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Chapter 22.
Reef fishes of Spencer Gulf

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Introduction

Spencer Gulf (SG) is a long, triangular body of water, tapering from a mouth ~80 km wide to an apex 320 km to the north, with an area of 21 700 km^2, and with depths from ~50 m at the mouth to zero in the northern extremity (see introductory map). The Gulf is an inverse estuary, with high summer water temperatures and salinity at the top (28ºC and ~48 psu), compared with oceanic conditions (21ºC and ~35.8 psu) at the entrance (see Chapters 3–5). Water movement on coastal reefs also changes with distance up the Gulf, as wave energy from the Southern Ocean swell is gradually dissipated, and wave energy from wind-driven waves becomes dominant.

In this Chapter our focus is principally on the changes in the near-shore fish assemblages on natural reefs of SG from its entrance between Cape Catastrophe, on SE Eyre Peninsula, and Cape Spencer, at the SW tip of Yorke Peninsula to the upper Gulf. Near-shore reefs are prominent at the southern end of the Gulf, except in bays and inlets, as far north as Point Gibbon, close to Cowell, on the western side, and Point Riley at a similar latitude on the eastern side. Further north, both sides of the Gulf are fringed by mangroves, or have sandy or muddy shores with only a few scattered near-shore reefs, notably those close to Point Lowly at the entrance to the upper Gulf, and several off-shore reefs in the upper Gulf.

The fish fauna in the Gulf is rich, and >200 species are likely to be encountered in reef and adjacent habitats in the Gulf region. However, the reef fish assemblages within the Gulf are poorly known, except for studies in adjoining Investigator Strait, and at the Althorpe Is (Shepherd *et al.* 2005; Shepherd & Baker 2008a). Those studies were based on 71 dive or snorkel surveys (Appendix 1) along 100 m transect lines on rocky bottom, following a constant depth contour, usually at 3–6 m depth. The standard underwater visual census (UVC) technique was used, in which the lengths of all fish >1–2 cm length within a 5 m swathe, indicated by the transect line, were recorded on an underwater slate in 5 cm length categories. For each survey average rocky bottom relief and percent canopy cover of the kelp *Ecklonia* or fucoids (usually species of *Cystophora* or *Sargassum*) were estimated, as well as an index of exposure to swell on a scale of 0 (very sheltered waters) to 4 (exposed to strong oceanic swell), as described by Shepherd & Brook (2003a). Distance up the Gulf for each survey site was measured along the geodesic running up the centre of the Gulf from Wedge I. which lies mid-way between Cape Catastrophe and Cape Spencer at one end to Point Lowly, and thence in a straight line north to Port Augusta (Fig. 1).

The subtidal near-shore reefs reflect the coastal geology of the region (Ludbrook 1980; Edyvane 1999). The western coast of lower and mid SG is mainly Precambrian granites, occasionally interspersed with overlying calcrete, as far as Point Gibbon, near Cowell. Apart from shallow calcrete reefs off Lucky Bay, reefs give way to sand and mangrove shores until Precambrian metamorphic reefs reappear around Pt Lowly in upper SG. Further north at ~10 m depth, several patchy, low relief calcrete reefs outcrop above sandy bottom 3–5 km south of Redcliff Point (Shepherd 1983). In contrast, the eastern coast of lower SG is mainly (a) calcrete reef, overlying granite, which occasionally outcrops, as at Gleesons Landing, Shell Beach and Goose and Wardang Is, or (b) schists, which occur along the coast of Hardwicke and Wallaroo Bays.

To examine the relation between fish assemblages at the 71 sites surveyed, a normalised Euclidean distance matrix was calculated from log (x + 1) abundance data, transformed to avoid dominance by the most common species, and the resulting site relationships plotted as two dimensional ordinations using non-parametric multi-dimensional scaling techniques (PRIMER 2007).

The latitudinal changes in fish assemblages of coastal reefs with increasing distance up the Gulf are described. Much of the ecology of reef fish species is described in the reef fish chapter in the companion volume on Gulf St Vincent (GSV) (see Shepherd & Baker 2008a), and is not repeated here. The common names of fish follow the texts of Gomon *et al.* (2008) and Hutchins and Swainston (1999). Caves or crevices were not systematically searched for cryptic species, so their numbers will likely be under-estimated. All other recorded fishes from bottom surveys of reefs, sand or seagrass habitats in SG are listed in Appendix 2.

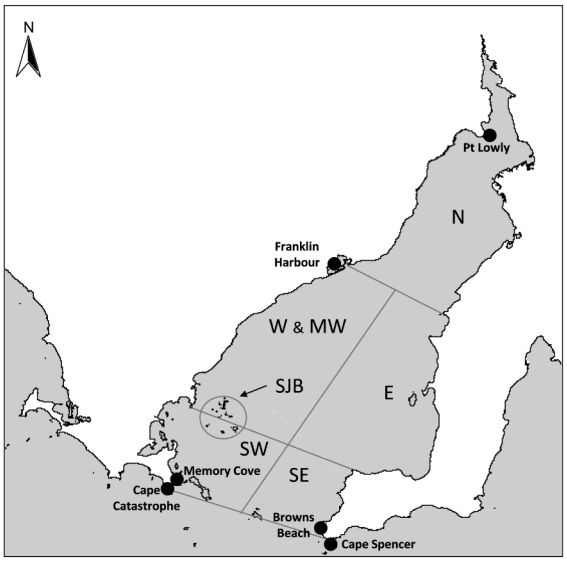


Figure 1. Map of Spencer Gulf showing the regions distinguished by the analyses. Filled in black circles are features referred to in the text, and SJB = the Sir Joseph Banks Group of islands.

Ecology of reef fishes

The diet and behaviour of reef fishes are closely related to their habitat, and here we classify them ecologically into five groups according to their spatial organisation, as described in detail by Shepherd and Baker (2008a) (Fig. 2). The five groups are:

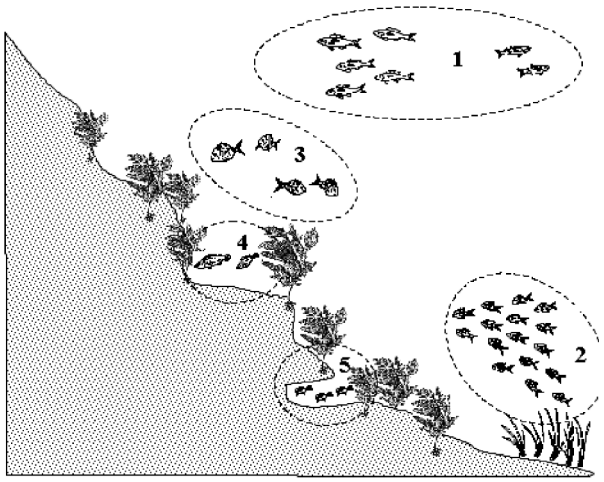
Group 1: mid-water schooling species that range widely, and often school above reef habitats. They are mainly planktivores and carnivores;

Group 2: species that live in seagrasses or on sandy bottom, and occasionally forage on reefs. They are mainly benthic carnivores;

Group 3: benthic, reef-dwelling species that swim within 1–2 m of the reef surface. They are benthic carnivores, herbivores or omnivores within home ranges of varying extent;

Group 4: benthic, reef-dwelling species that live below the algal canopy. They are benthic carnivores, herbivores or omnivores with small home ranges or territories;

Group 5: cryptic species, active mainly at night. They are planktivores or carnivores.



