

Spanish Mackerel (2018)

Scomberomorus commerson



Joanne Langstreth: Department of Agriculture and Fisheries, Queensland, **Ashley Williams:** Australian Bureau of Agricultural and Resource Economics and Sciences, **John Stewart:** Department of Primary Industries, New South Wales, **Nic Marton:** Australian Bureau of Agricultural and Resource Economics and Sciences, **Paul Lewis:** Department of Primary Industries and Regional Development, Western Australia, **Thor Saunders:** Department of Primary Industry and Resources, Northern Territory

STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Commonwealth	Torres Strait Spanish Mackerel Fishery	TSFF	Sustainable	Biomass, fishing mortality, catch and effort
Western Australia	Mackerel Managed Fishery	MMF	Sustainable	Catch, catch rate, SimpleSA
Northern Territory	Northern Territory	ACL, DF, ONLF, SMF	Sustainable	Biomass
Queensland	Gulf of Carpentaria	GOCDFFTF GOCLF, GOCIFFF, GOCLF	Sustainable	Catch, effort, catch rate, fishing mortality, length and age structure
Queensland, New South Wales	East Coast	ECSMF, OTLF	Sustainable	Biomass, fishing mortality, catch, effort, catch rate, length and age structure, TAC

TSFF Torres Strait Finfish Fishery (CTH), OTLF Ocean Trap and Line Fishery (NSW), DF Demersal Fishery (NT), ONLF Offshore Net and Line Fishery (NT), SMF Spanish Mackerel Fishery (NT), ECSMF East Coast Spanish Mackerel Fishery (QLD), GOCIFFF Gulf of Carpentaria Inshore Fin Fish Fishery (QLD), GOCLF Gulf of Carpentaria Line Fishery (QLD), MMF Mackerel Managed Fishery (WA), ACL Aboriginal Coastal License (NT), GOCDFFTF || GOCLF Gulf of Carpentaria Developmental Fin Fish Trawl Fishery ||Gulf of Carpentaria Line Fishery (QLD)

STOCK STRUCTURE

Genetic evidence indicates that there are three biological stocks of Spanish Mackerel across northern Australia [Moore et al. 2003]; however, evidence from otolith microchemistry, parasite analysis and limited adult movement (at scales greater than 100 km) indicates that there are likely to be a number of smaller biological stocks with limited interaction [Buckworth et al. 2007, Lester et al. 2001, Moore et al. 2003]. Each jurisdiction is likely to have multiple biological stocks within its boundaries; however, the difficulty in obtaining relevant biological, and catch and effort, information to assess each stock individually has meant that not all assessments are

undertaken at the biological stock level. Those that are, are based on the populations that receive the highest harvest rates; their status can be assumed to be representative of the highest level of exploitation that occurs on any population within each management unit or jurisdiction.

Here, assessment of stock status is presented at the biological stock level—Torres Strait Spanish Mackerel Fishery (Commonwealth) and East Coast (Queensland and New South Wales); management unit level—Mackerel Managed Fishery (Western Australia), Gulf of Carpentaria (Queensland); and jurisdictional level—Northern Territory.

STOCK STATUS

East Coast This cross-jurisdictional stock has components in Queensland and New South Wales [Ovenden and Street 2007]. Stock status for the entire East Coast biological stock has been established using combined information from these jurisdictions.

A recent stock assessment [O'Neill et al. 2018] estimated that spawning biomass in 2015–16 was at 40 per cent (range 30 to 50 per cent) of the unfished (1911) level. This is above the limit reference point of 25–30 per cent recommended in the assessment.

The majority of the commercial line fisheries in both jurisdictions (273 t in 2016–17) is within Queensland waters (98 per cent) [QDAF 2018] with a smaller catch during late summer–autumn in northern New South Wales waters [Stewart et al. 2015]. In 2016–17 47 per cent of the total commercial catch was taken from a very small area off Townsville (North Queensland) during a few months [QDAF 2018], indicating high localised fishing pressure. Recreational catch, estimated at 231 t in 2013–14 [Webley et al. 2015, Stewart et al. 2015, West et al. 2015], is similar to the commercial catch and is spread along the extent of the stock range.

