharhinus-plumbeus	Yes
<i>Loxodon macrorhinus</i> Müller & Henle, 1839	37018005	Sliteye Shark	GC	Fishbase/loxodon-macrorhinus	Yes
<i>Triaenodon obesus</i> (Rüppell, 1837)	37018038	Whitetip Reef Shark	GC	Fishbase/triaenodon-obeus	Yes
Sphyrnidae					
<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	37019001	Scalloped Hammerhead	GC	Fishbase/Sphyrna-lewini	Yes
Dasyatidae					
<i>Taeniurops meyeri</i> (Müller & Henle, 1841)	37035017	Blotched Fantail Ray	BC	Fishbase/taeniurops-meyeri	Yes
Muraenidae					
<i>Gymnothorax berndti</i> Snyder, 1904	37060089	Y-Patterned Moray*	GC**	Fishbase/gymnothorax-berndti	
<i>Gymnothorax elegans</i> Bliss, 1883	37060090	Elegant Moray*	GC**	Fishbase/gymnothorax-elegans	
<i>Gymnothorax intesi</i> (Fourmanoir & Rivaton, 1979)	37060076	Whitetip Moray	GC**	Fishbase/gymnothorax-intesi	
<i>Gymnothorax prionodon</i> Ogilby, 1895	37060049	Sawtooth Moray	GC**	Fishbase/gymnothorax-prionodon	
Fistulariidae					
<i>Fistularia commersonii</i> Rüppell, 1838	37278001	Smooth Flutemouth	BC	Fishbase/fistularia-commersonii@	Yes
Serranidae					

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
<i>Epinephelus cyanopodus</i> (Richardson, 1846)	3731114 5	Purple Rockcod	GC	Fishbase/epinephelus-cyanopodus	Yes
<i>Epinephelus morrhua</i> (Valenciennes, 1833)	3731115 1	Comet Grouper	GC	Fishbase/epinephelus-morrhua	Yes
<i>Plectranthias kelloggi</i> Jordan & Evermann, 1903	3731121 0	Eastern Flower Porgy*	Unknown	Fishbase/plectranthias-kelloggi	
<i>Plectropomus leopardus</i> (Lacépède, 1802)	3731107 8	Common Coral Trout	PI	Fishbase/plectropomus-leopardus	Yes
<i>Plectropomus laevis</i> (Lacépède, 1801)	3731107 9	Bluespotted Coral Trout	PI	Fishbase/plectropomus-laevis	Yes
<i>Pseudanthias engelhardi</i> (Allen & Starck, 1982)	3731111 5	Barrier Reef Basslet	Unknown	Fishbase/pseudanthias-engelhardi	
<i>Variola louti</i> (Forsskål, 1775)	3731116 6	Yellowedge Coronation Trout	GC	Fishbase/variola-louti	Yes
Malacanthidae					
<i>Hoplolatilus marcosi</i> Burgess, 1978	3733101 2	Redback Sand Tilefish*	BC**	Fishbase/hoplolatilus-marcosi	
Echeneidae					
<i>Echeneis naucrates</i> Linnaeus, 1758	3733600 1	Sharksucker	PI	Fishbase/echeneis-naucrates	Yes
Carangidae					
<i>Carangoides caeruleopinnatus</i> (Rüppell, 1830)	3733702 1	Onion Trevally	PI	Fishbase/carangoides-coeruleopinnatus	Yes
<i>Carangoides chrysophrys</i> (Cuvier, 1833)	3733701 1	Longnose Trevally	PI	Fishbase/carangoides-chrysophrys	Yes
<i>Carangoides dinema</i> Bleeker 1851	3733707 8	Shadow Trevally	PI	Fishbase/carangoides-dinema	Yes
<i>Carangoides ferdau</i> (Forsskål, 1775)	3733706 8	Blue Trevally	BC	Fishbase/carangoides-ferdau	Yes
<i>Carangoides fulvoguttatus</i> (Forsskål, 1775)	3733703 7	Turrun	BC	Fishbase/carangoides-fulvoguttatus	Yes
<i>Carangoides orthogrammus</i> (Jordan & Gilbert, 1882)	3733705 7	Thicklip Trevally	BC	Fishbase/carangoides-orthogrammus	Yes
<i>Carangoides plagiotaenia</i> Bleeker, 1857	3733707 0	Barcheek Trevally	GC	Fishbase/carangoides-plagiotaenia	Yes
<i>Caranx ignobilis</i> (Forsskål, 1775)	3733702 7	Giant Trevally	GC	Fishbase/caranx-ignobilis	Yes
<i>Caranx melampygus</i> Cuvier, 1833	3733705 0	Bluefin Trevally	GC	Fishbase/caranx-melampygus	Yes
<i>Gnathanodon speciosus</i> (Forsskål, 1775)	3733701 2	Golden Trevally	PI	Fishbase/gnathanodon-speciosus	Yes
<i>Pseudocaranx dentex</i> (Bloch & Schneider, 1801)	3733706 2	Silver Trevally	PL, BC	Fishbase/pseudocaranx-dentex	Yes
<i>Seriola dumerili</i> (Risso, 1810)	3733702 5	Amberjack	GC	Fishbase/seriola-dumerili	Yes
<i>Seriola rivoliana</i> Valenciennes, 1833	3733705 2	Highfin Amberjack	GC	Fishbase/seriola-rivoliana	Yes
Lutjanidae					
<i>Aphareus rutilans</i> Cuvier, 1830	3734600 1	Rusty Jobfish	GC	Fishbase/aphareus-rutilans	Yes

