Snapper (2016)

Chrysophrys auratus

Anthony Fowler: South Australian Research and Development Institute, **Anna Garland**: Department of Agriculture and Fisheries, Queensland, **Gary Jackson**: Department of Fisheries, Western Australia, **John Stewart**: Department of Primary Industries, New South Wales, **Paul Hamer**: Department of Economic Development, Jobs, Transport and Resources, Victoria

STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Shark Bay Inshore Denham Sound	BBRF, SBBSMNMF	Sustainable	Biomass
Western Australia	Shark Bay Inshore Eastern Gulf	BBRF	Sustainable	Biomass
Western Australia	Shark Bay Inshore Freycinet Estuary	BBRF	Sustainable	Biomass
Western Australia	Shark Bay Oceanic	BBRF, GDSMF	Transitional-recovering	CPUE, biomass
Western Australia	South Coast	BBRF, JASDGDLMF, SCEMF, SCTMF, WHRLF, WL (SC)	Sustainable	Catch, fishing mortality
Western Australia	West Coast	JASDGDLMF, SWTMF, WCDGDLIMF, WCDSIMF	Transitional-recovering	Catch, fishing mortality
Queensland, New South Wales, Victoria	East Coast	CIF, ECIFFF, OF, OTLF, RRFFF	Undefined	Biomass, standardised catch rates, fishery-dependent length and age frequency, estimates of total mortality rate, catch, effort, fishery-independent juvenile abundance

Victoria, South Australia	Western Victoria	MSF, PPBWPF	Sustainable	Catch, CPUE , pre-recruit surveys, age and length composition
South Australia	Gulf St. Vincent	MSF	Sustainable	Catch, CPUE, age structures, biomass
South Australia	Spencer Gulf/West Coast	MSF	Transitional-depleting	Catch, CPUE, age structures, biomass

OTLF Ocean Trap and Line (NSW), ECIFFF East Coast Inshore Fin Fish Fishery (QLD), RRFFF Rocky Reef Fin Fish Fishery (QLD), MSF Marine Scalefish Fishery (SA), CIF Corner Inlet Fishery (VIC), OF Ocean Fishery (VIC), PPBWPF Port Phillip Bay and Western Port Bay Fishery (VIC), BBRF Boat Based Recreational Fishery (WA), GDSMF Gascoyne Demersal Scalefish Managed Fishery (WA), JASDGDLMF Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (Zone 1 & Zone 2) (WA), SBBSMNMF Shark Bay Beach Seine and Mesh Net Managed Fishery (WA), SCEMF South Coast Estuarine Managed Fishery (WA), SCTMF, WHRLF, WL (SC) South Coast Trawl Managed Fishery, Windy Harbour Rock Lobster Fishery, Open access in the South Coast (WA), SWTMF, WCDGDLIMF South West Trawl Managed Fishery, West Coast Demersal Gillnet and Demersal Loneline (Interim) Managed Fishery, Open access in the West Coast (WA), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA)

STOCK STRUCTURE

Snapper has a wide distribution in Australia, from the Gascoyne region on the west coast of Western Australia, around the south of the continent, and up to northern Queensland, around Hinchinbrook Island[1]. Within this broad distribution, the biological stock structure is complex.

Snapper on the east coast of Australia, from Proserpine in north Queensland to around Wilsons Promontory (Victoria), show little genetic differentiation and are considered to represent a single genetic stock[2]. Similarly, in Victoria, little genetic variation has been found for Snapper[3]. However, tagging and otolith chemistry data have indicated some separation between Snapper to the east of Wilsons Promontory (the East coast biological stock) and to the west, including Port Phillip Bay and Western Port (Western Victorian biological stock) and extending across western Victoria to near the Murray mouth in South Australia[4–6].

Despite the separation of the Eastern and Western stocks in Victorian waters, Snapper are managed at a state-wide level in Victoria, with management arrangements that govern commercial fishing in specific regions such as bays and inlets, and offshore waters. Bag and size limits for the recreational sector are the same for the Western and Eastern stocks in Victorian waters. Recent changes to commercial fishing in Port Phillip Bay (Western stock) have resulted in removal of most of the fishing effort by net methods, and capping of catches for the remaining hook method operators. The Eastern stock, from Victoria to Queensland, is managed at a state level.

Further research has been undertaken to inform the level of stock sharing between Victoria and South Australia.

The South Australian fishery was originally divided into six management units, due to uncertainty about the extent of the movement of fish between different regional populations[7]. However, a recent study evaluated the stock structure and adult movement between regional populations of South Australia and western Victoria[8] based on inter-regional comparisons of otolith chemistry and increment widths, as well as demographic features. The study differentiated three stocks. The Western Victorian stock extends from Wilsons Promontory westward into south-eastern South Australia. This stock depends on recruitment into, and subsequent emigration from, Port Phillip Bay in Victoria. As such, this is a cross-jurisdictional stock, although the components from the two states are still assessed and managed independently. The two further stocks are wholly located within South Australia. The Spencer Gulf/West Coast stock depends on recruitment into Northern Spencer Gulf from where fish

emigrate to replenish the populations of Southern Spencer Gulf and the west coast of Eyre Peninsula. The third stock is the Gulf St. Vincent stock, which relies on recruitment into, and subsequent emigration from, Northern Gulf St. Vincent.