The distribution and abundance of coastal reef fishes depend on many physical and habitat features, including temperature, salinity, water movement (exposure to swell, wind waves and currents), reef topography and complexity (rocky bottom relief and presence of caves and crevices), algal abundance and structure (e.g. the

Figure 2. Schematic diagram of the spatial organisation of reef fishes. Group 1 is pelagic species. Group 2 is species living in seagrass or on soft bottoms. Group 3 is species with restricted ranges on rocky substrata that swim close to the algal canopy. Group 4 is species with localised ranges that live under the algal canopy, and Group 5 is cryptic species living in caves or crevices (after Shepherd & Brook 2003a).

presence of algal canopy and understorey species), and faunal communities. The reefs surveyed range in relief from low (~0.3 m) to high (~2.5 m) according to site, but average relief decreases only slightly with distance up the lower half of the Gulf; in the northern half, relief is generally low. The average exposure index for the different regions decreases slightly as swell dissipates at ~160 km from the entrance, and coasts are affected by wind waves and tidal currents. Canopy cover declines slightly to ~160 km north, and then falls to a low level as visibility declines and sedimentation and sponge cover increase.

Table 1. Mean densities (standard errors in brackets) in numbers 2000 m^{-2} of common reef fishes in six coastal regions of Spencer Gulf and the Sir Joseph Banks Group of islands (SGB). The six regions are: the SW, SE, (<25 km from the Gulf's entrance); western (W), mid-western (MW); and eastern (E) region (50–156 km from the Gulf's entrance); and the northern (N) region (170–300 km from the Gulf's entrance). F.T. =feeding type: P = planktivore; O = omnivore; H = herbivore; and C = carnivore.

Fish species	FT	SW	SE	SJB	W, MW	E	N
Number of sites surveyed		12	14	6	14	15	10
Schooling mid-water species							
Queen snapper	C	2.3	0.07	0	0	0	0
Nemadactylus valenciennesi		(0.8)	(0.07)				
Sea sweep	P,	23.7	21.8	8.7	15.6	19.7	0
Scorpis aequipinnis	O	(7.0)	(4.9)	(1.6)	(5.2)	(6.7)	
Barber perch	P	20.5	0	0	0	0	0
Caesioperca rasor		(15.3)					
Tommy ruff	O	42.5	4.3	1.0	0.8	6.6	0
Arripis georgiana		(21.5)	(3.4)	(0.8)	(0.7)	(6.9)	
Seagrass/sand species							
Little weed whiting	C	17.5	2.9	47.7	0.2	0.4	2.6
Neoodax balteatus		(10.5)	(2.9)	(39.3)	(0.2)	(0.2)	(1.4)
Red mullet	C	6.0	0.8	2	0.8	0.1	0.1
Upeneichthys vlamingii		(2.6)	(0.5)	(1.6)	(0.3)	(0.1)	(0.1)
Benthic/near benthic species							
Western blue groper	C	22.8	9.1	0.2	0.6	0	0
Achoerodus gouldii		(7.0)	(3.2)	(0.2)	(0.2)		
Dusky morwong	H	3.0	2.8	3.2	6.9	5.1	0.3
Dactylophora nigricans		(0.6)	(0.6)	(1.4)	(1.1)	(1.1)	(0.2)
Silver drummer	H	19.0	26.6	40.5	35.4	43.6	0
Kyphosus sydneyanus		(10.7)	(7.2)	(18.1)	(14.2)	(18.2)	
Magpie perch	C	10.1	6.9	3.2	7.6	6.9	0.3
Cheilodactylus nigripes		(1.8)	(1.4)	(1.2)	(1.3)	(1.2)	(0.2)
Zebra fish	H	43.9	47.4	14.2	48.7	39.9	0
Girella zebra		(24.2)	(15.3)	(8.7)	(14.1)	(15.1)	
Blue throated wrasse	C	104.8	24.3	41.8	31.9	6.3	0
Notolabrus tetricus		(21.5)	(3.0)	(13.7)	(8.6)	(1.8)	
Castelnau's wrasse	C	7.1	0.1	0	0.07	0	0
Dotalabrus aurantiacus		(1.7)	(0.1)		(0.06)		
Spiny tail leatherjacket	O	3.4	0	0	0	0.7	0
Acanthaluteres brownii		(2.5)				(0.6)	
Under-canopy/cave species							
Senator wrasse	C	11.3	1.9	1.2	0.07	0	0
Pictilabrus laticlavius		(2.6)	(0.6)	(0.7)	(0.06)		
Scaly fin	H	5.3	3.0	2.7	1.0	3.2	0
Parma victoriae		(1.1)	(0.7)	(0.9)	(0.4)	(1.7)	
Moonlighter	C	5.8	2.1	3	5.6	13.3	0.4
Tilodon sexfasciatus		(2.5)	(0.5)	(1.4)	(1.9)	(2.9)	(0.3)
Common bullseye	P	82.7	0.07	7.0	0.2	3.1	0
Pempheris multiradiata		(45.3)	(0.06)	(5.1)	(0.2)	(2.7)	
Yellow-headed hula fish	P	29.2	0	0	0	1.2	26.7
Trachinops noarlungae		(27.9)				(1.1)	(25.3)
Average Exposure Index		1.4	2.0	1.3	1.9	1.2	1.2
		(0.3)	(0.3)	(0.2)	(0.2)	(0.2)	(0.1)
Average canopy cover (%)		64	70	88	66	59	20
		(2)	(5)	(5)	(5)	(6)	(4)
Average rocky reef relief (m)		1.0	0.8	0.5	0.8	0.7	0.6
		(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)

Table 2. Mean densities of species found in upper Spencer Gulf (170–300 km from entrance), and rarely further south. FT = feeding type, as in the caption to Table 1. Standard errors in brackets.

Fish species	FT	D
Seagrass / sand species	P,	13.3 (11.1)
Siphamia cephalotes Wood's siphon fish	O	
Parequula melbournensis Silver belly	C	3.5 (2.5)
Bentho-pelagic species		
Chrysophrys auratus snapper	C	7.8 (4.5)
Benthic and cave species		
Brachaluteres jacksonianus Pygmy leatherjacket	C	0.5 (0.4)
Pempheris klunzingeri Rough bullseye	P	25.0 (19.9)
Synchiropus papilio Painted stinkfish	C	0.1 (0.1)
Diodon nichthemerus Globe fish	C	0.3 (0.2)
Parapercis haackei Wavy grubfish	C	7.2 (2.0)

Species' abundances

The fish species at the entrances to the Gulf are typical of those on exposed coasts and at the entrances to GSV (Shepherd & Baker 2008a). However, they change rapidly with distance up the Gulf (Tables 1, 2). Pelagic species (Group 1) and some cryptic species (Group 5), mainly planktivores, rapidly decline in abundance beyond ~25 km from the entrance, except for sweep. This species has a broad and flexible diet and can switch between plankton and benthic algae and animals (Shepherd & Baker 2008a). Similarly, benthic carnivores rapidly decline in abundance with distance up the Gulf, except for magpie perch, which take small crustaceans, worms and shellfish from algal turfs, a habitat which extends for ~150 km up the Gulf. Jones (2009) also found much lower recreational catches in the upper Gulf than in the lower regions.

Interestingly, the abundances of some species, mainly benthic carnivores – the western blue groper, blue throated wrasse, senator wrasse and magpie perch – differ markedly between the east and west sides of the Gulf (Fig. 3). On average, the environments are similar in terms of canopy cover and rocky bottom relief, but differ in terms of exposure to swell, and rock type. So why is there such a difference in fish abundances?