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
<i>Aprion virescens</i> Valenciennes, 1830	3734602 7	Green Jobfish	GC	Fishbase/aprion-virescens	Yes
<i>Etelis carbunculus</i> Cuvier, 1828	3734601 4	Ruby Snapper	GC	Fishbase/etelis-carbunculus	Yes
<i>Lipocheilus carnolabrum</i> (Chan, 1970)	3734603 1	Tang's Snapper	GC	Fishbase/lipocheilus-carnolabrum	Yes
<i>Lutjanus bohar</i> (Forsskål, 1775)	3734602 9	Red Bass	GC	Fishbase/lutjanus-bohar	Yes
<i>Lutjanus sebae</i> (Cuvier, 1816)	3734600 4	Red Emperor	GC	Fishbase/lutjanus-sebae	Yes
<i>Paracaesio kusakarii</i> Abe, 1960	3734606 0	Saddleback Snapper	GC	Fishbase/paracaesio-kusakarii	Yes
<i>Pristipomoides argyrogrammicus</i> (Valenciennes, 1831)	3734605 4	Ornate Jobfish	GC	Fishbase/pristipomoides-argyrogrammicus	Yes
<i>Pristipomoides auricilla</i> (Jordan, Evermann & Tanaka, 1927)	3734605 9	Goldflag Snapper	PI, PL	Fishbase/pristipomoides-auricilla	Yes
<i>Pristipomoides filamentosus</i> (Valenciennes, 1830)	3734603 2	Rosy Snapper	GC	Fishbase/pristipomoides-filamentosus	Yes
<i>Pristipomoides multidens</i> (Day, 1870)	3734600 2	Goldbanded Snapper	GC	Fishbase/pristipomoides-multidens	Yes
<i>Pristipomoides sieboldii</i> (Bleeker, 1857)	3734606 4	Lavender Snapper	GC	Fishbase/pristipomoides-sieboldii	Yes
<i>Pristipomoides typus</i> Bleeker, 1852	3734601 9	Sharptooth Snapper	GC	Fishbase/pristipomoides-typus	Yes
<i>Symphorus nematophorus</i> (Bleeker, 1860)	3734601 7	Chinamanfish	PI	Fishbase/symphorus-nematophorus	Yes
Caesionidae					
<i>Pterocaesio marri</i> Schultz, 1953	3734606 8	Bigtail Fusilier	PL	Fishbase/pterocaesio-marri	Yes
Nemipteridae					
<i>Nemipterus balinensis</i> (Bleeker, 1859)	3734703 9	Bali Threadfin Bream	BC**	Fishbase/nemipterus-balinensis	Yes
<i>Pentapodus aureofasciatus</i> Russell, 2001	3734702 9	Yellowstripe Threadfin Bream	BC**	Fishbase/pentapodus-aureofasciatus	
<i>Pentapodus nagasakiensis</i> (Tanaka, 1915)	3734701 2	Japanese Threadfin Bream	BC	Fishbase/pentapodus-nagasakiensis	Yes
Lethrinidae					
<i>Gymnocranius euanus</i> (Günther, 1879)	3735102 2	Paddletail Seabream	BC	Fishbase/gymnocranius-euanus	Yes
<i>Gymnocranius grandoculis</i> (Valenciennes, 1830)	3735100 5	Robinson's Seabream	GC	Fishbase/gymnocranius-grandoculis	Yes
<i>Lethrinus laticaudis</i> Alleyne & Macleay, 1877	3735100 6	Grass Emperor	GC	Fishbase/lethrinus-laticaudis	Yes
<i>Lethrinus miniatus</i> (Forster, 1801)	3735100 9	Redthroat Emperor	GC	Fishbase/lethrinus-miniatus	Yes
<i>Lethrinus nebulosus</i> (Forsskål, 1775)	3735100 8	Spangled Emperor	GC	Fishbase/lethrinus-nebulosus	Yes

