Snapper (2018)

Chrysophrys auratus

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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Shark Bay Inshore Denham Sound	SBBSMNMF	Sustainable	Catch, estimated biomass
Western Australia	Shark Bay Inshore Eastern Gulf	SBBSMNMF	Sustainable	Catch, estimated biomass
Western Australia	Shark Bay Inshore Freycinet Estuary	SBBSMNMF	Sustainable	Catch, estimated biomass
Western Australia	Shark Bay Oceanic	GDSMF, GDSMF || NDSMF || PLF, NDSMF, PLF	Depleted	Catch, CPUE, estimated biomass
Western Australia	South Coast	FBLC74, FBLC74 || JASDGDLMF || SCEMF || WL (SC), JASDGDLMF, SCEMF, WL (SC)	Sustainable	Catch, fishing mortality rate, spawning potential ratio
Western Australia	West Coast	CSLPMF, CSLPMF || WCDGDLIMF || WCDSIMF, WCDGDLIMF, WCDSIMF	Recovering	Catch, fishing mortality rate, spawning potential ratio
Queensland	Queensland	ECIFFF, RRFFF	Depleted	Estimated biomass, standardised catch rates, length and age

				composition, fishing mortality rate, catch, effort, CPUE
New South Wales	New South Wales	OTLF	Sustainable	Estimated biomass, catch, effort, size and age composition
Victoria	Eastern Victoria	CIF, GLF, OF, OPSF, VIT, VRLF	Undefined	Catch
Victoria, South Australia	Western Victoria	MSF || SZRLF, OF, OW, PPBWPF, SZRLF, VIT, VRLF	Sustainable	Catch, CPUE, pre-recruit survey, age and length composition
South Australia	Gulf St. Vincent	MSF || NZRLF, NZRLF	Sustainable	Catch, CPUE, age composition, fishery independent spawning biomass survey
South Australia	Spencer Gulf/West Coast	MSF || NZRLF, NZRLF	Depleted	Catch, CPUE, age composition, fishery independent spawning biomass survey

VIT Victorian Inshore Trawl Fishery (VIC), OTLF Ocean Trap and Line Fishery (NSW), ECIFFF East Coast Inshore Fin Fish Fishery (QLD), RRFFF Rocky Reef Fin Fish Fishery (QLD), NZRLF Northern Zone Rock Lobster Fishery (SA), SZRLF Southern Zone Rock Lobster Fishery (SA), CIF Corner Inlet Fishery (VIC), GLF Gippsland Lakes Fishery (VIC), OF Ocean Fishery (VIC), OPSF Ocean Purse Seine Fishery (VIC), PPBWPF Port Phillip Bay and Western Port 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), NDSMF Northern Demersal Scalefish Managed Fishery (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), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA), WL (SC) Open Access in the South Coast (WA), OW Ocean Wrasse (VIC), FBLC74 Fishing Boat Licence Conditions (WA), MSF || NZRLF Marine Scale Fishery (including Northern Zone Rock Lobster Fishery) (SA), MSF || SZRLF Marine Scale Fishery (including Southern Zone Rock Lobster Fishery) (SA), CSLPMF || WCDGDLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA), FBLC74 || JASDGDLMF || SCEMF || WL (SC) Various Fisheries combined due to 3 boat rule (WA), GDSMF || NDSMF || PLF Various Fisheries combined due to 3 boat rule (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 [Kailola et al. 1993]. Within this broad distribution, the biological stock structure is complex.

Recent genetic studies of Snapper using microsatellite markers have led to a refined understanding of stock structure for the east Australian coast that have indicated greater complexity than previously thought. Snapper from Queensland to central New South Wales show little genetic differentiation and are considered to represent a single genetic stock [Morgan et al. in press], consistent with earlier studies using allozymes [Sumpton et al. 2008]. This stock is referred to as the East Coast Stock, with the Queensland and New South Wales components managed and assessed at the jurisdictional level. However, migratory dynamics between Queensland and New South Wales are not well understood and some studies have suggested limited long-range movements, with many fish showing extended periods of local residency [Harasti et al. 2015, Sumpton et al. 2003]. The majority of commercial landings in New South Wales are thought to consist of fish that recruit from local estuaries [Gillanders 2002]. In addition to the limited mixing within the stock, key biological traits of Snapper (such as the size and age at maturity) vary with latitude [Stewart et al. 2010]. It is therefore appropriate to manage and report on stock status of the East Coast biological stock of Snapper at the jurisdictional level – as Queensland and New South Wales jurisdictional stocks.

It is now considered that Snapper from eastern Victoria are genetically differentiated from those to the north of Eden on the southern coast of New South Wales [Morgan et al. unpublished]. As such, Snapper from Wilsons Promontory to southern New South Wales are considered to be a

separate biological stock that is now referred to as the Eastern Victorian stock. Although there is low genetic variation between the eastern and western sides of Wilsons Promontory [Meggs and Austin 2003, Morgan et al. unpublished], separation between these populations has been supported by tagging and otolith chemistry studies [Coutin et al. 2003, Hamer et al. 2011]. Snapper to the west of Wilsons Promontory, including the important fisheries of Port Phillip Bay and Western Port, constitute the Western Victorian biological stock. This extends westward from Wilsons Promontory to near the mouth of the Murray River in south eastern South Australia [Donnellan and McGlennon 1996, Fowler et al. 2017, Hamer et al. 2011, Sanders 1974].

The South Australian fishery was originally divided into six management units, due to uncertainty about movement among different regional populations [Fowler et al. 2013]. However, a recent study evaluated the stock structure and adult movement among regional populations within South Australia, and also with western Victoria [Fowler 2016, Fowler et al. 2017], based on inter-regional comparisons of otolith chemistry and increment widths, as well as population characteristics. The study differentiated three stocks. The Western Victorian stock which extends westward into south-eastern South Australia 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 managed independently. The two other stocks are wholly located within South Australia. The Spencer Gulf/West Coast stock depends on recruitment into Northern Spencer Gulf from where some 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 Northern Gulf St. Vincent, and subsequent emigration to Southern Gulf St. Vincent and Investigator Strait [Fowler et al. 2016].