In Western Australia, Snapper is divided into six management units, some at small geographic scales (for example, there are three separate biological stocks located inside Shark Bay) and others that cover greater areas of oceanic waters in the Gascoyne, west and south coast regions[9–13]. The inshore Shark Bay biological stocks in the inner gulfs are predominantly fished by the recreational and charter sectors.

Here, assessment of stock status is presented at the biological stock level—Shark Bay inshore–Eastern Gulf, Shark Bay inshore–Denham Sound, Shark Bay inshore–Freycinet Estuary (Western Australia); East coast, Western Victorian, Spencer Gulf West Coast (South Australia) and Gulf St Vincent Fishery (South Australia); and the management unit level—South coast, Shark Bay oceanic and West coast (Western Australia).

STOCK STATUS

East Coast

The cross-jurisdictional East coast biological stock has components in Queensland, New South Wales and Victoria. Each jurisdiction assesses and manages the part of the biological stock that occurs in its waters. However, status is presented here for the entire East coast biological stock, considering evidence from the three jurisdictions. The total annual catch from the East coast biological stock has averaged around 307 t over the period 2011–15, of which Queensland 21 per cent, New South Wales contributed 75 per cent and Victoria four per cent.

The New South Wales part of the biological stock is assessed annually in terms of commercial harvest, catch rates and size composition of landings. Periodic sampling of age composition is used to generate mortality estimates. Snapper are currently assessed as being growth overfished in New South Wales waters, with yield from the stock being limited by harvesting at too small a size and at an excessive rate. Nominal commercial median catch rates (kg per day trapping) have more than doubled since the minimum legal length (MLL) was increased to 300 mm total length (TL) in 2001, although some declines have been observed during the past 2 years[18]. Catch rates in the recreational fishery remained stable between 2000–01 and 2013–14[19]. The size composition of Snapper in commercial landings has remained highly stable, with the average size between approximately 310 and 320 mm fork length each year since 2004[18]. The most recent commercial age composition samples in 2013–14 and 2014–15 showed that the fishery continues to be dominated by fish aged between 3 and 6 years, with recent increases in the proportion of fish aged more than 5 years. The above evidence indicates that the biomass of this part of the stock is unlikely to be recruitment overfished.

Commercial landings in the New South Wales part of the biological stock in 2015 (around 150 t) were the lowest on record (noting that the catch records for 2015 may be incomplete at this time) and the reported number of fisher days in the trap fishery when Snapper were reported in 2015 was also at an all-time low of less than 5000 days. The New South Wales recreational harvest declined by 20 per cent between 2000–01 and 2013–14[19], due largely to a reduction in fishing effort. The selectivity of the New South Wales demersal trap fishery

means that it continues to harvest Snapper over a relatively narrow size range generally between 300 and 450 mm TL. Typical size compositions in 2015 suggest no large changes to the fishery. Since 2011–12, estimates of total mortality from the commercial line sector have been around twice natural mortality. The above evidence indicates that the current level of fishing pressure is unlikely to cause this part of the stock to become recruitment overfished.

Queensland assessed its jurisdictional component of the East coast Australian biological stock in 2009 (including data up until 2007) using a sex, age and length based stock assessment model[20]. The assessment estimated exploitable biomass to be around 35 per cent of unfished levels[20], with biomass expected to decline further if fishing pressure remained unchanged. Since the completion of the stock assessment, no measurable improvement in biomass has been detected, and the standardised commercial catch rate has fallen a further 15 per cent[21], to historically low levels. Decreases in the recreational and charter sector nominal catch rates were also observed between 2007 and 2015[21–24]. Catch rates for all sectors indicate a further reduction in biomass. Increased harvest at the northern extent of the fishery (particularly the Swains Reef area, off Rockhampton, Queensland), the most northern distribution of this species, has increased the north's relative importance and contribution to total commercial harvest[21]. Spatial expansion of the commercial fishery to fishing grounds further north and offshore may have occurred in response to declining catches and catch rates in other areas.

In 2015, average Queensland Snapper pre-recruit catch rates from fishery-independent trawl surveys were very low in comparison to previous years, showing a relative decrease of 57 per cent since 2014 and a decrease of 94 per cent since 2011[21], indicating a corresponding decrease in available biomass. Fishery-dependent monitoring shows commercial and recreational length structures dominated by fish within 150 mm of the current MLL[21]. This pattern has been consistent since monitoring began in 2007. Fishery-dependent monitoring shows truncated commercial and recreational age frequencies dominated by young fish; particularly in the recreational sector[21]. Relatively few older fish are present in the Queensland fishery. The above data raises further concerns about the level of Snapper biomass that remains, with evidence indicating that the Queensland component of the stock is likely to be recruitment overfished.

Between 2007 and 2015, harvest data show no indication of recovery or improvement in the Queensland component of the stock, with commercial, charter and recreational sectors all declining to, or below, historic lows[21–24]. Active commercial fishing licenses and fishing effort days continue to decrease[21]. Estimates of fishing mortality continue to remain high, and are the highest in 9 years, exceeding natural mortality in 2015[21]. Despite protection of Snapper through a variety of mechanisms that aim to reduce fishing mortality, the data indicate that the current level of fishing pressure is too high to allow the Queensland component of the East coast Snapper stock to recover from being recruitment overfished.