To answer this, we examined in detail the blue-throated wrasse, a common reef species, whose ecology has been studied throughout SA (Shepherd et al. 2010). Juveniles of this wrasse are most abundant in sheltered to moderately exposed reef habitats (Exposure Index = 1–3), and recruit best on schists, followed by calcrete, and least on granite, probably because the last rock type, unlike the first two, forms smooth, sloping reefs, with few crevices or caves that favour recruiting fishes. After reaching sexual maturity at ~15 cm size at an age of ~2 years (Shepherd & Hobbs 1986), the wrasse remains attached to its natal reef, but from an age of ~3 years at ~20 cm size, some begin to migrate to deeper or more exposed waters, while others remain site-attached on near-shore reefs in haremic groups of 10–15 females to each male. Shepherd et al. (2010) noted that large fish in these haremic groups are readily taken by recreational rock fishers, and found that (a) the mean size of females in near-shore populations is a direct and valuable index of fishing intensity, and (b) the sex ratio of females:males also becomes severely biased toward females, because males are more susceptible to capture.

Examination of the abundance of juvenile and sub-adult blue-throated wrasse on the two sides of the Gulf showed that they were 3–7 times more abundant on the west side than on the east side (Fig. 3), despite the less favourable juvenile substratum (granite) on the west side (Table 3). The remaining parameters measured (mean female size, sex ratio and proportion of sites without males) showed no clear differences in fishing pressure between the two sides of the Gulf, other than to suggest that recreational fishing intensity is moderate to high in the mid-west and mid-east regions of the Gulf, and in the Sir Joseph Banks Group. We conclude that the regional differences in abundance of this wrasse are due to the much stronger recruitment on the western side of the Gulf. We propose an Ocean Source hypothesis that larval sources are mainly

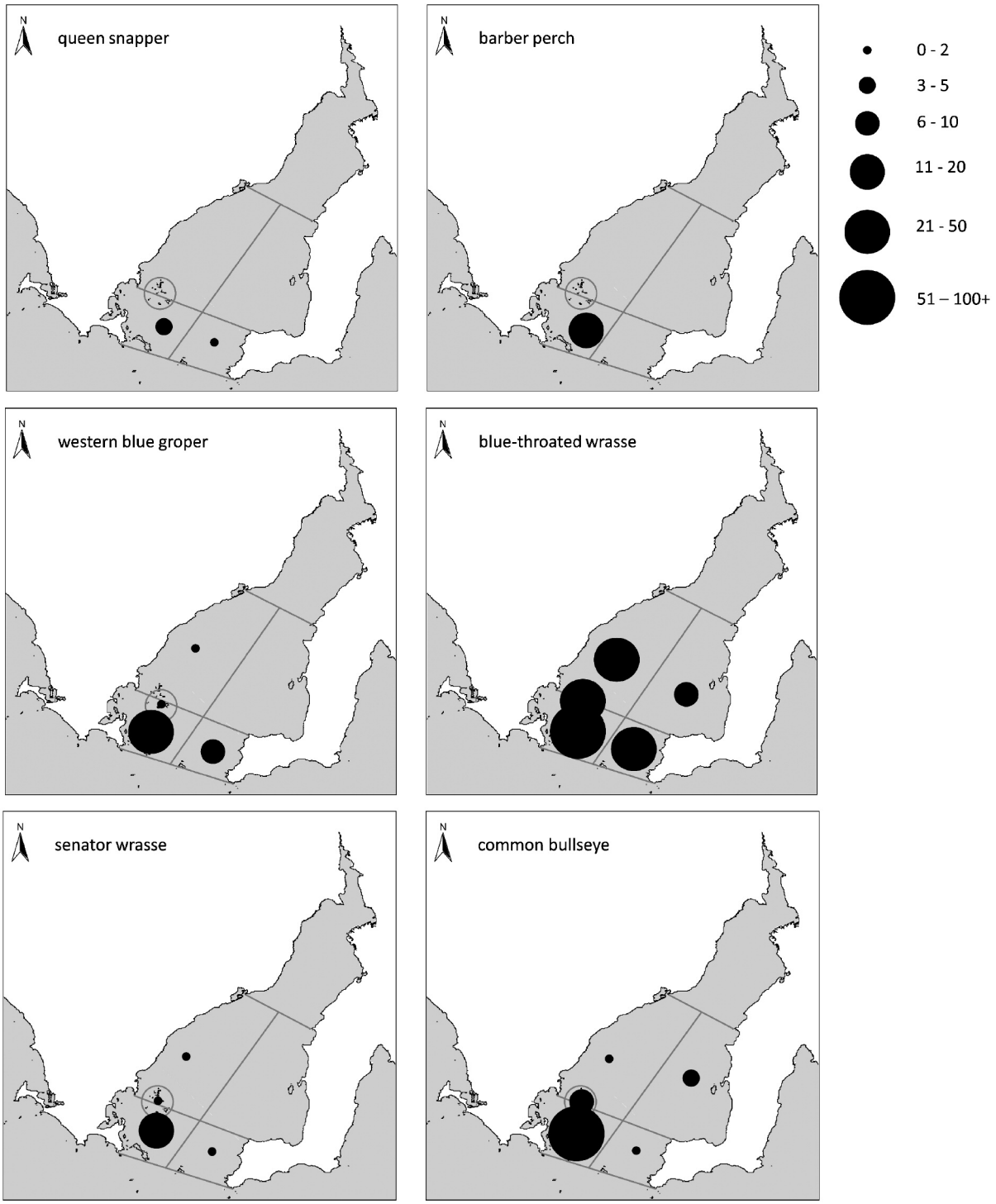


Figure 3. Distribution of density of six species in Spencer Gulf. Queen snapper and barber perch are pelagic species, western blue groper, blue-throated wrasse and senator wrasse are benthic carnivores, and the common bullseye is a cryptic species, living in caves.

from wrasse populations on exposed coasts of southern Eyre Peninsula outside or just inside the southern entrance to the Gulf. The larvae are then transported into the Gulf by the Lincoln Current flowing northward on the western side of the Gulf (Chapters 4, 5). Given a larval life of up to 2–3 months (Welsford 2003), wrasse larvae would drift up the Gulf along the western coast, across the Gulf in the clockwise eddy SW of Franklin Harbour (Bullock 1975), and down again on the eastern side of the Gulf to maintain recruitment to wrasse populations along those coasts. The hypothesis predicts declining larval abundance as they progressively settle on reefs or suffer mortality. The following data support this hypothesis (Fig. 3):

Table 3. A comparison of abundance of juveniles/sub-adults <15 cm size (numbers 2000 m^{-2}), female mean sizes (cm), and sex ratios of the blue-throated wrasse *Notolabrus tetricus* in six regions of Spencer Gulf. Abbreviations are those given in Table 1. Standard errors in brackets.

Parameter	SW	SE	SJB	West, MW	E
Mean Density (<15 cm)	49.6 (11.9)	7.1 (1.6)	11.1 (2.0)	7.1 (1.9)	2.3 (0.8)
Female mean size (cm)	22.0 (0.5)	22.6 (0.7)	21.0 (0.2)	21.4 (0.3)	20.0 (0.9)
Sex ratio (f:m)	11.9:1 (1.4)	14.9:1 (3.0)	21.9:1 (6.5)	21.4:1(0.3)	10:1
Sites without males (%)	0	36	67	43	83*

* wrasse present only at 47% of sites, and rare north of Goose I.