In Western Australia, Snapper is currently divided into six management units. At the smaller geographic scale inside Shark Bay, genetically-related but biologically separate stocks have been identified in the Eastern Gulf, Denham Sound and Freycinet Estuary based on otolith chemistry and tagging [Bastow *et al.* 2002, Edmonds *et al.* 1999, Gardner et al. 2017, Johnson *et al*. 1986, Moran *et al*. 2003, Norriss *et al.* 2012]. At the wider scale, Snapper in oceanic waters off the Western Australian coast that comprise the three remaining management units, i.e. Shark Bay oceanic, West Coast and South Coast, show low levels of genetic differentiation (microsatellites) over hundreds of kilometers consistent with a semi-continuous genetic stock where gene flow is primarily limited by geographic distance [Gardner and Chaplin 2011, Gardner et al. 2017]. Otolith chemistry has indicated residency of adult Snapper in the Gascoyne, West and South Coast bioregions, but with recruitment likely coming from multiple nursery areas [Fairclough *et al.* 2013, Wakefield et al. 2011]. Tagging studies support these findings with the majority of adults tagged at the key spawning locations in the Gascoyne and West Coast bioregions recaptured within 100 km, as well as location philopatry of adults that aggregate to spawn in embayments on the west coast [Crisafulli et al. in press, Moran *et al.* 2003, Wakefield *et al*. 2011].

Here, assessment of stock status for Snapper is presented at the biological stock level—Shark Bay inshore Eastern Gulf, Shark Bay inshore Denham Sound, Shark Bay inshore Freycinet Estuary (Western Australia); Eastern Victoria (Victoria), Western Victoria (Victoria and South Australia), Gulf St Vincent, Spencer Gulf/West Coast (South Australia); the management unit level—South Coast, Shark Bay Oceanic and West Coast (Western Australia); and the jurisdictional level–Queensland and New South Wales.

STOCK STATUS

Eastern Victoria

The Eastern Victorian biological stock extends from Wilsons Promontory into southern New South Wales [Morgan et al. unpublished]. In this region commercial harvests are mostly by Victorian and Commonwealth licensed operators. Recreational fishing is also important and thought to be growing, particularly in coastal waters between Lakes Entrance and Corner Inlet-Nooramunga where spawning aggregations are targeted on inshore reefs during the late spring/early summer.

Catch by the Victorian commercial sector is low relative to catches in the Western Victoria stock, averaging approximately 3.5 t per year since 2009–10, and rarely exceeding 5 t per year [VFA 2017]. Catches by Commonwealth operators are higher, averaging approximately 14.5 t since 2009–10 [VFA 2017].

Snapper is a bycatch species in the Commonwealth fishery. Due to the low and sporadic catches, and lack of any notable targeted commercial fishery, there is no reliable information on biomass trends from fishery dependent catch and effort data for the Eastern Victorian biological stock. Recreational catch is also unknown and there are no time series of catch rates or length/age composition for the recreational fishery. Given the lack of information on biomass or fishing mortality there is insufficient information available to confidently classify the status of this stock.

On the basis of the evidence presented above, the Eastern Victoria biological stock is classified as **undefined**.

Gulf St. Vincent

Snapper is one of the most valuable species in South Australia's commercial multi-species, multi-gear and multi-sectoral Marine Scalefish Fishery, providing both a high volume and high price per unit weight to commercial fishers. The Gulf St. Vincent stock (GSVS) includes two regional populations: Northern Gulf St. Vincent (NGSV) and Southern Gulf St. Vincent (SGSV). NGSV has recently supported the bulk of the biomass and is the primary nursery area for the stock [Fowler et al. 2016]. As such, it supports a self-replenishing regional population and is the source for fish that emigrate to replenish the population in SGSV.

The most recent assessment of the GSVS of Snapper was completed in 2018 [Steer et al. 2018] and used data to the end of December 2017. The primary measures for biomass and fishing mortality are total catch, targeted effort and catch per unit effort (CPUE) from commercial fishers, an estimate of spawning biomass from the daily egg production method and measures of recruitment strength from fish age composition. In recent years, the GSVS has produced the highest catches ever recorded in South Australia [Steer et al. 2018]. Whilst catches were low between 1984 and 2006, they increased rapidly from 2006 to 2010, culminating in the record catch of 454.1 t in the latter year. Although annual catches have declined subsequently, there has been a period of eight consecutive years of high catches. The maintenance of high catches relates, to some extent, to the transformation from a largely handline to a longline fishery, with the adoption of new longline technology that increased the efficiency of fishing. Targeted longline effort and CPUE both increased rapidly between 2008 and 2010 to record levels and have remained relatively high to 2017, indicative of a high fishable biomass.

The increase in fishery performance indicators up to 2017 reflects a substantial increase in the biomass of this stock since the early 2000s [Steer et al. 2018]. In 2014, an estimate of spawning biomass based on the daily egg production method indicated that the biomass was ten times that of the Spencer Gulf/West Coast stock, at 2 780 t [Steer et al. 2017]. Recent population age compositions show that numerous strong year classes recruited to the NGSV throughout the 2000s, augmenting several strong year classes from the late 1990s [Fowler et al. 2016]. Between 2010 and 2017 for the GSVS, the estimates of total catch, longline effort and CPUE have gradually decreased, suggesting some decline in biomass. Nevertheless, the estimates of the performance indicators in 2017 still remain high compared with historical values [Steer et al. 2018]. Between 2012 and 2016, management changes were implemented to restrict the fishing pressure on the stock and to maximise the opportunity for reproduction and recruitment.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

New South Wales

The most recent integrated stock assessment for East Coast Snapper [Wortmann et al. 2018] that included data from 1880 to 2016 from the entire biological stock (Queensland and New South Wales) produced a range of relative biomass estimates that varied between 10 per cent and 45 per cent of unfished levels. However, the majority of harvest from the East Coast stock occurs in New South Wales waters, with more than 80 per cent of the commercial harvest being taken in New South Wales since the 1980s [Wortmann et al. 2018], mostly in the trap fishery. The New South Wales recreational harvest is also larger than the recreational harvest in Queensland, although there is no reliable time series of recreational catch in New South Wales (only 2 estimates in 2000–01 and 2013–14 respectively [West et al. 2015]).