An assessment of the status of the East coast biological stock of Snapper in Victorian waters was attempted in 2016[25]. The assessment found that insufficient data were available. The catch of Snapper for this part of the state is substantially less than for Victoria's Western biological stock, and only made up

around one per cent (2.6 t) of the estimated total catch of 213 t from the East coast biological stock in 2015. For commercial fishers, Snapper in the Victorian part of the East coast biological stock has historically been considered to be a by-product species, and the majority of the catch is taken by Commonwealth licensed operators in the Danish seine fishery. The status of the Victorian component of the East coast biological stock is therefore undefined although, given the small contribution to catches, it is relatively uninfluential on the status of the whole stock.

On the basis of conflicting indicators for the Queensland and New South Wales components of this stock, the East coast biological stock is classified as an **undefined stock**.

Gulf St. Vincent

The Gulf St. Vincent Fishery (South Australia) biological stock involves two regions previously described as management units: Northern Gulf St. Vincent (NGSV) and Southern Gulf St. Vincent (SGSV). NGSV includes an important nursery area and supports a self-replenishing population[8]. SGSV has recently supported a much lower biomass than NGSV. This may reflect that it is at the boundary of the three South Australian stocks, and occasionally receives some emigration from those stocks, although apparently at relatively low levels.

In recent years, NGSV has provided the highest catches ever recorded from any regional Snapper population of South Australia[26]. Total catch increased from 66–417 t between 2007 and 2010 and has subsequently remained at record high levels. This related particularly to expansion of the commercial longline sector. Targeted effort, catch and CPUE increased to record levels to 2010, and have subsequently remained at these high levels. These results indicate that there has been a considerable increase in biomass since the early-2000s. There has also been adoption of new longline technology that increased the efficiency of the fishing activity. For SGSV, increasing trends in total catch and longline data were also evident, but the annual catch was an order of magnitude less than for NGSV (38 t in 2010) and the trends were not persistent. As such, there appears to have been a temporary increase in biomass in the region between 2009 and 2012.

The population age structures for NGSV help explain the substantial increase in biomass[26]. Numerous strong year classes recruited to this region throughout the 2000s, augmenting several strong year classes from the late-1990s. The high recent biomass relates to successful recruitment throughout the 2000s, indicating a differentiation from the Spencer Gulf/West Coast stock. Recent management changes implemented in 2012–13 for the recreational and commercial sectors are expected to control fishing pressure, to the extent that average recruitment levels in this region are maintained into the future. The evidence above indicates that the biomass of this stock is unlikely to be recruitment overfished and that the current level of fishing mortality is unlikely to cause the biomass to become recruitment overfished.

On the basis of the evidence provided above, the Gulf St. Vincent (South Australia) biological stock is classified as a **sustainable stock**.

Shark Bay

The most recent integrated model-based stock assessment (unpublished data,

Inshore Denham Sound

Department of Fisheries, Western Australia) that included data from 2012, indicated that spawning biomass was around 75 per cent of the unfished level; well above the management target of 40 per cent of unfished biomass. The biological stock is therefore not considered to be recruitment overfished.

The total commercial catch of Snapper in the Denham Sound biological stock was around 1 t in 2015. The recreational catch was likely to have been minor and within the target catch range (0–12 t). This level of fishing mortality is unlikely to cause the biological stock to become recruitment overfished.

On the basis of the evidence provided above, the Shark Bay inshore–Denham Sound (Western Australia) biological stock is classified as a **sustainable stock**.

Shark Bay Inshore Eastern Gulf

The most recent integrated model-based stock assessment (unpublished data, Department of Fisheries, Western Australia) that included data from 2012, indicated that spawning biomass was around 80 per cent of the unfished level; well above the management target of 40 per cent of unfished biomass. The biological stock is therefore not considered to be recruitment overfished.

There was no commercial catch of Snapper from the Eastern Gulf biological stock in 2015. The recreational catch was likely to have been minor and within the target range (0–12 t). This level of fishing mortality is unlikely to cause the biological stock to become recruitment overfished.

On the basis of the evidence provided above, the Shark Bay inshore–Eastern Gulf (Western Australia) biological stock is classified as a **sustainable stock**.

Shark Bay Inshore Freycinet Estuary

The most recent integrated model-based stock assessment (unpublished data, Department of Fisheries, Western Australia) that included data from 2013, indicated that spawning biomass was between 42 and 57 per cent of the unfished level, that is, above the management target level of 40 per cent of unfished biomass. The biological stock is therefore not considered to be recruitment overfished.

There was no commercial catch of Snapper from the Freycinet Estuary biological stock in 2015. The recreational catch was assumed to have been within the target catch range (0–3.8 t) for this sector because of the conservative management regime that has been in place since 2003. This level of fishing mortality is unlikely to cause the biological stock to become recruitment overfished.

On the basis of the evidence provided above, the Shark Bay inshore–Freycinet Estuary (Western Australia) biological stock is classified as a **sustainable stock**

Shark Bay Oceanic

The most recent integrated model-based stock assessment (unpublished data, Department of Fisheries, Western Australia) that included data up to the 2014–15 season indicated that spawning biomass in 2015 was between 32 and

38 per cent of the unfished level, that is, between the threshold and target level (40 per cent of the unfished level) for this management unit. The spawning biomass is estimated to have been slowly rebuilding since a historical low of around 20 per cent of the unfished level in 2002–03, and is projected to reach the target level around 2020–21. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished.