- The diminishing abundances of juveniles and sub-adults along this trajectory.
- The reduced numbers of adults on the two sides of the central Gulf.
- The greater abundances extending further north on the Gulf's western than eastern side.

Fish are not the only group that has higher abundances on the west side of the Gulf compared with the east side. In trawl studies of sandy bottom throughout the Gulf, Currie et al. (2011) found that the western side supported the highest, and the SE side the lowest, abundances and biomass of fishes, invertebrates and algae (a total of 395 species). Another factor no doubt contributing to the community richness on the western side of the Gulf is the hotspot of primary productivity at the SW Gulf entrance, which would be carried northwards in the Lincoln current (van Ruth et al. 2010).

Our conclusions regarding the blue-throated wrasse may equally apply to the other labrids in the Gulf – the western blue groper, Castelnau's and senator wrasse, all of which show similar patterns of abundance in the Gulf (Table 1; Fig. 3). Similarly, many other fish species with long-lived larvae and spawning populations restricted to the southern part of the Gulf would be expected to follow the same pattern of abundance, although our survey data cannot provide estimates of juvenile abundance of other species. Neither could we compare abundances of juvenile blue groper between the two sides of the Gulf, because the nursery habitat for juveniles of this species is highly specific, requiring shallow (<5 m) waters in sheltered bays or lagoons, and only a few sites have these characteristics (Shepherd & Brook 2003b; Shepherd 2006). Recruitment hotspots for juvenile groper <20 cm size (and up to ~2 years old – Coulson et al. 2009) were only recorded within Memory Cove in the SW region (mean density, 3.3 (s.e. 0.6) per 500 m^2; N=6)) and in Browns Beach lagoon in the SE region (mean density 6.4 (s.e. 1.4) per 500 m^2; N=7) – a non-significant difference (t=1.74; ns).

Three of the four major herbivores, dusky morwong, silver drummer and zebra fish, in contrast to the above pattern, increase or do not decline until at least ~150 km up the Gulf. These species commonly swim above, and feed in, seagrass beds, which become more extensive up the Gulf, suggesting that the decline in reef habitat and reef algal food up the Gulf is more than offset by increasing seagrass habitat, and abundant seagrass epiphytes. The recruitment patterns of these species are unknown.

The herring cale, *Olisthops cyanomelas*, was found at many sites in the SW, SE (in particular: 13 of the 14 sampled sites in that region), W, E, and Sir Joseph Banks regions. Its distribution may be associated with the presence of *Ecklonia* kelp, and/or fucoid species (*Cystophora* spp. and *Sargassum* spp.), on which this facultative browser feeds (Shepherd & Baker 2008b). Another common reef fish recorded in all regions except the north was the horseshoe leatherjacket *Meuschenia hippocrepis* (at 30 of the 71 sampled sites). Horseshoe leatherjacket has a broad southern Australian distribution, and is often found in small aggregations over near-shore coastal reefs, in the vicinity of macroalgal forests (Baker 2009, and references therein). Most juveniles inhabit shallow subtidal reefs, moving to deeper reefs as they grow, although adults have also been observed on shallow reefs (e.g. 5 m) (B. Hutchins pers. comm.). A common Gulf labrid, the brown-spotted wrasse, *Notolabrus parilus*, was also recorded in all regions except upper SG. This wrasse is common from SW Australia to Victoria, and is found in shallow depths on reefs over a range of wave exposures. The species is relatively common in macroalgal forests (Gomon et al. 2008), with higher numbers recorded in denser cover (Harvey et al. 2004); juveniles have also been recorded in seagrass beds.

Deeper-water pelagic species associated with offshore reefs, such as queen snapper and barber perch, were only recorded at the southern sites (Fig. 3). Also common at the southern sites was the common bullseye *Pempheris multiradiata* (Fig. 3), likely due to the abundance of caves and crevices in the higher relief reefs there, compared with the central sites. A similar pattern has been noted in Western Australia, where this species was recorded only in high-relief limestone reefs, and not in low-relief granite or limestone reefs (Harman et al. 2003).

Fish assemblages

The multivariate analysis (Fig. 4) shows the separate assemblage groupings of the SW, W, E, N and Sir Joseph Banks sites, with a central region of overlap as expected along the S-N gradient. We note that the two sites MW5 and MW6 at the northern end of the MW region group align more closely with the northern sites. These two sites are within the northern SG bioregion (IMCRA 1998), and the reef assemblage data support the boundaries of those bioregions, originally suggested on the basis of a range of physical and biological parameters. SW sites (in the upper and left side of the MDS plot) were the most species-rich in reef fishes, and common species included several of the wrasses (blue-throated, Castelnau's, senator), Victorian scalyfin, six-banded coralfish, zebra fish and magpie perch. Northern sites were characterised by a paucity of species (range = 2–9 of the visible fishes, compared with 13–25 for SW sites) and a relative abundance of fishes not commonly recorded further south, such as wavy grubfish (Table 2). Outliers in the MDS plot typically had high numbers of one or more species, including schools of small, site-associated reef fishes, not recorded at other sites. Examples include MW6 (Bokos Reef) and SW10 (off McLaren Point) where yellow-headed hulafish were abundant, and MW5 (Lucky Bay), where Wood's siphonfish were abundant. At the Sir Joseph Banks Group, fewer species (N = 7) were recorded at the outlying site (SJ6) compared with others in the group (range 11–16).

Uncommonly recorded and cryptic species

In addition to the common, near-shore reef fish species described above, many other reef fishes occur in the Gulf, some of them only in deeper water. Some of the shallow water species are cryptic and seldom seen (see Appendix 2). Both the leafy and weedy seadragon are found in the Gulf in reef and seagrass

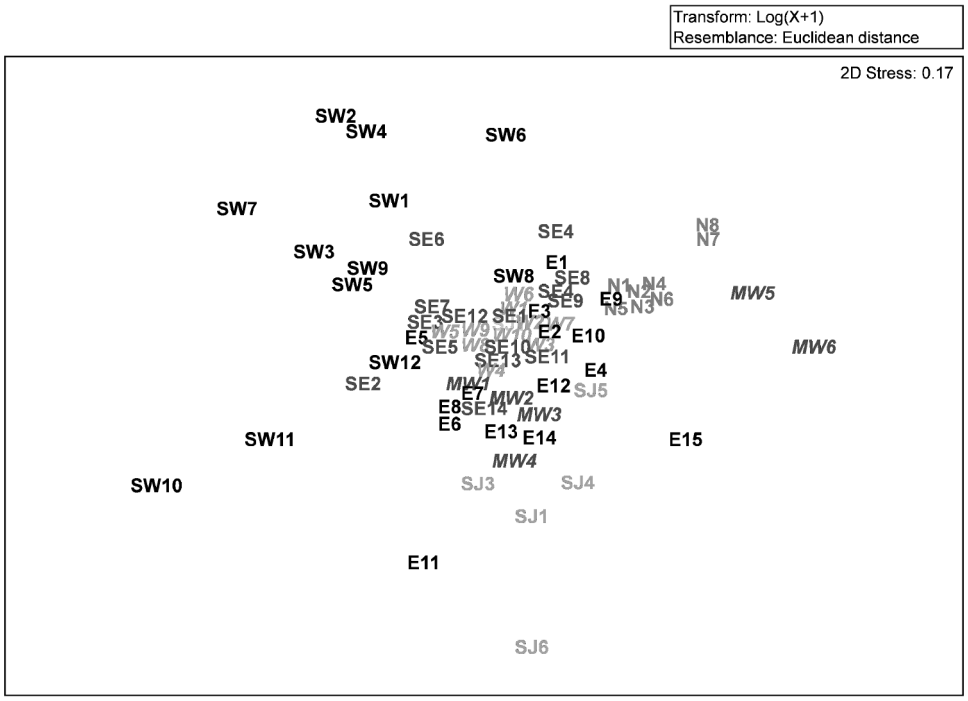


Figure 4. MDS plot of sites surveyed in Spencer Gulf. Sites are grouped according to the regions shown in Figure 1 i.e. SW, W, SJB, MW, SE, E and N. Site locations are given in Appendix 1.