In Queensland, a total allowable catch (TAC) and individual transferable quotas (ITQs), introduced in 2004 for the commercial fishery, substantially reduced participation to the lowest levels recorded in 25 years. Fishing effort has varied since 2004 with up to 13 500 tender vessel days, and was at 8 700 days in 2016–17 [QDAF 2018]. Standardised catch rates, using data up to 2015–16, reduced by up to 50 per cent from 1990, and up to 65 per cent on the main spawning grounds [O'Neill et al. 2018]. In 2016–17 they have increased marginally (around 12 per cent) on the main spawning grounds [QDAF 2018]. The nominal catch rates in New South Wales vary but show no overall trends during the past 20 years [Stewart et al. 2015]. The fish length and age frequencies in Queensland show annually variable, but continuous, recruitment into the fishery [QDAF 2018]. A strong year class of two-year-olds in 2014–15 comprised around 60 per cent of catch in Queensland waters and is still dominating as four-year-olds in 2016–17. The stock is not considered to be recruitment impaired.

Fishing pressure is concentrated on a very small area of important spawning grounds off the coast of Townsville [Tobin et al. 2013, Tobin et al. 2014]. Fishing pressure is near a point equivalent to fully-fished [O'Neill et al. 2018] with fishing mortality rates between 2011–12 and 2015–16 at or below the limit reference point FMSY [O'Neill et al. 2018]. In 2016–17 total landings for Queensland and New South Wales were 505 t which is well below the MSY calculated in O'Neill et al. 2018. This level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

Gulf of The Gulf of Carpentaria (Queensland) management unit has a line and net

Carpentaria component—the Gulf of Carpentaria Line Fishery and the Gulf of Carpentaria Inshore Fin Fish Fishery, respectively. The recreational fishery for this management unit is considered minor [Webley et al. 2015, QDAF 2018] and the Indigenous catch considered negligible. Nominal catch rates for the line fishery have been relatively variable over the recent four years after an increasing trend since the late 1990s. Nominal catch rates for the net fishery have decreased by 50 per cent over the last three years and are the lowest recorded in the recent 10 year period. Length and age frequencies from routine monitoring of commercial line catches since 2007 indicate relatively consistent recruitment and length and age compositions in the fishery, with the majority of catches since 2007 comprising fish between 2–6 years of age [QDAF 2018]. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Total commercial catch is within historical harvest levels (248 t in 2017) with a majority taken by the line fishery (83 per cent in 2017). Catch share between the line and net fishery has been relatively stable over the recent eight year period. Participation in the line fishery has had a general decreasing trend since the mid-1990s and, at 19 active licences in 2017, is at a new historical low since the introduction of compulsory logbooks in the late 1990s. Fishing effort has also decreased over this period from around 1 500 primary vessel days to 622 days in 2016. The effort reported in 2017, however, increased by over 70 per cent from the previous year to 1 065 fishing days. Participation in the net fishery has shown an increasing trend since the late 1980s with 2017 fishing effort around the highest recorded with 692 fishing days from 27 active licences. Shifts in regional trends of catch are noted from around 2010, when a reduction in the catch on the southern fishing grounds (around Mornington Island and Lost City) as well the far northern Mapoon region, timed with increases in the catch in the north-central region (around Aurukun and Weipa) regions. 2017 catches were concentrated in this north-central region comprising 74 per cent of the catch. An estimate of fishing mortality for 2017 based on fishery-dependent monitoring data of the line fishery is less than natural mortality for this species [QDAF 2018]. 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 of Carpentaria (Queensland) management unit is classified as a **sustainable stock**.