The total allowable commercial catch was initially reduced from 564–338 t in 2004 and reduced further to 277 t in 2007 to assist stock rebuilding to the target level. Approximately 230 t of Snapper was caught in 2014–15 (all sectors), and the level of fishing mortality is likely to promote rebuilding of this stock. The above evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, the Shark Bay oceanic (Western Australia) management unit is classified as a **transitional–recovering stock.**

South Coast

The first stock assessment of Snapper on the south coast of Western Australia was completed in 2015[17] using a weight-of-evidence approach to determine the risk profile of this management unit. The most important evidence was derived from catch curve models that estimated fishing mortality (F = 0.103) to be 0.76 of natural mortality (M = 0.135). The models also provided estimates of spawning potential ratio (SPR): traditional SPR = 0.39 and extended SPR = 0.33. All estimates were between target and threshold levels. These estimates, their corresponding confidence levels and all other lines of evidence demonstrated the level of depletion and risk profile to be acceptable.

On the basis of the evidence provided above, the South coast (Western Australia) management unit is classified as **sustainable stock**.

Spencer Gulf/West Coast

The Spencer Gulf/West Coast (South Australia) (SG/WC) stock involves three regions that were previously described as management units: Northern Spencer Gulf (NSG), Southern Spencer Gulf (SSG) and the west coast of Eyre Peninsula (WC)[8]. The NSG supports the primary nursery area for the stock and is a self-replenishing region. Replenishment of the other two regions depends, to some extent, on emigration of fish from NSG. The 32-year time series of annual commercial fishery statistics from 1984–2015 provide significant fishery performance indicators for each of the three regional populations. The recent fisheries in each region are characterised by declining trends in total catch, targeted effort and targeted CPUE for the two primary gear types of handlines and longlines[26]. For NSG, the performance indicators all declined considerably in 2012, and have subsequently remained low. In SSG, total catch, targeted effort and CPUE have all shown declining trends since 2007. For the WC, the trends in commercial statistics have been downward, particularly between 2009 and 2015. Such decreasing trends across the component regional populations of the stock are consistent with declining biomass across the broad spatial scale.

South Australian Snapper populations are characterised by high inter-annual variability in recruitment, which results in strong and weak year classes that are manifested in the population age structures over numerous years[7]. The recent age structures from NSG show the lack of strong year classes since 1999[26], indicating that recruitment has been below average throughout the 2000s. This is particularly evident in SSG which relies on emigration of fish from strong year

classes from NSG. As recruitment has been relatively low in the north, such emigration has been minimal, which is evident as weak year classes in the age structures throughout the 2000s.

While there is evidence that the biomass of the SG/WC stock is declining, it is not clear that the stock is recruitment overfished, even though recruitment has been below average through the 2000s. Low recent fishing effort in the three regions since 2012 indicates that exploitation rates have declined. Significant management changes were implemented for the recreational (including charter) and commercial sectors fisheries between 2012 and 2013[7] that were focussed on reducing commercial catch and increasing reproductive output and recruitment. They included: introduction of a daily commercial catch limit; a further restriction to the number of hooks that can be used on set lines; extension of the state-wide closed season for a further 2 weeks into mid-December; implementation of four spatial spawning closures throughout SG to protect key spawning aggregation sites. Benefits from these changes may take some time to be realised.

On the basis of the evidence provided above, the Spencer Gulf/West Coast (South Australia) biological stock is classified as a **transitional–depleting stock**.

West Coast

Assessments completed in 2007, 2009 and 2014 indicated that fishing mortality in the West coast management unit of Western Australia exceeded the limit reference point of 1.5 times natural mortality[14–16]. However, the most recent assessment indicated that fishing mortality rates had decreased, providing evidence that stock recovery had begun, following significant changes to the management of the commercial and recreational sectors. Based on agreed decision rules to reduce fishing mortality to a level that would allow the stock to recover, the total catch of Snapper by all sectors had to be reduced by at least 50 per cent, to no more than 163 tonnes (t). Catches of Snapper by the commercial West Coast Demersal Scalefish Interim Managed Fishery in this region were above the acceptable level of 120 t for that fishery for a period of 3 years, but further management action reduced catches in 2015 to around 91 t, a level expected to allow recovery to continue. The above evidence indicates that the stock is likely to be recruitment overfished, but that the current level of fishing mortality should allow the stock to recover.

On the basis of the evidence provided above, the West coast (Western Australia) management unit is classified as a **transitional–recovering stock.**

Western Victoria

The main indicators used for assessment of the Western Victorian biological stock are catch per unit effort (CPUE) from the commercial and recreational sectors, fishery-independent annual surveys of pre-recruit (young-of-the-year) catch rates in Port Phillip Bay (the main spawning and nursery area for the Western stock)[4], and age and length composition of catches taken by the recreational and commercial sectors.

The most recent stock assessment was in 2016[25]. This assessment indicated that the stock was in good condition. Commercial longline catch rates of adult Snapper in the main fishery of Port Phillip Bay have declined since the recent peak in 2011–12, but remain well above the long-term average since 1978. The recent decline in the longline catch rate was consistent with a decline in

recreational catch rate evident in creel survey and diary angler data. This decline was expected as the two dominant year classes in the adult component of the fishery (birth years 2001 and 2004) are now depleted beyond their peak biomass. The catch rates in the haul seine fishery, which catches sub-adults, had a recent peak in 2011–14, consistent with recruitment of the three moderate year classes detected by the 2008, 2009 and 2010 Port Phillip Bay pre-recruit surveys. These sub-adults will enter the fishery over the next 3 years, which is expected to increase catch rates. Effort has remained relatively stable for both longline and haul seine gear types, which account for most of the commercial catch. Recent pre-recruit surveys in Port Phillip Bay have shown above-average (24-year time series) recruitment for the 2013 and 2014 year classes, but very poor recruitment for 2015 and 2016.