This high relative harvest in New South Wales, in combination with the limited movement of East Coast Snapper [Harasti et al. 2015, Sumpton et al. 2003], indicates that the indices of relative abundance derived from the New South Wales trap fishery are more likely to represent the New South Wales stock than indices from the relatively small and less well understood line fishing sectors. Based on the most suitable model scenarios for New South Wales, the most recent assessment [Wortmann et al. 2018] estimated that biomass in 2016 was between 20 and 45 per cent of the virgin level. The stock in New South Wales is not considered to be recruitment impaired.

Commercial and recreational catch and fishing effort are at historically low levels in New South Wales. Commercial landings during 2016–17 were approximately 170 t, lower than the 10 year average of 245 t, and substantially lower than during the early 1980s when commercial landings approached 1 000 t per year. The number of days reported fish trapping when Snapper were landed has declined from 4 790 in 2009–10 to 3 226 in 2016–17, largely due to management driven reforms to the sector. The recreational harvest of Snapper in New South Wales declined from approximately 250 000 fish in 2000–01 to approximately 185 000 fish during 2013–14, and effort also declined markedly during this period [West et al. 2015). Trends in the size and age compositions in landed catches suggest population rebuilding from around 2008 onwards, with continual increases in the average sizes and ages of fish in commercial landings [Wortmann et al. 2018]. This indicates that the stock in New South Wales waters is increasing under existing levels of harvest. This level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.

On the basis of the evidence provided above, Snapper in New South Wales is classified as a **sustainable stock**.

Queensland

The most recent integrated stock assessment for East Coast Snapper [Wortmann et al. 2018] that included data from 1880 to 2016 from the entire biological stock (Queensland and New South Wales) produced a range of relative biomass estimates that varied between 10 per cent and 45 per cent of unfished levels. The annual age-structured model partitioned the fishery into four sectors: New South Wales trap; New South Wales commercial line and charter; Queensland commercial line and charter, and, New South Wales and Queensland recreational. Model outputs for all line-fishing sectors estimated biomass to be below 20 per cent. In contrast, model scenarios using standardized New South Wales trap catch rates ranged between 20 per cent and 45 per cent of unfished levels, with the majority of estimates being above 30 per cent.

Queensland harvests (all fishing sectors combined) approximately one third of the east coast Snapper stock shared with New South Wales. The majority of the harvest from the Queensland part of the biological stock is taken by line fishing. Standardised commercial catch rates have been declining since 2006 [QDAF 2018]. Fishery-dependent biological monitoring to 2017 shows truncated commercial and recreational age frequencies with declining proportions of large mature fish in the catch. Based on the relevant model scenarios for Queensland

using line catch rates, the stock assessment estimated the spawning biomass of the stock in 2016 at between 10 per cent and 23 per cent of the virgin level. The stock is therefore considered to be recruitment impaired.

Commercial harvest (97 per cent line caught) of Snapper in 2017 was 56 t; a level approximately 15 t (22 per cent) lower than 2016 and 34 per cent lower than the previous 10 year average [QDAF 2018]. The number of active line commercial fishing licences and line fishing effort days have continued to decrease over the last decade, indicating a reduction in commercial fishing pressure. Estimated total harvest across the whole stock from the stock assessment shows high fishing pressure in the 1950s to 1990s (above levels to sustain BMSY). Modelling suggests that maintaining total harvest at current levels will not rebuild stocks in Queensland, given the likely depleted state of the stock and low estimated spawning ratios.

The estimated recreational harvest decreased by 34 per cent from 2010–11 (around 84 000 fish) to 2013–14 (around 56 000 fish) [Taylor et al. 2012, Webley et al. 2015]. Recreational fishing is subject to a possession limit of four fish per person (only one over 700 mm). Fishing pressure is further regulated by a minimum legal size which allows a proportion of mature fish to spawn before becoming available to the fishery. Despite the variety of mechanisms aimed at reducing fishing mortality of Snapper in Queensland, the current level of fishing mortality is expected to prevent the stock recovering from its recruitment impaired state.

On the basis of the evidence provided above, Snapper in Queensland is classified as a **depleted stock**.

Shark Bay Inshore Denham Sound

The most recent integrated model-based stock assessment (completed in 2015) that included data to 2012, indicated that spawning biomass was well above the management target of 40 per cent of unfished biomass [Jackson et al. 2015]. Given the very conservative management arrangements that have been in effect since 2003, and the corresponding low level of catches against the target ranges (see below), the biological stock is not considered to be recruitment impaired.

The commercial catch of Snapper from the Denham Sound biological stock was around 2 tonnes (t) in 2017, within the target range of < 3 t. The recreational catch (including charter sector) in 2016 (no estimates for 2017 available) was around 7 t, within the target range of < 12 t. This level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.

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 (completed in 2015) that included data to 2012, indicated that spawning biomass was well above the management target of 40 per cent of unfished biomass [Jackson et al. 2015]. Given the very conservative management arrangements that have been in effect since 2003, and the corresponding low level of catches against the target ranges (see below), the biological stock is not considered to be recruitment impaired.

The commercial catch of Snapper from the Eastern Gulf biological stock was < 0.5 t in 2017, well within the target range of < 3 t. The recreational catch (including charter sector) in 2016 (no estimates for 2017 available) was around 4 t, well within the target range of < 12 t. This level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.

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 (completed in 2015) that included data to 2013, indicated that spawning biomass was above the management target level of 40 per cent of unfished biomass [Jackson et al. 2015]. Given the very conservative management arrangements that have been in effect since 2003, and the corresponding low level of catches against the target ranges (see below), the biological stock is not considered to be recruitment impaired.

The commercial catch of Snapper from the Freycinet Estuary biological stock in 2017 was around 0.5 t, within the target range of < 1 t. The recreational catch (including charter sector) in 2016 (no estimates for 2017 available) was around 4 t, just within the target range of < 4 t. This level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.