habitats. Based on diver sightings and trawl records, weedy seadragons are rare north of the Wallaroo–Tickera area, and leafies north of Port Neill–Arno Bay (Baker 2005; Currie & Sorokin 2010). However, there is an unusual record of one weedy and three leafies reportedly caught (live) in a trawl at 12–20 m, at Douglas Bank, in the upper Gulf, in November 1985 (Dragon Search data, cited in Baker 2005). A number of pipefishes are found on reefs and in mixed habitats in the Gulf, both common and rare species, the latter including *Campichthys galei* (Gale's pipefish), which occurs in mixed reef rubble, shelly sand and seagrass habitat, as is common in the Sir Joseph Banks Group. The South Australian endemic pipefish *Stigmatopora narinosa* also occurs in the Gulf, sometimes in large numbers, as off Port Victoria. This species is known from various habitats, including: patchy brown macroalgae and rubble/rock substrate within seagrass; and patches of seagrass in sand among brown macroalgal stands (Baker 2009).

The potentially vulnerable site-attached harlequin fish *Othos dentex*, which is often solitary, occurs in caves or under reef ledges to >30 m deep in the southern part of the Gulf, including around islands.

The east Australian luderick *Girella tricuspidata* is at the end of its range in the Gulf, where it is rarely recorded. It is an omnivorous species, and ranges over reef, seagrass and estuarine habitats. The western foxfish *Bodianus frenchii*, a SW Australian labrid, is close to its eastern limit in the Gulf, where it inhabits exposed reefs in the southern regions and around islands, from 10–40 m deep.

The rare white-nose pigfish, *Perryena leucometopon*, has also been recorded occasionally in the Gulf, most notably at Tiparra Reef (Baker 2009). This well-camouflaged benthic fish has brown, scaleless, granular skin, and poisonous spines (Gomon et al. 2008). Another peculiar benthic fish is the large-headed, cryptic tropical deep velvetfish, *Kanekonia queenslandica*, with only nine records from SA, mostly from the Gulf (Baker 2009). This tiny (<7 cm) species lives in cobbles, rubble, coarse gravel habitats and sand. Seven angler fish have also been recorded in the Gulf (Appendix 2). The commoner species are the tasselled *Rhycherus filamentosus*, and prickly *Echinophryne crassispina*, and the rarer ones include:

- Bougainville's anglerfish *Histiophryne bougainvilli*, found mainly in eastern and SE Australia, but extending to at least the gulf regions of South Australia (Baker 2009). Records from the Gulf, include Sir Joseph Banks Group, and Tiparra.
- Glover's anglerfish *Rhycherus gloveri*, which ranges from southern WA to eastern SA, and known from shallow reefs and under jetties (Gomon et al. 2008). In the Gulf it ranges from Port Lincoln to Whyalla (Baker 2009). Anglerfishes are oviparous, and eggs are brooded in a hollow behind a parent's left pectoral fin (Pietsch & Grobecker 1987).

Of the slow-moving, site-associated boarfishes, the uncommon short boarfish *Parazanclistius hutchinsi* has been recorded from deeper coastal reefs and around jetty piles in the middle Gulf, such as Middle Bank, Wallaroo, and 'The Gutter', and from trawling in the central Gulf (Baker 2009; Currie & Sorokin 2010).

One of the rarest southern reef fishes is the cryptic, whiskered prowfish *Neopataecus waterhousii*, which has been recorded from a few eastern sites, such Port Broughton, Tiparra, and Port Rickaby, mostly from ~10–40 m depth, (Baker 2009). This well camouflaged species is occasionally seen in floating macroalgae, such as *Sargassum*. It is extremely variable in colour and pattern, and may variously resemble: a piece of *Ecklonia* kelp; crustose coralline algae with a network of thin red lines; pink blotches; or encrusting sponge with an orange body and white blotches.

Another rare species is the little pineapplefish *Sorosichthys ananassa* (with a trawl record from southern SG (Baker 2009; Currie & Sorokin 2010). This species ranges from 32–99 m deep. A related deeper water (to 320 m) species, the western roughy *Optivus agrammus* ranges from Fremantle to the Great Australian Bight (Gomon 2004), and was recorded from southern SG, at 44 m deep (Currie & Sorokin 2010).

The estuary catfish *Cnidoglanis macrocephalus* occurs at a few locations throughout the Gulf (Baker 2009). This species is generally found on sand and on reef or seagrass in clear to turbid waters. In some areas, adults are found in holes, and on (or under) ledges in banks, where they conceal themselves during daylight hours (Kailola et al. 1993; Crawley et al. 2006). This large fish (to >70 cm) is near-threatened

in this State, due to its high edibility, strong site association, low reproductive output, and nest guarding by the male (Nel et al. 1985). Small, mouth-brooding cardinal fishes of several species (*Vincentia badia*, the more common *V. conspersa* and the rarely recorded *V. macrocauda*) have been found in the Gulf. These cryptic, rarely seen, and strongly site-associated fishes live under ledges and in caves.

Small weedfish and snake-blennies (Clinidae) occur in algal and mixed reef/seagrass habitats in the Gulf. They are cryptic, and often well camouflaged, due to their ability to change colour and pattern. The species in this family are viviparous, with low dispersal, a characteristic that can increase their vulnerability to processes causing population decline. Examples of some of the less common weedfishes recorded in the Gulf include short-tassel weedfish, *Heteroclinus flavescens* (formerly *H. marmoratus*), seven-bar weedfish *H. heptaeolus*, Kuiter's weedfish *H. kuiteri*, little weedfish *H. puellarum*, Whitley's weedfish *Heteroclinus* sp. 2, and few ray weedfish *Heteroclinus* sp. 5 (Appendix 2). The eel-blenny *Peronedys anguillaris*, as well as six other species of snake blennies in the genera *Ophiclinops* and *Ophiclinus*, have also been recorded in the Gulf. These small clinids are important in the trophic ecology of reef systems, and are eaten by higher order predators (Robertson 1982). Various tiny clingfish species also occur in the Gulf, but little is known about them, and specialised (destructive) sampling techniques are usually required to detect them.

Threats

The two major threats to reef fish assemblages in SG are, in the short term, fishing and, in the long term, climate change. Rock fishing is moderately intense along the coasts of the Gulf, especially close to population centres and tourist destinations, as in Innes National Park and along the eastern coasts of the Gulf, while commercial fish stocks are heavily fished offshore. Charter fishing on deeper reefs south of the Gulf, and around offshore islands, targets some of the large reef fishes, as well as large pelagic species. Fishing truncates the age and size structure of populations, and the removal of large adults decreases the reproductive potential of stocks, and their ability to withstand overexploitation. Fishing also induces evolutionary changes in life-history traits, e.g. maturation at smaller sizes and smaller body size, and decreases populations' resilience and sustainable yield (Miethe et al. 2010). While a few commercial species are carefully monitored for these effects, the majority of reef species are not, and virtually nothing is known about the effects of fishing on them. Overfishing can also affect the food web, giving rise to top-down effects ('Fishing down the food web'), and causing jellyfish blooms, which further degrade the ecosystem by their predation on larvae of many fish species (Vasas et al. 2007; Shepherd et al. 2008). Jellyfish blooms, although occasionally reported in the Gulf (Shepherd & Edgar 2013), have never been investigated.