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
<i>Lethrinus olivaceus</i> Valenciennes, 1830	3735100 4	Longnose Emperor	GC	Fishbase/lethrinus-olivaceus	
<i>Lethrinus ravus</i> Carpenter & Randall, 2003	3735103 1	Drab Emperor	Unknown	Fishbase/lethrinus-ravus	
<i>Lethrinus rubrioperculatus</i> Sato, 1978	3735101 2	Spotcheek Emperor	GC	Fishbase/lethrinus-rubrioperculatus	
<i>Lethrinus semicinctus</i> Valenciennes, 1830	3735101 6	Blackblotch Emperor	GC	Fishbase/lethrinus-semicinctus	Yes (Carpenter 1997)
<i>Wattsia mossambica</i> (Smith, 1957)	3735102 7	Mozambique Seabream	GC	Fishbase/wattsia-mossambica	Yes (Carpenter 1997)
Mullidae					
<i>Mulloidichthys pfluegeri</i> (Steindachner, 1900)	3735504 0	Orange Goatfish	BC	Fishbase/mulloidichthys-pfluegeri	Yes
<i>Parupeneus heptacanthus</i> (Lacépède, 1802)	3735500 4	Cinnabar Goatfish	BC	Fishbase/parupeneus-heptacanthus	Yes
<i>Parupeneus multifasciatus</i> (Quoy & Gaimard, 1825)	3735502 6	Banded Goatfish	BC	Fishbase/parupeneus-multifasciatus	Yes
<i>Parupeneus pleurostigma</i> (Bennett, 1831)	3735502 7	Sidespot Goatfish	BC	Fishbase/parupeneus-pleurostigma	Yes
Chaetodontidae					
<i>Heniochus diphreutes</i> Jordan, 1903	3736500 5	Schooling Bannerfish	PL	Fishbase/heniochus-diphreutes	Aquarium
Pomacanthidae					
<i>Pomacanthus imperator</i> (Bloch, 1787)	3736501 4	Emperor Angelfish	BC	Fishbase/pomacanthus-imperator	Yes & Aquarium
<i>Pomacanthus semicirculatus</i> (Cuvier, 1831)	3736508 0	Blue Angelfish	BC	Fishbase/pomacanthus-semicirculatus	Yes & Aquarium
Cirrhitidae					
<i>Cyprinocirrhites polyactis</i> (Bleeker, 1875)	3737400 6	Lyretail Hawkfish	PL	Fishbase/cyprinocirrhites-polyactis	Aquarium
Pomacentridae					
<i>Chromis circumaurea</i> Pyle, Earle & Greene, 2008	3737215 3	Gold-rim Chromis*	PL**	Fishbase/chromis-circumaurea	
<i>Chromis mirationis</i> Tanaka 1917	3737204 8	Japanese Puller	PL	Fishbase/chromis-mirationis	
<i>Chromis okamurai</i> Yamakawa & Randall, 1989	3737215 4	Okinawa Chromis*	PL**	Fishbase/chromis-okamurai	
Labridae					
<i>Bodianus anthioides</i> (Bennett, 1832)	3738405 2	Lyretail Pigfish	BC	Fishbase/bodianus-anthioides	Aquarium
<i>Bodianus bennetti</i> Gomon and Walsh, 2016	3738421 9	Lemon-striped Pygmy Hogfish	BC**	Fishbase/bodianus-bennetti	
<i>Bodianus bimaculatus</i> Allen, 1973	3738405 5	Twospot Pigfish	BC	Fishbase/bodianus-bimaculatus	Aquarium
<i>Bodianus izuensis</i> Araga & Yoshino, 1975	3738405 8	Striped Pigfish	BC	Fishbase/bodianus-izuensis	Aquarium