The productivity of the Western Victorian biological stock has declined since the peak in 2011–12, and may decline further over the coming 1–2 years until the 2008, 2009 and 2010 year classes fully recruit to the adult fishery. Recent strong year classes observed in pre-recruit surveys in 2013 and 2014 will further bolster the fishery in 6–7 years' time. Commercial catches by Victorian licensed operators will, however, decline from 2016 onwards due to removal of most netting effort from Port Phillip Bay and capping of the catches by remaining longline operators. Nonetheless, continued above-average catch rates of both sub-adult and adult Snapper, particularly in the Port Phillip Bay Fishery, and the recent strong recruitment of juvenile Snapper suggests that the Western Victorian biological stock is not recruitment overfished and that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, the Western Victorian biological stock is classified as a **sustainable stock**.

BIOLOGY

Snapper biology[8,10,12,27–29]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Snapper	30–40 years; 1300 mm TL	2–7 years; 220–560 mm TL

DISTRIBUTION

Distribution of reported commercial catch of Snapper

TABLES

Commercial Catch Methods	New South Wales	Queensland	South Australia	Victoria	Western Australia
Danish Seine				✓	
Demersal Longline			✓		
Fish Trap	✓			✓	
Hand Line, Hand Reel or Powered Reels			✓		
Line	✓	✓		✓	
Mesh Net				✓	
Net		✓			
Otter Trawl				✓	
Traps and Pots				✓	
Unspecified				✓	✓
Various					✓

Fishing methods					
	New South Wales	Queensland	South Australia	Victoria	Western Australia
Commercial					
Danish Seine				✓	
Demersal Longline			✓		
Fish Trap	✓				

Hand Line, Hand Reel or Powered Reels			✓		
Line	✓	✓		✓	
Mesh Net				✓	
Net		✓			
Unspecified				✓	✓
Various					✓
Indigenous					
Hand Line, Hand Reel or Powered Reels	✓		✓		
Spearfishing	✓		✓		
Recreational					
Hand Line, Hand Reel or Powered Reels	✓	✓	✓	✓	✓
Spearfishing	✓		✓	✓	✓

Management Methods					
	New South Wales	**Queensland**	**South Australia**	**Victoria**	**Western Australia**
Commercial					
Catch limits			✓	✓	✓
Gear restrictions	✓	✓	✓	✓	✓
Limited entry	✓	✓	✓	✓	✓
Seasonal closures			✓		
Size limit	✓	✓	✓	✓	✓
Spatial closures	✓	✓	✓	✓	✓
Indigenous					
Bag limits	✓		✓		
Gear restrictions	✓				
Section 31 (1)(c1), Aboriginal cultural fishing authority	✓				
Size limit	✓		✓		
Spatial	✓		✓		

closures					
Recreational					
Bag/boat limits	✓		✓	✓	✓
Catch limits					✓
Gear restrictions	✓	✓	✓	✓	✓
Possession limit	✓	✓			✓
Seasonal closures			✓		✓
Size limit	✓	✓	✓	✓	✓
Spatial closures	✓	✓	✓	✓	✓

Active Vessels					
	New South Wales	**Queensland**	**South Australia**	**Victoria**	**Western Australia**
	35 License in EGF, 46 License in OTF, 170 License in OTLF, 170 Vessel in OTLF,	15 License in ECIFFF, 136 License in RRFFF,	187 license in MSF,	6 Fisher in GLF, 28 Fisher in OF, 36 Fisher in PPBF, 9 Fisher in VRLF,	8 License in CSLPMF, 16 License in GDSMF, 21 License in JASDGDLMF, 6 License in PLF, 7 License in SBBSMNMF, 27 License in SCEMF, 5 License in WCDGDLIMF, 37 License in WCDSCMF, 69 License in WL (SC),

EGF Estuary General Fishery(NSW)

OTF Ocean Trawl Fishery(NSW)

OTLF Ocean Trap and Line(NSW)

ECIFFF East Coast Inshore Fin Fish Fishery(QLD)

RRFFF Rocky Reef Fin Fish Fishery(QLD)

MSF Marine Scalefish Fishery(SA)

GLF Gippsland Lakes Fishery(VIC)

OF Ocean Fishery(VIC)

PPBF Port Phillip Bay Fishery(VIC)

VRLF Victorian Rock Lobster Fishery(VIC)

CSLPMF Cockburn Sound (Line and Pot) Managed Fishery(WA)

GDSMF Gascoyne Demersal Scalefish Managed Fishery(WA)

JASDGDLMF Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (Zone 1 & Zone 2)(WA)

PLF Pilbara Line Fishery(WA)

SBBSMNMF Shark Bay Beach Seine and Mesh Net Managed Fishery(WA)

SCEMF South Coast Estuarine Managed Fishery(WA)

WCDGDLIMF West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery(WA)

WCDSCMF West Coast Deep Sea Crustacean Managed Fishery(WA)