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 (completed in 2017) that included data to the 2015–16 season indicated that spawning biomass in 2015 was around the management limit level of 20 per cent of the unfished biomass [Jackson et al. 2018]. The stock is considered to be recruitment impaired.

The commercial catch of Snapper from the Shark Bay Oceanic management unit in the 2016–17 season was 133 t which is well below the TACC (277 t) and below the annual 'tolerance' range of approximately 230–240 t. Commercial catch rate was below the annual limit reference level of 500 kg/standard boat day) in the 2014–15, 2015–16 and 2016–17 seasons. The recreational catch (includes charter) in 2016 (no estimates for 2017 available) was around 30 t. This level of fishing mortality is expected to prevent the stock from recovering from its recruitment impaired state.

On the basis of the evidence provided above, Shark Bay Oceanic (Western Australia) management unit is classified as a **depleted stock**.

South Coast

The most recent (completed in 2015) stock assessment of Snapper on the south coast of Western Australia [Norriss et al. 2016] that included data to 2014 indicated that estimates of fishing mortality rate and spawning potential ratio were between the management target and threshold levels. The stock is not considered to be recruitment impaired.

The total commercial catch of Snapper from the South Coast management unit in 2017 was 44 t. The recreational catch in 2016 (no estimates for 2017 available) was around 6 t. While there are no formal catch limits in place, under the current catch levels that are well within the historic range, the level of fishing mortality, estimated to be above the reference level (i.e. F=M), is unlikely to cause the stock to become recruitment impaired.

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

Spencer Gulf/West Coast

The Spencer Gulf/West Coast (SG/WC) stock involves the regional populations of Northern Spencer Gulf (NSG), Southern Spencer Gulf (SSG) and the west coast of Eyre Peninsula (WC) [Fowler et al. 2017]. NSG supports the primary nursery area for the whole stock. It is a self-replenishing region, whilst the other two regions depend on migration of Snapper from NSG. The population dynamics are strongly driven by inter-annual variation in recruitment of the 0+ year class and subsequent emigration from NSG to adjacent regional populations [Fowler et al.

2017]. In particular, occasional strong year classes are evident in age compositions, and contribute to population abundance, biomass and fishery productivity for years and even decades [Fowler et al. 2016].

The most recent assessment of stock status considered data up to December 2017 [Steer et al. 2018]. The primary measures for biomass and fishing mortality are total catch, targeted effort and CPUE from commercial fishers, an estimate of spawning biomass from the daily egg production method and measures of recruitment strength from fish age composition. Across the 34 year time series of annual commercial fishery statistics for this stock from 1984 to 2017, estimates of total catch, effort and CPUE have varied cyclically over time [Steer et al. 2018], reflecting the influence of variable recruitment [Fowler et al. 2016]. Nevertheless, in 2012, there were unprecedented declines in total catch, and in handline effort and CPUE, whilst low longline effort and CPUE were also recorded. Recent age compositions for both NSG and SSG showed the lack of any strong recruitment year classes since 1999, which indicates that recruitment throughout the 2000s has been relatively weak [Fowler et al. 2016]. Weak year classes in the SSG indicate that rates of migration from NSG have been poor, reflecting the low recruitment to the region throughout the 2000s [Fowler et al. 2016].

From at least 2012 onwards, fishery performance indicators show that the biomass of the SG/WC Stock has declined considerably [Fowler et al. 2013, Fowler et al. 2016, Steer et al. 2018]. In response, significant fishery management changes were implemented between 2012 and 2016 to reduce the commercial catch and to increase reproductive output to provide the opportunity for improved recruitment [Fowler et al. 2016]. These changes included: introduction of daily commercial catch limits; a further restriction to the number of hooks that could be used on set lines; an extension of two weeks to the State-wide, seasonal closure for taking Snapper (thus spanning 1 November to 15 December); implementation of four spatial spawning closures throughout SG to protect the key spawning aggregations throughout the entire reproductive season [Fowler et al. 2016]. Recreational bag and boat limits have also been reduced [Steer et al. 2018].

Despite these changes, commercial fishery statistics up to 2017 showed no improvement, with all estimates of catch and gear-specific effort and CPUE remaining near historically low levels [Steer et al. 2018]. A daily egg production survey in 2013 provided an estimate of biomass of 280 t across all of NSG and part of SSG [Steer et al. 2017]. This biomass is considerably lower than the catches that were recorded during the early 2000s, and is an order of magnitude less than the estimated biomass for the adjacent Gulf St. Vincent stock. The population age composition also indicates that recruitment has been relatively low throughout the 2000s [Fowler et al. 2016, Steer et al. 2018].

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. Furthermore, the above evidence indicates that the current fishing mortality is constrained by management to a level that should allow the stock to recover from its recruitment impaired state; however, measurable improvements are yet to be detected.

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

West Coast

Assessments completed in 2007, 2009 and 2014, based on catch curve analyses of age composition data, indicated that fishing mortality rate (*F)* in the West Coast management unit of Western Australia exceeded the limit reference point of 1.5 times the natural mortality rate [Department of Fisheries, 2015, Fairclough et al. 2009, Fairclough et al. 2014, Wise et al. 2007]. Significant changes were made to the management of the commercial and recreational sectors between 2007 and 2010 to recover stocks, in response to the high

fishing mortality rates. To reduce fishing mortality to a level that would allow the stock to recover, the total retained catch of Snapper by all sectors had to be reduced by at least 50 per cent, to no more than 163 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 the commercial fishery between 2011 and 2014. Catches of Snapper by the recreational sector recently exceeded the acceptable level of 37 t [Fairclough et al. 2018]. Further management action was taken, which reduced annual commercial catches to less than 90 t [Fairclough et al. 2018], a level expected to allow recovery to continue. Unit entitlements were also reduced for the WCDGDLIMF to limit Snapper catches. Management is currently evaluating options to reduce recreational catches to ensure recovery continues.