The long-term effects of climate change are far more serious, but the precise temperature increases are still uncertain (see Chapter 29). In SG sea surface temperatures have increased by 0.11ºC/decade since 1950. Average sea surface temperatures in southern Australia are predicted to increase by ~2ºC by 2100 (Poloczanska et al. 2012), and it is reasonable to predict greater increases in sea temperature in the shallow Gulf waters. Evaporation will increase in the upper Gulf, and the temperature-salinity gradient down the Gulf will increase. These changes will profoundly transform the Gulf's food webs. Pelagic species will shift their range in response to temperature changes, while cool-water benthic species will disappear, and possibly be replaced by warm-water West Australian species transported across the Bight by the Leeuwin Current.

Ocean acidification will also increase steeply over the next 40 years with climate change. Coralline algae and many invertebrates will progressively decline, and deleteriously affect the food of many fish species. These effects will interact with higher sea temperatures and other stressors, e.g. increased nutrients, and be magnified (Russell et al. 2009). In addition, sublethal effects, such as susceptibility to disease and changes in behaviour and reproduction are likely to lead to complex and synergistic effects.

Acknowledgements

We thank the many divers, who assisted with fish surveys. They were (in alphabetical order): Ali Bloomfield, the late Kevin Branden, James Brook, Adrian Brown, Tim Cuthbertson, Luke Kotys, Ben Parkhurst, Lana Roediger, Janet Scott, Brad Siviour and Kevin Smith. Especially we thank Sue Murray-

Jones and James Brook, who surveyed the Sir Joseph Banks Group sites, and Graham Edgar, who surveyed nine sites in mid- to upper Spencer Gulf. We also thank the reviewers for their helpful comments.

Appendix 1

Appendix 1. List of sites surveyed in Spencer Gulf, with survey depth. D = distance (km) from the entrance to the Gulf (see text). The date is month and year.

Western shores of Gulf	Date	D	Eastern and northern shores	Date	D
South West coasts (SW)			**South East coasts (SE)**		
1. Memory Cove South 5 m	12.04	4	1. Groper Bay south 4 m	3.08	6
2. Memory Cove South 10 m	12.04	4	2. Groper Bay north Pt 5 m	12.02	7
3. Memory Cove North 4 m	12.04	5	3. Groper Bay headland 10 m	12.02	7
4. Memory Cove South 2 m	12.04	5	4. Groper Bay inshore 2 m	12.02	7
5. Memory Cove North 5 m	12.04	6	5. Groper Bay past north Pt 6 m	12.02	7
6. Thistle I. Waterhouse Bay12m	4.87	5	6. Browns Beach lagoon 2 m	12.02	9
7. Thistle I. Horny Pt 10 m	4.87	8	7. Browns Beach lagoon sth 3 m	12.02	9
8. Taylors Landing 3 m	12.04	10	8. Shell Beach west 4 m	12.02	10
9. McLaren Point 3 m	12.04	15	9. Shell Beach east 10 m	12.02	10
10. Off McLaren Point 10 m	12.04	18	10. Shell Beach east Point 5 m	12.02	10
11. McLaren Point North 5 m	12.04	20	11. Formby Bay 3 m	10.02	12
12. Cape Donington 4 m	12.04	25	12. Gleesons Landing in bay 3 m	10.02	24
West coast (W)			13. Gleesons Landing offshore 3m	10.02	24
1. Moonlight Bay SE 4 m	10.05	38	14. Gleesons Landing lagoon 2 m	3.08	24
2. Moonlight Bay SW 2 m	10.05	38	**East & Central East coasts (E)**		
3. Peake Bay North 2 m	10.05	42	1. Port Minlacowie 3 m	3.08	80
4. Peake Bay South 2 m	10.05	41	2. Point Gawler near shore 4 m	3.08	102
5. Thurunna Point North 2 m	10.05	50	3. Point Gawler north 4 m	10.08	103
6. Thurunna Point South 4 m	10.05	48	4. Rocky Island 4 m	11.07	103
7. White Rock near-shore 2 m	10.05	50	5. Goose Island 4 m	11.07	105
8. White Rock offshore 2 m	10.05	50	6. Island Point north 3 m	12.05	109
9. White Rock offshore 5 m	10.05	50	7. Island Point inshore 2 m	12.05	110
10. White Rock Mainland Pt 2 m	10.05	50	8. Island Point west 5 m	12.05	111
Sir Joseph Banks Group (SJ)			9. Balgowan inshore 2 m	12.05	124
1. Partney I. 2 m	5.09	50	10. Balgowan offshore 4 m	12.05	124
2. Roxby I. 2 m	5.09	51	11. Cape Elizabeth inshore 2 m	12.05	143
3. Winceby I. 2 m	5.09	52	12. Cape Elizabeth offshore 4 m	12.05	144
4. Marum I. 2 m	5.09	55	13. Cape Elizabeth 300 m off 5 m	12.05	144
5. Reevesby I. 1 m	5.09	57	14. Cape Elizabeth 400 m off 6 m	12.05	145
6. Reevesby I. 2 m	5.09	58	15. Point Riley 2 m	6.08	159
Mid West coast (MW)			**Northern coasts (N)**		
1. Lipson Island 4 m	4.06	75	1. Black Point 5 m	7.09	272
2. Cape Burr 4 m	4.06	102	2. Third Dip 5 m	7.09	273
3. Cape Driver 4 m	4.06	135	3. Santos fence line 5 m	7.09	273
4. Point Gibbon 4 m	4.06	156	4. Point Lowly Lighthouse 5 m	7.09	274
5. Lucky Bay 8 m	7.09	172	5. Backy Point 3 m	7.09	280
6. Bokos Reef 8 m	7.09	174	6. Fitzgerald Bay 3 m	7.09	282
			7. Redcliff south reef 12 m	11.80	304
			8. Redcliff north reef 12 m	11.80	308

Appendix 2.

Reef-associated fishes recorded in Spencer Gulf, including species recorded less commonly during the surveys (with codes corresponding to sites listed in Appendix 1), as well as museum records, and species recorded during other surveys. Sand-dwelling and seagrass-dwelling species, found near reef edges, are included, and also wider-ranging mid-water species, except for small, open-water schooling species, such as anchovy and sprats. The clingfishes (Family Gobiesocidae) are also excluded due to lack of site-specific records, despite their likely presence in Spencer Gulf. Sources for species' records (not seen in the reef surveys) are coded as follows:

(1) Otter trawl surveys, using prawn trawling gear employed in SG (Currie & Sorokin 2010).

(2) References in Baker (2009), including S.A. Museum and Museum of Victoria records, Svane et al. (2007), fish survey data by Baker et al. (2008), data and photographs by D. Muirhead, K. Smith, J. Lewis;

(3) Museum records cited in OZCAM (2010).

(4) Port Hughes jetty species' list, in Baker et al. (2009). Some species are known from multiple sources, although only one is given here. # = record verified by S.A. Museum, but specimen is out of its range and population might not be established in South Australia. * = records not confirmed (unverified survey data, or old museum records, that have not been recently verified).