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
<i>Bodianus masudai</i> Araga & Yoshino, 1975	3738422 1		BC	Fishbase/bodianus-masudai	
<i>Cheilinus undulatus</i> Rüppell, 1835	3738403 8	Humphead Maori Wrasse	GC	Fishbase/cheilinus-undulatus	Yes, and Aquarium
<i>Choerodon venustus</i> (De Vis, 1884)	3738404 2	Venus Tuskfish	Unknown	Fishbase/choerodon-venustus	
<i>Cirrhilabrus punctatus</i> Randall & Kuiter, 1989	3738408 3	Finespot Wrasse	Unknown	Fishbase/cirrhilabrus-punctatus	Aquarium
<i>Cirrhilabrus roseafascia</i> Randall & Lubbock, 1982	3738421 8	Pink-Banded Fairy Wrasse*	Unknown	Fishbase/cirrhilabrus-roseafascia	Aquarium?
<i>Coris dorsomacula</i> Fowler, 1908	3738409 3	Pinklined Wrasse	Unknown	Fishbase/coris-dorsomacula	Aquarium
<i>Labroides dimidiatus</i> (Valenciennes, 1839)	3738402 8	Common Cleanerfish	GC	Fishbase/labroides-dimidiatus	Aquarium
<i>Oxycheilinus digrammus</i> (Lacépède, 1801)	3738406 5	Violetline Maori Wrasse	BC	Fishbase/oxycheilinus-digrammus	Yes, and Aquarium
<i>Oxycheilinus orientalis</i> Günther, 1862	3738403 0	Oriental Maori Wrasse	GC	Fishbase/oxycheilinus-orientalis	Yes, and Aquarium
<i>Terelabrus rubrovittatus</i> Randall & Fourmanoir, 1998	3738421 0	Yellowbar Hogfish*	Unknown	Fishbase/terelabrus-rubrovittatus	
Pinguipedidae					
<i>Parapercis nebulosa</i> (Quoy & Gaimard, 1825)	3739000 5	Pinkbanded Grubfish	BC	Fishbase/parapercis-nebulosa	Aquarium
Blenniidae					
<i>Meiacanthus luteus</i> Smith-Vaniz, 1987	3740805 4	Yellow Fangblenny	Unknown	Fishbase/meiacanthus-luteus	
Acanthuridae					
<i>Acanthurus xanthopterus</i> Valenciennes, 1835	3743702 0	Yellowmask Surgeonfish	H, PL	Fishbase/acanthurus-xanthopterus	Yes, and Aquarium
<i>Naso caesi</i> Randall & Bell, 1992	3743704 6	Silverblotched Unicornfish	PL	Fishbase/naso-caesi	
Scombridae					
<i>Gymnosarda unicolor</i> (Rüppell, 1836)	3744102 9	Dogtooth Tuna	PI	Fishbase/gymnosarda-unicolor	Yes
<i>Scomberomorus commerson</i> (Lacépède, 1800)	3744100 7	Spanish Mackerel	PI	Fishbase/scomberomorus-commerson	Yes
Balistidae					
<i>Abalistes stellatus</i> (Anonymous, 1798)	3746501 1	Starry Triggerfish	Unknown	Fishbase/abalistes-stellatus	
<i>Balistoides conspicillum</i> (Bloch & Schneider, 1801)	3746503 1	Clown Triggerfish	BC	Fishbase/balistoides-conspicillum	Yes
<i>Sufflamen bursa</i> (Bloch & Schneider, 1801)	3746507 8	Pallid Triggerfish	BC	Fishbase/sufflamen-bursa	Yes
<i>Sufflamen fraenatum</i> (Latreille, 1804)	3746501 4	Bridled Triggerfish	BC	Fishbase/sufflamen-fraenatum	Yes
Tetraodontidae					

Species	CAAB Code	Australian Standard Name	Trophic Group	Fishbase Trophic and Habitat Information	Fisheries
<i>Trionodon macropterus</i> Lesson, 1831	3799188 5	Threetooth Puffer*	PL, BC	Fishbase/trionodon- macropterus	

Table S2: Each habitat variable was compared in a simple linear model to principal components to see how different habitat gradients could explain the variation in the two major components (PC1 and PC2) between the trophic communities. Residual standard error is a measure of the quality of a linear regression fit and reported for a model with 45 degrees of freedom. Multibeam information from the 50×50 kernel was used. For planar curvature, absolute values were compared. Significance values are expressed as * (** $p < 0.01$ and * $p < 0.05$). Non-significant variables (not listed in table) included curvature, range, topographic position index, epibenthic categories (filterers, encrusting organisms, coral, *Halimeda*) and substratum categories (boulders, gravel, indeterminate substratum, mud, rubble).

Environmental variable		Residual Standard Error	R ²	p- value	Residual Standard Error	R ²	p- value
Depth (category)	Deep	0.55	0.20	NS	0.61	0.02	NS
	Middle			NS			
	Shallow			**			
Location (category)	Myrmidon	0.61	0.04	NS	0.61	0.02	NS
	Transect			NS			NS
	Northern			NS			NS
	Submerged Shoals			NS			NS
	Viper			NS			NS
		PC1			PC2		
Depth		0.54	0.20	**	0.60	0.04	NS
Aspect (combined Easting and Northing)		0.58	0.09	*	0.56	0.01	NS
Average Depth		0.57	0.13	*	0.54	0.08	NS
Planar Curvature		0.58	0.09	*	0.56	0.02	NS
Slope		0.60	0.03	NS	0.52	0.13	*
Standard Deviation		0.60	0.07	NS	0.53	0.09	*
Surface Ratio		0.57	0.10	*	0.54	0.09	NS
Bare		0.55	0.19	**	0.61	0.00	NS
Plants		0.55	0.18	**	0.60	0.03	NS
Bedrock		0.56	0.15	**	0.59	0.05	NS
Calcified Reef		0.58	0.09	*	0.61	0.00	NS
Sand		0.57	0.12	*	0.60	0.03	NS