An assessment in 2017 (based on age structure data from 2012–14) indicated that *F* was above the limit and spawning potential ratio (SPR) was between the limit and threshold reference points of SPR = 0.2–0.3. However, *F* had decreased from that derived from the previous period of age structure data in 2009–11 [Department of Primary Industries and Regional Development, unpublished data]. Additional estimates of *F* were derived from the same age structures using a method that allows for a change in fishing mortality, i.e. for cohorts that have recruited to the fishery pre- and post- management changes commencing in 2008 [Fisher 2013]. This demonstrated that *F* estimates were lower for age classes recruited to the fishery after management changes vs those that had recruited before, i.e. $F = 0.14$ vs 0.27, demonstrating that there was a reduction in recent fishing mortality. The above evidence indicates that current fishing mortality is constrained by management to a level that should allow the stock to recover from its recruitment impaired state.

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

Western Victoria

Assessment of the Western Victorian biological stock is based on consideration of catch per unit effort (CPUE) fishery-independent trawl survey of pre-recruit (young-of-the-year) abundance in Port Phillip Bay, the main spawning and nursery area for this stock [Hamer et al. 2011]. Although this stock extends throughout the coastal waters of central/western Victoria and south-east South Australia, the main indicator data are derived from the major bay fisheries in Victoria; Port Phillip Bay and Western Port.

The most recent stock assessments were in 2016 and 2017 [Hamer and Conron 2016, VFA 2017]. These assessments indicated that commercial longline catch rates of adult Snapper in the main fishery region of Port Phillip Bay had increased from the late 1990s until the mid-2000s. The highest catch rates since effort recording began in 1978 were observed in 2011–12. In recent years, catch rates have declined slightly, but have remained at three to four times higher than the historic lows observed in the mid-late 1990s. Recreational catch rates of adult Snapper in Port Phillip Bay displayed a similar pattern of increase from the mid-1990s through the 2000s, peaking between 2010 and 2012. From 2013, recreational catch rates of adult Snapper dropped by approximately 50 per cent, but from 2014 have stabilised at levels approximately two times higher than the historical lows in the mid-1990s [VFA, unpublished data].

While the increased catch rates from the late 1990s to early 2010s may be partially attributed to increased capture-efficiency due to technology uptake, gear modifications and mobile communications, the increases were entirely consistent with increased recruitment rates observed by the pre-recruit surveys. Following moderate recruitment events in the mid-late 1990s, fishery independent surveys and age and length composition of catches by the recreational and commercial sectors showed three strong recruitment events occurred in 2001, 2004 and 2005 [Hamer and Conron 2016, VFA 2017]. These recruitment events were important in driving the increase in biomass of the Western Victorian Snapper stock observed during the 2000s. The recent decline

in catch rates was expected as the two dominant cohorts in the adult component of the fishery (birth years 2001 and 2004) are now depleted. Pre-recruit surveys over the last 10 years have shown moderate recruitments in 2008, 2009, and 2010, strong recruitments in 2013 and 2014, and the largest recruitment in 26 years in 2018 [VFA 2017, VFA unpublished data]. The earlier of these cohorts recently recruited to the adult biomass, contributing to increased catch rates. The adult biomass and fishery catch rates are expected to increase further over the coming years due to the recent high juvenile recruitments.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Commercial netting is being phased out in Port Phillip Bay. Since 2016, 34 of the 43 licences have been bought out by the Victorian Government. Commercial net fishing in Port Phillip Bay will cease by 2022 and has already ceased in Corio Bay. Netting methods (haul seine and mesh nets) accounted for, on average, approximately 35 per cent of the total Snapper harvest from Port Phillip Bay since 2000, mostly comprising immature/sub-adult fish. From 2015 to 2017, the commercial Snapper harvest in Port Phillip Bay dropped from approximately 104 t to 42 t due to the structural changes to the fishery and the remaining fishers transitioning from net to primarily hook methods. The Port Phillip Bay commercial Snapper harvest is currently capped at 88 t. Commercial harvest from coastal waters by the Victorian, South Australian and Commonwealth operators combined, was less than 20 t in 2016–17, compared to a peak of 285 t in 2009–10 [VFA, unpublished data]. The recreational fishery is the dominant harvest sector, with the most recent harvest estimate in 2006–07 in the order of 600 t [Ryan et al. 2017].

The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

BIOLOGY

Snapper biology [Fowler et al. 2016, Jackson et al. 2010, Stewart et al. 2010, Wakefield et al. 2015, Wakefield et al. 2016]

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
Beach Seine					✓
Demersal Longline	✓		✓		
Dropline	✓				✓
Fish Trap	✓				✓
Gillnet					✓
Hand Line, Hand Reel or Powered Reels					✓
Haul Seine					✓
Hook and Line	✓	✓	✓	✓	✓
Longline (Unspecified)					✓
Net		✓		✓	✓
Otter Trawl					✓
Traps and Pots				✓	✓
Trawl				✓	
Trolling	✓				✓
Unspecified	✓		✓	✓	✓

Fishing methods					
	New South Wales	Queensland	South Australia	Victoria	Western Australia
Charter					
Hook and Line	✓	✓			✓
Commercial					

Beach Seine					✓
Demersal Longline	✓		✓		
Dropline	✓				✓
Fish Trap	✓				✓
Gillnet					✓
Hand Line, Hand Reel or Powered Reels					✓
Haul Seine					✓
Hook and Line	✓	✓	✓	✓	✓
Longline (Unspecified)					✓
Net		✓		✓	
Traps and Pots				✓	
Trawl				✓	
Trolling	✓				✓
Unspecified	✓		✓	✓	✓
Indigenous					
Hook and Line	✓		✓		
Spearfishing	✓		✓		
Recreational					
Hook and Line	✓	✓	✓	✓	✓
Spearfishing	✓		✓	✓	

Management Methods					
	New South Wales	Queensland	South Australia	Victoria	Western Australia
Charter					
Bag and possession limits	✓				
Bag limits	✓				
Gear restrictions	✓	✓			
Licence	✓				✓
Marine park closures	✓				
Possession limit		✓			
Size limit	✓	✓			
Spatial closures	✓	✓			
Temporal closures		✓			