Acanthaluteres spilomelanurus bridled leatherjacket (1)
Acanthaluteres vittiger toothbrush leatherjacket MW5-6
Acanthosphex leurynnis wasp-spine velvetfish (2)
Aetapcus maculatus warty prowfish (2)
Alabes dorsalis common shore-eel / red-banded shore-eel (3)
Aldrichetta forsteri yellow-eye mullet SE6
Allomycterus pilatus Australian burrfish / deepwater burrfish (2)
Anoplocapros lenticularis white-barred boxfish (2)
Aploactisoma milesii southern velvetfish (2)
Aplodactylus arctidens southern sea carp / marblefish SE2-3, SE11
Aplodactylus westralis western sea carp SE7, W3
Aptychotrema vincentiana western shovelnose ray (1)
Aracana aurita Shaw's cowfish SJ4, MW5-6
Aracana ornata ornate cowfish (1)
Arothron firmamentum starry toadfish #
Asymbolus vincenti gulf catshark (2)
Asymbolus sp. (a catshark) (1)
Aseraggodes haackeanus / Solea haackeana southern sole (2)
Aspasmogaster tasmaniensis Tasmanian clingfish (4)
Austrolabrus maculatus black-spotted wrasse SW1-2, SW4, SW6-7, SW10, SE9, SJ4
Bathygobius krefftii / kreffti Frayed-Fin Goby / Krefft's Frillgoby (2)
Bodianus frenchii western foxfish (2)
Bovichtus angustifrons dragonet W6, E7-8, E12, E14
Caesioperca lepidoptera butterfly perch SW6, SW7
Callogobius mucosus sculptured goby (3)
Callorhinchus milii elephant fish / elephant shark (1)
Campichthys galei Gale's pipefish (2)
Cantheschenia longipinnis smoothspine leatherjacket (1)
Capropygia unistriata spiny boxfish / black-banded pygmy boxfish (2)
Carcharhinus brachyurus bronze whaler shark (2)
Carcharhinus obscurus dusky whaler / black whaler (2)
Carcharodon carcharias white shark / great white shark (2)
Centroberyx gerrardi Bight redfish (2)
Centroberyx lineatus swallowtail (2)
Cephaloscyllium laticeps Australian swellshark / draughtboard shark (2)
Chelidonichthys kumu red gurnard (1)
Chelmonops curiosus western talma SW2, SW10-11, MW6, E6, E8, E10-11, E13-15, N5
Chironemus georgianus western kelpfish / tasselled kelpfish (2)
Cnidoglanis macrocephalus estuary catfish (1)
Cochleoceps spatula spade-nose clingfish (4)
Conger verreauxi southern conger eel (2)
Cristiceps australis southern crested weedfish (1)
Dactylosurculus gomoni southern pygmy blindfish (2)
Dasyatis brevicaudata smooth stingray SW8
Dasyatis thetidis black stingray (1)
Dentiraja flindersi pygmy thornback skate (2)
Dermatopsis multiradiatus slender blindfish / yellow eelpout (2)
Dinolestes lewini longfin pike SW6, SW7, SE3, SE5,
Dipturus whitleyi Melbourne skate (1)
Echinophryne crassispina prickly anglerfish (2)
Echinophryne reynoldsi sponge anglerfish (2)
Enoplosus armatus old wife SW5, SW6, SW10, SW11, SE3, SE8, W4, E5, E13, E14
Eubalichthys bucephalus black reef leatherjacket (2) *
Eubalichthys cyanoura blue-tail leatherjacket (2) *
Eubalichthys gunnii Gunn's leatherjacket (1)
Eubalichthys mosaicus mosaic leatherjacket SE12
Eubalichthys quadrispinis fourspine / four-spined leatherjacket (1)
Eupetrichthys angustipes snakeskin wrasse SW2, SJ4
Filicampus tigris tiger pipefish (1)
Foetorepus calauropomus common stinkfish (1)
Furgaleus macki whiskery shark (2)
Galeorhinus galeus school shark (2)
Genypterus tigerinus rock ling (1)
Girella tricuspidata luderick (2)
Glyptauchen panduratus goblin fish (1)
Gnathanacanthus goetzeei red velvetfish (2)
Gymnapistes marmoratus soldierfish / South Australian cobbler (1)
Haletta semifasciata blue rock whiting / blue weed whiting SW2, SW4, E4, E5,
Helcogramma decurrens black-throated threefin E3
Heteroclinus adelaidae Adelaide weedfish (4)
Heteroclinus flavescens (prev. *H. marmoratus*) short-tassel weedfish (2)
Heteroclinus heptaeolus seven-bar weedfish / Ogilby's weedfish (2)