WL (SC) Open Access in the South Coast(WA)

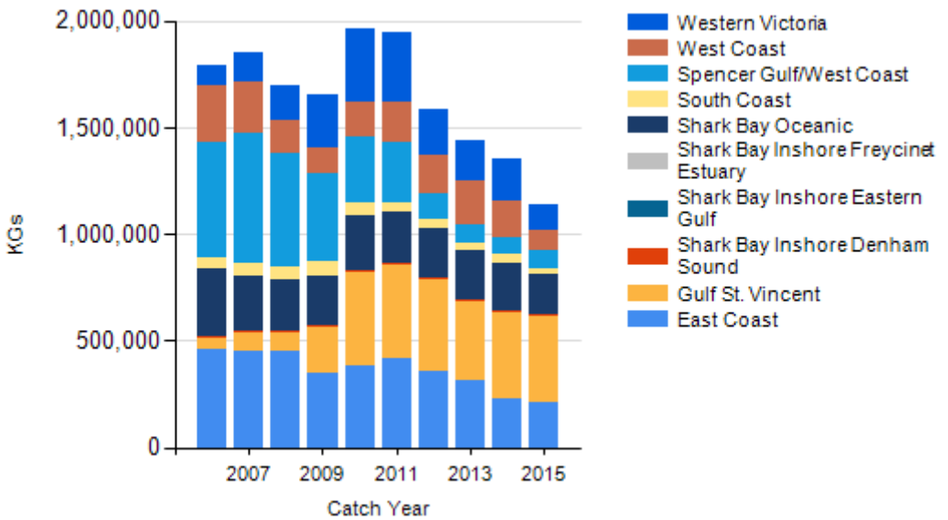
Catch					
	New South Wales	Queensland	South Australia	Victoria	Western Australia
Commercial	148.649t in OTLF,	1.236t in ECIFFF, 60.817t in RRFFF,	505.778t in MSF,	0.179t in CIF, 2.425t in OF, 104.705t in PPBWPF,	191.007t in GDSMF, 17.4949t in JASDGDLMF, 1.01t in SBBSMNMF, 4.414t in SCEMF, 11.3194t in SCTMF, WHRLF, WL (SC), 4.18995t in SWTMF, WCDGDLIMF, 83.6911t in WCDSIMF,
Indigenous	Unknown	Unknown	Unknown	Unknown	Unknown
Recreational	148 t (in 2013–14)	85 t (2013–14)	332 t (2013–14)	~600 t (2006–07)	80–100 t (2012–13)

OTLF Ocean Trap and Line (NSW), ECIFFF East Coast Inshore Fin Fish Fishery (QLD), RRFFF Rocky Reef Fin Fish Fishery (QLD), MSF Marine Scalefish Fishery (SA), CIF Corner Inlet Fishery (VIC), OF Ocean Fishery (VIC), PPBWPF Port Phillip Bay and Western Port Bay Fishery (VIC), BBRF Boat Based Recreational Fishery (WA), GDSMF Gascoyne Demersal Scalefish Managed Fishery (WA), JASDGDLMF Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (Zone 1 & Zone 2) (WA), SBBSMNMF Shark Bay Beach Seine and Mesh Net Managed Fishery (WA), SCEMF South Coast Estuarine Managed Fishery (WA), SCTMF, WHRLF, WL (SC) South Coast Trawl Managed Fishery, Windy Harbour Rock Lobster Fishery, Open access in the South Coast (WA), SWTMF, WCDGDLIMF South West Trawl Managed Fishery, West Coast Demersal Gillnet and Demersal Loneline (Interim) Managed Fishery, Open access in the West Coast (WA), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA),

a Victoria – Indigenous In Victoria, regulations for managing recreational fishing are also applied to fishing activities by Indigenous people. Recognised Traditional Owners (groups that hold native title or have agreements under the Traditional Owner Settlement Act 2010 [Vic]) are exempt (subject to conditions) from the requirement to hold a recreational fishing licence, and can apply for permits under the Fisheries Act 1995 (Vic) that authorise customary fishing (for example, different catch and size limits, or equipment). The Indigenous category in Table 3 refers to customary fishing undertaken by recognised Traditional Owners. In 2012–13, there were no applications for customary permits to access Snapper.
b Queensland – Indigenous Under the Fisheries Act 1994 (Qld), Indigenous fishers in Queensland are entitled to use prescribed traditional and non-commercial fishing apparatus in waters open to fishing. Size and possession limits, and seasonal closures do not apply to Indigenous fishers. Further exemptions to fishery regulations may be applied for through permits.
c Western Australia – Recreational (management methods) In Western Australia, total recreational catch limits (that is, maximum catch limits) have been applied to stocks of Snapper in inner Shark Bay and the west coast, to aid recovery of stocks.
d New South Wales – Indigenous (management methods) Aboriginal fishing interim compliance policy (increased bag limits) – allows an Indigenous fisher in New South Wales to

take in excess of a recreational bag limit in certain circumstances, for example, if they are doing so to provide fish to other community members who cannot harvest themselves.
e New South Wales – Indigenous (management methods) Aboriginal cultural fishing authority - the authority that Indigenous persons can apply to take catches outside the recreational limits under the Fisheries Management Act 1994 (NSW), Section 37 (1)(c1), Aboriginal cultural fishing authority.