Commercial					
Catch limits			✓	✓	✓
Gear restrictions	✓	✓	✓	✓	✓
Licence				✓	
Limited entry	✓	✓	✓	✓	✓
Marine park closures	✓				
Seasonal closures			✓		
Size limit	✓	✓	✓	✓	✓
Spatial closures	✓	✓	✓	✓	✓
Vessel restrictions	✓				
Indigenous					
Bag limits	✓		✓		
Customary fishing permits				✓	
Native Title	✓				
Seasonal closures			✓		
Section 37 (1d)(3)(9), Aboriginal cultural fishing authority	✓				
Size limit			✓		
Spatial closures			✓		
Recreational					
Bag and boat limits			✓		✓
Bag and possession limits	✓				
Bag limits	✓			✓	
Catch limits					✓
Gear restrictions	✓	✓	✓	✓	✓
Licence	✓			✓	✓
Marine park closures	✓				
Possession limit		✓			✓
Seasonal closures			✓		✓
Size limit	✓	✓	✓	✓	✓

Spatial closures	✓	✓	✓	✓	✓

Active Vessels					
	New South Wales	**Queensland**	**South Australia**	**Victoria**	**Western Australia**
	31 Fishing Business in EGF, 7 Fishing Business in NSWRLF, 35 Fishing Business in OTF, 177 Fishing Business in OTLF,	15 in ECIFFF, 127 in RRFFF,	166 Licences in MSF, 3 Licences in NZRLF, 8 Licences in SZRLF,	12 Licence Holders in CIF, 5 Licence Holders in GLF, 31 Licence Holders in OF, 10 Licence Holders in PPBWPF, 3 Licence Holders in ITF, 16 Licence Holders in VRLF, 1 Licence Holders in OW,	<3 in CSLPMF, 16 in GDSMF, 17 in JASDGDLMF, 5 in PLF, 3 in SBBSMNMF, 11 in SCEMF, 5 in WCDGDLIMF, 40 in WCDSIMF, 38 in WL (SC), 62 in Charter, <3 in FBLC74, <3 in NDSF,

EGF Estuary General Fishery(NSW)

NSWRLF New South Wales Lobster Fishery(NSW)

OTF Ocean Trawl Fishery(NSW)

OTLF Ocean Trap and Line Fishery(NSW)

ECIFFF East Coast Inshore Fin Fish Fishery(QLD)

RRFFF Rocky Reef Fin Fish Fishery(QLD)

MSF Marine Scalefish Fishery(SA)

NZRLF Northern Zone Rock Lobster Fishery(SA)

SZRLF Southern Zone Rock Lobster Fishery(SA)

CIF Corner Inlet Fishery(VIC)

GLF Gippsland Lakes Fishery(VIC)

OF Ocean Fishery(VIC)

PPBWPF Port Phillip Bay and Western Port Bay Fishery (VIC)

ITF Inshore Trawl 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)

WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery(WA)

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

OW Ocean Wrasse(VIC)

Charter Tour Operator(WA)

FBLC74 Fishing Boat Licence Conditions(WA)

NDSF Northern Demersal Scalefish Fishery(WA)

Catch					
	New South Wales	**Queensland**	**South Australia**	**Victoria**	**Western Australia**
Charter					23.1554t in Charter,
Commercial	170.78t in OTLF,	1.5605t in ECIFFF, 54.35t in RRFFF,	329.211t in MSF || NZRLF, 8.9913t in MSF || SZRLF,	1.02t in CIF, 0t in GLF, 4.832t in OF, 0t in OPSF, 0t in OW, 42.304t in PPBWPF, 0t in VIT, 4.932t in VRLF,	59.5112t in CSLPMF || WCDGDLIMF || WCDSIMF, 49.0321t in FBLC74 || JASDGDLMF || SCEMF || WL (SC), 133.461t in GDSMF || NDSMF || PLF, 2.39t in SBBSMNMF,
Indigenous	Unknown	Unknown	Unknown	Unknown (No catch under permit)	Unknown
Recreational	148 t (2013–14)	85 t (2013–14)	332 t (2013–14)	~600 t (2006–07)	80–100 t (2015–16) (all stocks/management units combined)

VIT Victorian Inshore Trawl Fishery (VIC), OTLF Ocean Trap and Line Fishery (NSW), ECIFFF East Coast Inshore Fin Fish Fishery (QLD), RRFFF Rocky Reef Fin Fish Fishery (QLD), NZRLF Northern Zone Rock Lobster Fishery (SA), SZRLF Southern Zone Rock Lobster Fishery (SA), CIF Corner Inlet Fishery (VIC), GLF Gippsland Lakes Fishery (VIC), OF Ocean Fishery (VIC), OPSF Ocean Purse Seine Fishery (VIC), PPBWPF Port Phillip Bay and Western Port 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), NDSMF Northern Demersal Scalefish Managed Fishery (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), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA), WL (SC) Open Access in the South Coast (WA), OW Ocean Wrasse (VIC), FBLC74 Fishing Boat Licence Conditions (WA), MSF || NZRLF Marine Scale Fishery (including Northern Zone Rock Lobster Fishery) (SA), MSF || SZRLF Marine Scale Fishery (including Southern Zone Rock Lobster Fishery) (SA), CSLPMF || WCDGDLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA), FBLC74 || JASDGDLMF || SCEMF || WL (SC) Various Fisheries combined due to 3 boat rule (WA), GDSMF || NDSMF || PLF Various Fisheries combined due to 3 boat rule (WA),

Western Australia - Recreational (Catch) Ryan et al. 2017.

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.

Queensland – **Indigenous (Management Methods)** 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.