Heteroclinus johnstoni Johnston's / broad-headed weedfish (4)
Heteroclinus kuiteri Kuiter's weedfish (2)
Heteroclinus macrophthalmus large-eye weedfish / tasselled weedfish (2)
Heteroclinus perspicillatus common weedfish N6
Heteroclinus puellarum little Weedfish / the girls' weedfish (2)
Heteroclinus roseus rosy weedfish (2)
Heteroclinus tristis Forster's weedfish / long-snouted weedfish (2)
Heteroclinus sp. 2 Whitley's weedfish (2)
Heteroclinus sp. 5 fewray weedfish (2)
Heterodontus portusjacksoni Port Jackson shark SE12, E11
Heteroscarus acroptilus rainbow cale SW10, SE6-7, SJ1
Hippocampus breviceps short-headed / short-snouted seahorse (3)
Hippocampus cf. *bleekeri (H. abdominalis)* southern Australian potbelly seahorse (1)
Histiogamphelus cristatus rhino pipefish / Macleay's crested pipefish (1)
Histiophryne bougainvilli Bougainville's anglerfish / smooth anglerfish (2)
Histiophryne cryptacantha rodless anglerfish (1)
Hypnos monopterygium Australian numbfish / coffin ray (1)
Hypoplectrodes nigroruber / nigrorubrum black-banded sea perch (2)
Hyporhamphus melanochir southern sea garfish SE12, SE14
Hypselognathus rostratus knife-snout pipefish (2)
Ichthyscopus barbatus fringed stargazer (1)
Irolita waitii southern round skate (2)
Kanekonia queenslandica deep velvetfish (1)
Kathetostoma laeve common stargazer (1)
Kathetostoma nigrofasciatum deepwater stargazer / black-banded stargazer (2) *****
Kaupus costatus deep-bodied pipefish (2)
Kestratherina brevirostris short-snout hardyhead (2)
Latropiscis cf. purpurissatus (resembling Sergeant Baker) (1)
Lepidoblennius marmoratus western jumping blenny (2)
Lepidotrigla papilio spiny gurnard / southern spiny gurnard (1)
Lepidotrigla spinosa southern shortfin gurnard / shortfin gurnard (2)
Lepidotrigla vanessa butterfly gurnard (2)
Leptoichthys fistularius brush-tail pipefish (1)
Lepidotrigla papilio spiny gurnard / southern spiny gurnard (1)
Lepidotrigla spinosa southern shortfin gurnard / shortfin gurnard (2)
Lepidotrigla vanessa butterfly gurnard (2)
Leptoichthys fistularius brush-tail pipefish (1)
Leviprora inops longhead flathead (1)
Lissocampus caudalis smooth / Australian smooth pipefish (2)
Lissocampus runa javelin pipefish (2)
Lotella rhacina beardie / largetooth beardie (2)
Maroubra perserrata sawtooth pipefish (4)
Maxillicosta meridianus southern gurnard perch (2)
Maxillicosta scabriceps little gurnard perch / little scorpionfish (1)
Meuschenia flavolineata yellow-striped leatherjacket SW2, SW10-11, SE5, E8
Meuschenia freycineti six-spined leatherjacket SW7, SW9, W6, MW6, E15, N2
Meuschenia galii blue-lined leatherjacket SE3
Meuschenia hippocrepis horseshoe leatherjacket SW2-3, SW5-8, SW11, SE2-5, SE8-9, SE11-13, W4-5, W9, SJ3-4, MW2, MW4, E4, E6-8, E11, E13-14
Meuschenia scaber velvet leatherjacket (1)
Mustelus antarcticus gummy shark (1)
Myliobatis australis southern eagle ray SE7, SW11, W9
Nelusetta ayraudi ocean leatherjacket (1)
Neopataecus waterhousii whiskered prowfish (1)
Nesogobius pulchellus sailfin goby (4)
Nesogobius sp. 4 groove-cheeked goby (2)
Nesogobius sp. (unidentified sand goby) (4)
Neoaploactis tridorsalis threefin velvetfish (2)
Neosebastes bougainvillii gulf gurnard perch (1)
Neosebastes pandus bighead gurnard perch (1)
Neosebastes scorpaenoides common gurnard perch / ruddy gurnard perch (2)
Notolabrus parilus brown-spotted wrasse SW3, SW5, SW7, SW10, SE14, W5, W8-10, SJ1, SJ3-4, SJ6, E6, E8, E11
Notorynchus cepedianus broadnose sevengill shark (2)
Olisthops cyanomelas herring cale SW2-4, SW6-8, SW12, SE1-13, W6, W8-9, SJ1, SJ3, SJ5, E5-8, E11, E13-14
Omegophora armilla ringed toadfish SJ5
Ophiclinops pardalis spotted snake-blenny (4)
Ophiclinops varius variegated snake-blenny (2)
Ophiclinus antarcticus Adelaide snake-blenny (2)
Ophiclinus brevipinnis shortfin snake-blenny (2)
Ophiclinus gabrieli frosted snake-blenny (2)
Ophiclinus ningulus variable snake-blenny E3
Ophthalmolepis lineolatus Maori wrasse SW2, SW4
Optivus agrammus western roughy N8
Orectolobus halei large ornate wobbegong (1)
Orectolobus maculatus spotted wobbegong (2)
Othos dentex harlequin fish (2)
Parablennius tasmanianus Tasmanian blenny E14
Parapercis haackei wavy grubfish (3)
Parapercis ramsayi spotted grubfish N4
Paraplesiops meleagris southern blue devil E11
Parapriacanthus elongatus slender bullseye SW7
Parascyllium ferrugineum rusty catshark (1)
Parascyllium variolatum varied carpetshark (2)
Paratrachichthys macleayi sandpaper fish (1)
Parazanclistius hutchinsi short boarfish / Hutchins boarfish (1)
Pempheridae (unidentified bullseye species) (4)
Pegasus lancifer sculptured seamoth (1)
Pelates octolineatus western striped trumpeter N7, N8
Peronedys anguillaris eel-blenny / eel snake blenny (2)
Perryena leucometopon white-nose pigfish (2)
Phycodurus eques leafy sea dragon (1)
Phyllopteryx taeniolatus weedy seadragon (1)
Phyllophryne scortea smooth anglerfish / white-spotted anglerfish (2)
Platycephalus laevigatus rock flathead / grass flathead
Neoplatycephalus conatus deepwater flathead (2)
Pentaceropsis recurvirostris long-snouted boarfish SW2, SW6, W5, W10, E3, E6, E7, N5, N8
Platycephalus speculator yank flathead (1)
Polyspina piosae orange-barred puffer fish (1)

Pristiophorus cirratus common sawshark (2)
Pristiophorus nudipinnis southern sawshark / shortnose sawshark (2)
Pseudocaranx georgianus silver trevally SW4, N7, N8
Pseudolabrus mortonii rosy wrasse (2)
Pseudophycis bachus red cod (1)
Pseudophycis barbata bearded cod / bearded rock cod (2)
Pterygotrigla polyommata latchet / sharp-beaked gurnard (4)
Pugnaso curtirostris pug-nose pipefish (2)
Repomucenus calcaratus spotted dragonet / spotted stinkfish (1)
Rhycherus filamentosus tasselled anglerfish (2)
Rhycherus gloveri Glover's anglerfish (2)
Scobinichthys granulatus rough leatherjacket SE14, W8
Scorpis georgianus banded sweep SE2, SE3, SE5, SE11, SW2, MW1-MW4, E1
Scorpaena papillosa southern red scorpionfish / southern rock cod / red rock cod (2)
Seriola hippos samsonfish / sea kingfish (2)
Seriola lalandi yellowtail kingfish MW4
Sillago schomburgkii yellowfin whiting
Siphamia cephalotes Wood's siphonfish (3)
Siphonognathus argyrophanes tubemouth (1)
Siphonognathus attenuatus slender weed whiting SW6
Siphonognathus caninus sharp-nosed weed whiting SW6
Siphonognathus beddomei pencil weed whiting SW11, SJ1, MW5, MW6,
Siphonognathus radiatus long-rayed / longray weed whiting SW9
Sorosichthys ananassa little pineapplefish (1)
Sphyraena novaehollandiae snook / short-finned pike (4)
Sphyraena obtusata striped seapike / striped barracuda (1)
Squalus acanthias white-spotted spurdog / spiny dogfish (2)
Squalus megalops shortnose spurdog / piked dogfish (2)
Squalus chloroculus greeneye spurdog (2)
Squatina australis Australian angel shark (1)
Squatina tergocellata ornate angel shark (2)
Stichariu dorsale sand crawler (2)
Stigmatopora argus spotted pipefish (1)
Stipecampus cristatus ring-back pipefish (2)
Stigmatopora narinosa southern gulfs pipefish (4)
Sutorectus tentaculatus cobbler wobbegong / cobbler carpetshark (1)
Tetractenos glaber smooth toadfish SE2-3, SE5
Thamnaconus degeni Degen's leatherjacket / bluefin leatherjacket (1)
Threpterius maculosus silver spot (2)
Thysanophrys cirronasa tassel-snout flathead (1)
Torpedo macneilli short-tail torpedo ray (2) *****
Torquigener pleurogramma weeping toado / banded toadfish / common blowfish (2)
Torquigener vicinus orange-spotted pufferfish **#**
Trianectes bucephalus bighead (or bullhead) triplefin / threefin
Trinorfolkia clarkei common threefin N6
Trygonoptera mucosa western stingaree (2) *****
Trygonoptera testacea common stingaree (2)
Trygonorrhina dumerilii southern fiddler ray E1, N8
Trinorfolkia cristata crested threefin / crested triplefin (4)
Trinorfolkia incisa notched triplefin / threefin (3)
Trachichthys australis southern roughy (1)
Urolophus cruciatus banded stingaree (1)
Urolophus gigas spotted stingaree (1)
Urolophus orarius coastal stingaree (1)
Urolophus paucimaculatus sparsely-spotted stingaree (2)
Vanacampus margaritifer mother-of-pearl pipefish (2)
Vanacampus poecilolaemus long-snout pipefish (4)
Vanacampus vercoi Verco's pipefish (2)
Vincentia badia scarlet cardinalfish (1)
Vincentia conspersa southern cardinalfish / southern gobbleguts (1)
Vincentia macrocauda smooth cardinalfish (1)
Zebrias penescalaris dusky-banded sole (2)

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