CATCH CHART



Commercial catch of Snapper - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

- Most of the fisheries that target adult Snapper use hook and line fishing techniques, which are likely to have little direct impact on benthic habitats. To date, limited research on the effects of fish traps on the benthic environment in New South Wales suggests only a minor influence (unpublished data, Department of Primary Industries, New South Wales).

- Snapper are generalist feeders and normally just one of a number of such species inhabiting continental shelf waters. Effects on the food chain from fishing for Snapper are considered to be low risk. This is supported by a recent study which found no evidence of material changes in finfish community structure over the past 30 years in the three Western Australian Bioregions where Snapper are captured[32].

ENVIRONMENTAL EFFECTS on Snapper

- A recent Fisheries Research and Development Corporation project identified two potential significant effects of climate change on Snapper populations[33]. First, there is an optimal temperature range of 18–22°C for the production and survivorship of Snapper larvae. Furthermore, peak spawning times vary with latitude, resulting in peak production corresponding to the optimal temperature range. Warmer projected sea surface temperature regimes in the future will alter the timing and/or length of these optimal conditions for spawning and larval survivorship in different regions. This might restrict opportunities for successful spawning and recruitment in the northern fisheries, but provide enhanced opportunities for some southern fisheries, and the opportunity for establishing new populations and fisheries further south. Such environmental changes might also affect spawning and recruitment for the populations in South Australia's gulfs and Port Phillip Bay, Victoria.

- The second possible effect of climate change on Snapper populations is greater variation in recruitment of fish aged 0+ years[33]. Such variable recruitment already accounts for the population dynamics and variation in fishery productivity for a number of Australia's southern Snapper fisheries. Variation in recruitment is driven by the survivorship of the larvae. Larval survivorship depends on the overlap of the optimal temperature window with periods of high larval prey concentrations. The latter depends on nutrient input to marine environments. The effects of climate change on the dynamics of nutrient supply in Snapper spawning areas are difficult to predict because the sources of such nutrients vary from place to place. Furthermore, current understanding of nutrient supply and the dynamics of planktonic food chains is limited.

References

1	Kailola, PJ, Williams, MJ, Stewart, PC, Reichelt, RE, McNee, A and Grieve, C 1993, *Australian fisheries resources*, Bureau of Resource Sciences, Department of Primary Industries and Energy and Fisheries Research and Development Corporation, Canberra.
2	Sumpton, WD, Ovenden, JR, Keenan CP and Street, R 2008, Evidence for a stock discontinuity of Snapper (*Pagrus auratus*) on the east coast of Australia, *Fisheries Research*, 94(1): 92–98.
3	Meggs, LB and Austin CM 2003, Low allozyme variation in Snapper, *Pagrus auratus*, in Victoria, Australia, *Fisheries Management and Ecology*, 10: 155–162.
4	Donnellan, SC and McGlennon D 1996, *Stock identification and discrimination in Snapper (*Pagrus auratus*) in southern Australia*, final report to the Fisheries Research and Development Corporation, project 94/168, South Australian Research and Development Institute, Adelaide.
5	Hamer, PA, Acevedo, S, Jenkins, GP and Newman, A 2011, Connectivity of a large embayment and coastal fishery: spawning aggregations in one bay source local and broad-scale fishery replenishment, *Journal of Fish Biology*, 78: 1090–1109.
6	Sanders, MJ 1974, Tagging study indicates two stocks of Snapper (*Chrysophrys auratus*) off south east Australia, *Australian Journal of Marine and Freshwater Research*, 8: 371–374.
7	Fowler, AJ, McGarvey, R, Burch, P, Feenstra, JE, Jackson, WB and Lloyd MT 2013, *Snapper (*Chrysophrys auratus*) fishery*, Fishery assessment report to Primary Industries and Regions South Australia (Fisheries and Aquaculture), South Australian Research and Development Institute (Aquatic Sciences) publication F2007/000523-3, SARDI research report series 713, SARDI, Adelaide.
8	Fowler, AJ 2016, The influence of fish movement on regional fishery production and stock structure for South Australia's Snapper (*Chrysophrys auratus*) fishery. Final Report to FRDC (Project No. 2012/020). 181 pp.
9	Edmonds, JS, Steckis, RA, Moran, MJ, Caputi, N and Morita, M 1999, Stock delineation of Pink Snapper *Pagrus auratus* and Tailor *Pomatomus saltatrix* from Western Australia by analysis of stable isotope and strontium/calcium ratios in otolith carbonate, *Journal of Fish Biology*, 55: 243–259.
10	Jackson G 2007, Fisheries biology and management of Pink Snapper, *Pagrus auratus*, in the inner gulfs of Shark Bay, Western Australia, PhD thesis, Murdoch University, Perth.
11	Johnson, MS, Creagh, S and Moran, M 1986, Genetic subdivision of stocks of Snapper, *Chrysophrys unicolor*, in Shark Bay, Western Australia, *Australian Journal of Marine and Freshwater Research*, 37: 337–345.
12	Lenanton, R, St John, J, Keay, I, Wakefield, C, Jackson, G, Wise, B and Gaughan, D (eds) 2009, *Spatial scales of exploitation among populations of demersal scalefish: implications for management*, part 2, *Stock structure and biology of two indicator species, West Australian Dhufish (*Glaucosoma hebraicum*) and Pink Snapper (*Pagrus auratus*), in the West Coast Bioregion*, Fisheries research report 174, Western Australian Department of Fisheries, Perth.
13	Moran, M, Burton, C and Jenke, J 2003, Long-term movement patterns of continental shelf and inner gulf Snapper (*Pagrus auratus,* Sparidae) from tagging in the Shark Bay region of Western Australia, *Marine and Freshwater Research*, 54: 913–922.
14	Fairclough, D, Johnson C and Lai, E 2009, West Coast Demersal Scalefish Fishery, in WJ Fletcher and K Santoro (eds) 2009, *State of the fisheries report 2008/09*, Western Australian Department of Fisheries, Perth.
15	Fairclough, DV, Molony, BW, Crisafulli, BM, Keay, IS, Hesp, SA and Marriott, RJ 2014, *Status of demersal finfish stocks on the west coast of Australia*, Fisheries research report 253, Western Australian Department of Fisheries, Perth.
16	Wise, BS, St John, J and Lenanton, RC (eds) 2007, Spatial scales of exploitation among populations of demersal scalefish: implications for management, part 1, Stock status of the key indicator species for the demersal scalefish fishery in the West Coast Bioregion, Fisheries research report 163, Western Australian Department of Fisheries, Perth.