New South Wales – **Indigenous (Management Methods)** (a) Aboriginal Cultural Fishing Interim Access Arrangement—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 for themselves; (b) The Aboriginal cultural fishing authority is the authority that Indigenous persons can apply to take catches outside the recreational limits under the *Fisheries Management Act 1994* (NSW), Section 37 (1d)(3)(9), Aboriginal cultural fishing authority; and (c) In cases where the *Native Title Act 1993* (Cth) applies fishing activity can be undertaken by the person holding native title in line with S.211 of that Act, which provides for fishing activities for the purpose of satisfying their personal, domestic or non-commercial communal needs. In managing the resource where

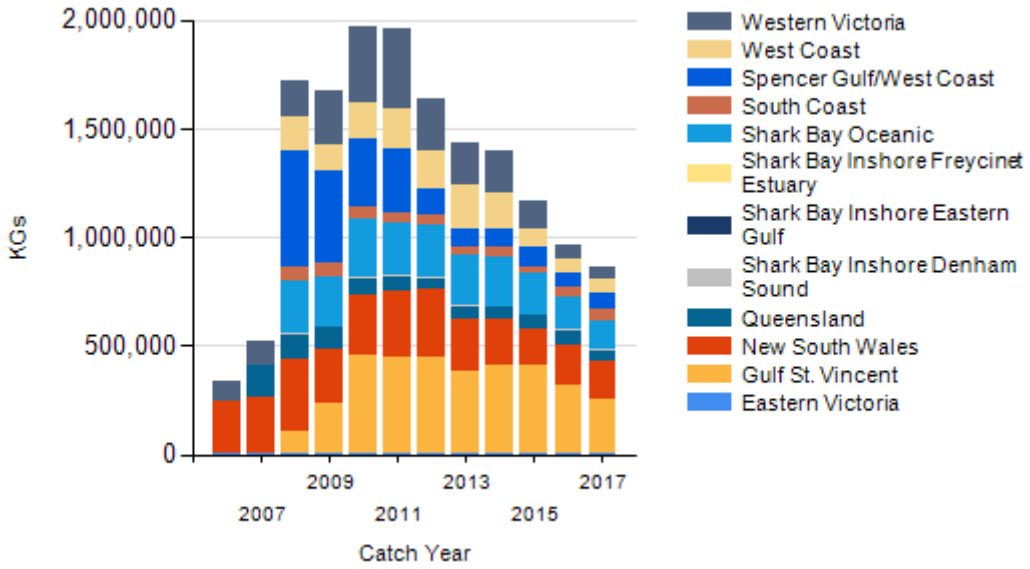
native title has been formally recognised, the native title holders are engaged with to ensure their native title rights are respected and inform management of the State's fisheries resources.

New South Wales – **Recreational (Catch)** West et al. 2015.

Victoria – Indigenous (Management Methods) In Victoria, regulations for managing recreational fishing may not apply to fishing activities by Indigenous people. Victorian traditional owners may have rights under the Commonwealth's *Native Title Act 1993* to hunt, fish, gather and conduct other cultural activities for their personal, domestic or non-commercial communal needs without the need to obtain a licence. Traditional Owners that have agreements under the *Traditional Owner Settlement Act 2010* (Vic) may also be authorised to fish without the requirement to hold a recreational fishing licence. Outside of these arrangements, Indigenous Victorians can apply for permits under the *Fisheries Act 1995* (Vic) that authorise fishing for specific Indigenous cultural ceremonies or events (for example, different catch and size limits or equipment). There were no Indigenous permits granted in 2017 and hence no Indigenous catch recorded.

South Australia – Recreational (Catch) Giri and Hall 2015.

CATCH CHART



Commercial catch of Snapper - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

ENVIRONMENTAL EFFECTS on Snapper

References	
737	Gardner, MJ and Chaplin, JA 2011, Genetic (microsatellite) determination of the stock structures of the Baldchin grouper (Choerodon rubescens) and Pink snapper (Pagrus auratus) in Western Australian waters, including an assessment of stock boundaries, recruitment sinks and sources and environmental influences on gene flow. Final Report, WAMSI Sub-project 4.4.2-b. Murdoch University, Perth.
738	Gardner, MJ, Chaplin, JA, Potter, I, Fairclough, DV and Jackson, G 2017, The genetic structure of a marine teleost, Chrysophrys auratus, in a large, heterogeneous marine embayment. Environmental Biology of Fishes, 1411–1425.
739	Gillanders, BM 2002, Connectivity between juvenile and adult fish populations: do adults remain near their recruitment estuaries? Marine Ecology Progress Series, 240:215–223.
740	Giri, K, and Hall, K, 2015, South Australian Recreational Fishing Survey. Fisheries Victoria Internal report Series No. 62.
741	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.
722	Bastow, TP, Jackson, G, Edmonds, JS 2002, Elevated salinity and isotopic composition of fish otolith carbonate: stock delineation of snapper, Pagrus auratus, in Shark Bay, Western Australia. Marine Biology 141: 801–806.
723	Coutin, PC, Cashmore, S, and Sivakumuran, KP, 2003, Assessment of the snapper fishery in Victoria. Final report to Fisheries Research and Development Corporation, Australia. Project No 97/127., p. 210.
724	Crisafulli, BM, Fairclough, DV, Keay, IS, Lewis, P, How, JR, Ryan, KL, Taylor, SM and Wakefield, CB in press, Does a spatio-temporal closure to fishing Chrysophrys auratus (Sparidae) spawning aggregations also protect individuals during migration? Canadian Journal of Fisheries and Aquatic Sciences
725	Department of Fisheries 2015, Harvest strategy policy and operational guidelines for the aquatic resources of Western Australia, Fisheries Management Paper No. 271, Department of Fisheries Western Australia, Perth.
726	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.
727	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.
728	Fairclough, DV, Edmonds, JS, Jackson, G, Lenanton, RCJ, Kemp, J, Molony, BW, Keay, IS, Crisafulli, BM, and Wakefield, CB 2013, A comparison of the stock structures of two exploited demersal teleosts, employing complementary methods of otolith element analysis. Journal of Experimental Marine Biology and Ecology, 439: 181–195
729	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.
730	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.
731	Fairclough, D, Walters, S and Holtz, M 2018, West coast demersal scalefish resource status report 2017, in DJ Gaughan and K Santoro (eds), Status reports of the fisheries and aquatic resources of Western Australia 2016/17: The State of the Fisheries, Department of Primary Industries and Regional Development, Western Australia, Perth.
732	Fisher, E 2013, Tools for assessing data-limited fisheries and communicating stock status information, PhD thesis, Murdoch University, Perth.
734	Fowler, AJ, Hamer, PA and Kemp J 2017, Age-related otolith chemistry profiles help resolve demographics and meta-population structure of a widely-dispersed, coastal fishery species. Fisheries Research 189: 77–94.
735	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.
733	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.
736	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), Adelaide. F2007/000523-4. SARDI Research Report Series No. 930. 82 pp.
742	Hamer, P and Conron, S 2016, Snapper stock assessment 2016, Fisheries Victoria Science Report Series 10, Fisheries Victoria, Queenscliff.
743	Harasti, D, Lee, KA, Gallen, C, Hughes, JM and Stewart, J 2015, Movements, home range and site fidelity of snapper (Chrysophrys auratus) within a no-take marine protected area. PLoS One 10(11): e0142454
744	Jackson, G, Brown, J and Zilles, H. 2015, Inner Shark Bay Scalefish Fishery Status Report, in Fletcher, WJ and Santoro , K (eds), Status reports of the Fisheries and Aquatic Resources of Western Australia 2014/15: The State of the Fisheries, Department of Fisheries, Western Australia, Perth.
745	Jackson, G, Norriss JV, Mackie MC and Hall NG 2010, Spatial variation in life history characteristics of snapper (Pagrus auratus) within Shark Bay, Western Australia. New Zealand Journal of Marine and Freshwater Research, 44: 1–15
746	Jackson, G, Zilles, H. and Turner, S. 2018 Gascoyne Demersal Scalefish Fishery Status

	Report, in Gaughan, DJ and Santoro, K (eds), 2018 Status reports of the Fisheries and Aquatic Resources of Western Australia 2016/17: The State of the Fisheries, Department of Primary Industries and Regional Development, Western Australia, Perth.
747	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.
748	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.
749	Meggs, LB and Austin CM 2003, Low allozyme variation in Snapper, Pagrus auratus, in Victoria, Australia, Fisheries Management and Ecology, 10: 155–162.
750	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.
751	Morgan, JA, Sumpton, W, Jones, A, Campbell, AB, Stewart, J, Hamer, P, and Ovenden JR 2018, Assessment of genetic structure among Australian east coast populations of snapper, Chrysophrys auratus (Sparidae). Marine and Freshwater Research, in press.
752	Norriss, JV, Fisher, EA, Hesp, SA, Jackson, G, Coulson, PG, Leary, T and Thomson AW 2016, Status of inshore demersal scalefish stocks on the South Coast of Western Australia Fisheries Research Report 276, Western Australian Department of Fisheries, Perth.
753	Norriss, J, Moran, M and Jackson, G 2012 Tagging studies reveal restricted movement of snapper (Pagrus auratus) within Shark Bay, supporting fine scale fisheries management Marine and Freshwater Research, 63: 1191–1199
754	Department of Agriculture and Fisheries 2018, Queensland Stock Status Assessment Workshop Proceedings 2018. Species Summaries, 19-20 June 2018, Brisbane.
755	Ryan, KL, Hall, NG, Lai, EK, Smallwood, CB, Taylor, SM and Wise BS 2017. Statewide survey of boat-based recreational fishing in Western Australia 2015/16. Fisheries Research Report No. 287, Department of Primary Industries and Regional Development, Western Australia.
756	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.
757	Steer, MA, Fowler, AJ, McGarvey, R, Feenstra, J, Westlake, EL, Matthews, D, Drew, M, Rogers, PJ and Earl, J 2018, Assessment of the South Australian Marine Scalefish Fishery in 2016. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2017/000427-1. SARDI Research Report Series No. 974. Pp 250.
758	Steer, MA, McGarvey, R, Oxley, A, Fowler, AJ, Grammer, G, Ward, TM, Westlake, E, Matthews, D and Matthews, J 2017 Developing a fishery independent estimate of biomass for Snapper (Chrysophrys auratus). Final report to FRDC (Project No. 2014/019) 68 pp.
759	Stewart, J, Rowling, K, Hegarty, A-M and Nuttall, A 2010, Size and age at sexual maturity of snapper Pagrus auratus in New South Wales 2008/09. Industry and Investment NSW – Fisheries Research Report Series No. 27. 38pp.
760	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.
761	Sumpton, WD, Sawynok, B, Carstens, N 2003, Localised movement of snapper (Pagrus auratus, Sparidae) in a large subtropical marine embayment. Marine and Freshwater Research 54:923–930
762	Taylor, S, Webley, J and McInnes K 2012, 2012 Statewide recreational Fishing Survey, Department of Agriculture Fisheries and Forestry, Queensland.
763	Victorian Fisheries Authority 2017, Review of key Victorian fish stocks — 2017 Victorian Fisheries Authority Science Report Series No. 1.
764	Wakefield, CB, Fairclough, DV, Lenanton, RCJ and Potter, IC 2011, Spawning and nursery habitat partitioning and movement patterns of Pagrus auratus (Sparidae) on the lower west coast of Australia, Fisheries Research 109: 243–251
765	Wakefield, CB, Potter, IC, Hall NG, Lenanton RCJ, and Hesp SA 2015, Marked variations in reproductive characteristics of snapper (Chrysophrys auratus, Sparidae) and their relationship with temperature over a wide latitudinal range. ICES Journal of Marine Science 70: 2341–2349
766	Wakefield, CB, Potter, IC, Hall NG, Lenanton RCJ, and Hesp SA 2016, Timing of growth zone formations in otoliths of snapper, Chrysophrys auratus, in subtropical and temperate waters differ and growth follows a parabolic relationship with latitude, ICES Journal of Marine Science 74: 180–192
767	Webley, J, McInnes, K, Teixeira, D, Lawson, A and Quinn, R 2015, Statewide Recreational Fishing Survey 2013–14, Department of Agriculture and Fisheries, Queensland.

768	West, LD, Stark, KE, Murphy, JJ, Lyle, JM and Ochwada-Doyle, FA 2015, Survey of recreational fishing in New South wales and the ACT, 2013–14, Fisheries Final Report Series 149, NSW Department of Primary Industries, Sydney.
769	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.
770	Wortmann, J, O'Neill, MF, Sumpton, W and Stewart, J 2018, Stock assessment of Australian east coast snapper, Chrysophrys auratus. Predictions of stock status and reference points for 2016. Queensland Department of Agriculture and Fisheries