17	Norriss, JV, Fisher, EA, Hesp, SA, Jackson, G, Coulson, PG, Leary, T and Thomson AW (in press) *Status of inshore demersal scalefish stocks on the South Coast of Western Australia* Fisheries Research Report, Western Australian Department of Fisheries, Perth.
18	Stewart, J, Hegarty, A, Young, C, Fowler, AM and Craig, J 2015, Status of Fisheries Resources in NSW 2013-14, NSW Department of Primary Industries, Mosman: 391pp.
19	West, L.D, Stark, KE, Murphy, JJ, Lyle JM and Doyle, FA 2015, Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series
20	Campbell, AB, O'Neill, MF, Sumpton, W, Kirkwood, J and Wesche, S 2009, Stock assessment summary of the Queensland Snapper fishery (Australia) and management strategies for improving sustainability, Queensland Department of Employment, Economic Development and Innovation, Brisbane.
21	Henry, GW and Lyle, JM 2003, The National Recreational and Indigenous Fishing Survey, Fisheries Research and Development Corporation project 99/158, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.
22	Queensland Department of Agriculture, Fisheries and Forestry 2016, Queensland Stock Status Assessment Workshop 2016, 14–15 June 2016, Brisbane, Queensland DAF, Brisbane.
23	Taylor, S, Webley, J and McInnes, K 2012, 2010-11 Statewide Recreational Fishing Survey, Queensland Department of Agriculture, Fisheries and Forestry, Brisbane.
24	Webley, J, McInnes, K, Teixeira, D, Lawson, A and Quinn, R 2015, 2013-14 Statewide Recreational Fishing Survey, Queensland Department of Agriculture and Fisheries, Brisbane.
25	Hamer, P and Conron, S 2016, *Snapper stock assessment 2016*, Fisheries Victoria Science Report Series 10, Fisheries Victoria, Queenscliff.
26	Fowler, AJ, McGarvey, R, Carroll, J, Feenstra, JE, Jackson, WB and Lloyd MT 2016, *Snapper (Chrysophrys auratus) fishery*, Fishery assessment report to Primary Industries and Regions South Australia (Fisheries and Aquaculture), South Australian Research and Development Institute (Aquatic Sciences) in preparation.
27	Coutin, PC, Cashmore, S and Sivakumuran, KP 2003, *Assessment of the Snapper fishery in Victoria*, Fisheries Research and Development Corporation final report, project 97/128, Victorian Department of Primary Industries, Melbourne.
28	Stewart, J, Rowling, K, Hegarty, AM and Nuttall, A 2010, *Size and age at sexual maturity of Snapper (*Pagrus auratus*) in New South Wales 2008/09*, Fisheries research report series 27, Industry and Investment New South Wales, Cronulla.
29	Wakefield, CB 2006, Latitudinal and temporal comparisons of the reproductive biology and growth of Snapper, *Pagrus auratus*, in Western Australia, PhD thesis, Murdoch University, Perth.
30	Ryan, KL, Morison, AK and Conron, S 2009, *Evaluating methods of obtaining total catch estimates for individual Victorian bay and inlet recreational fisheries*, Fisheries Research and Development Corporation final report 2003/047, Department of Primary Industries, Victoria
31	Giri, K, and Hall, K, 2015, South Australian Recreational Fishing Survey. Fisheries Victoria Internal report Series No. 62.
32	Hall, NG and Wise, BS 2011, *Development of an ecosystem approach to the monitoring and management of Western Australian fisheries*, Fisheries Research and Development Corporation report 2005/063, Fisheries research report 215, Western Australian Department of Fisheries, Perth.
33	Pecl, G, Ward, T, Briceno, F, Fowler, A, Frusher, S, Gardner, C, Hamer, P, Hartmann, K, Hartog, J, Hobday, A, Hoshino, E, Jennings, S, Le Bouhellec, B, Linnane, A, Marzloff, M, Mayfield, S, Mundy, C, Ogier, E, Sullivan, A, Tracey, S, Tuck, G and Wayte, S 2014, *Preparing fisheries for climate change: identifying adaptation options for four key fisheries in south eastern Australia*, draft final report to the Fisheries Research and Development Corporation, project 2011/039.