**Mackerel
Managed
Fishery**

The most recent full assessment of Spanish Mackerel in Western Australia was during 1999–2002 [Mackie et al. 2003] using catch and effort, biological information, age structure and yield-per-recruit modelling indicated the stock was sustainable, when catches were higher than current levels. Recent Catch-MSY analysis (SimpleSA package) indicated the Western Australia stock is likely to be just above the target biomass and is stable at current catch levels. Catch and fishing effort throughout the Mackerel Managed Fishery (Western Australia) have been relatively stable since 2006, following the introduction of quotas and reductions in vessels due to management changes, with total catches within the target range (246–430 t) [Gaughan and Santoro 2018]. The high catch rates for the two main northern fishery areas (Kimberley and Pilbara, covering Onslow to the Northern Territory border), both above historical levels, indicate a relatively high abundance of Spanish Mackerel in these management areas. Catch rates in the southern (Gascoyne–West Coast) area have declined in recent years, after the influence of the 2011–12 "heatwave" apparently increased abundance for a period [Pearce et al. 2011], but remain above historical levels. Thus, based on the available information the weight of evidence assessment [DPIRD *In prep*] determined it is possible that there is an acceptable moderate depletion of the stock. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

The total commercial catch of Spanish Mackerel in Western Australia for 2017 was 283 t, and has been stable, within target range, since management changes

in 2006. Although the estimated boat based recreational fishing harvest weights of Spanish Mackerel have declined from 62–86 t to 35–54 t (95 per cent confidence interval), from the 2011–12 to 2015–16 boat based surveys, respectively [Ryan et al. 2017], the charter catch has been stable between 14–20 t since 2008. The lower recent recreational catch estimate can be attributed in part to declining recreational effort levels in the northern bioregions and likely lower abundance and catch associated with lower water temperatures in the West Coast Bioregion, as seen in the commercial catch rate. As the minimum size limit for Spanish Mackerel in Western Australia of 900 mm TL is similar to the size at maturity for this species [Mackie et al. 2003] which provides resilience to fishing pressure and means the spawning stock is essentially the same as the exploited stock. Thus, the weight of evidence assessment concluded the current management settings are maintaining risk to the stock at acceptable, medium levels. 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 Mackerel Managed Fishery (Western Australia) management unit is classified as a **sustainable stock**.

Northern Territory

Spanish Mackerel stocks have been assessed at a territory-wide level. The most recent assessment (using data to 2015) indicated that stocks had declined substantially because of high Taiwanese catches in the 1970s and 1980s but have recovered since the implementation of more stringent management in the early 1990s [NTG 2018]. Estimated biomass at the conclusion of 2015 was 72 per cent of the unfished level (1973); this is within sustainable limits and there may be capacity for the catch to be increased [Grubert et al. 2013]. The stock is not considered to be recruitment impaired. The current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, Spanish Mackerel in the Northern Territory is classified as a **sustainable stock**.

Torres Strait Spanish Mackerel Fishery

There are two commercial sectors (Traditional Inhabitant Boat and Transferable Vessel Holder) and an Islander subsistence sector that participate in the Torres Strait Spanish Mackerel Fishery. Annual catches of Spanish mackerel have been relatively stable since 2007, at around 70–100 tonnes (t).

The stock assessment of Spanish Mackerel in 2006 [Begg et al. 2006] was updated in 2016 using an integrated age-structured model and catch and effort data to 2014 [O'Neill and Tobin (unpublished)]. Four separate analyses were run to examine the effects of uncertainty in natural mortality, assumed historical catches, and changes in catch reporting since the implementation of a new non-Indigenous commercial logbook in 2003. Across the four analyses, maximum sustainable yield (MSY) estimates ranged from approximately 140 to 210 t, and the 2014 spawning biomass was estimated to be between approximately 40 and 60 per cent of unfished (1940) levels. Therefore, the stock is not considered to be recruitment impaired [Marton et al. 2017]. Reported catches since 2007 have been below the range of MSY estimates from the assessment, and the current (2014) fishing mortality rate was estimated to be below the level that would produce MSY ($F_{2014}/F_{MSY} = 0.2–0.6$) [O'Neill and Tobin (unpublished)]. This level of fishing mortality is unlikely to cause the stock to become recruitment impaired [Marton et al. 2017].

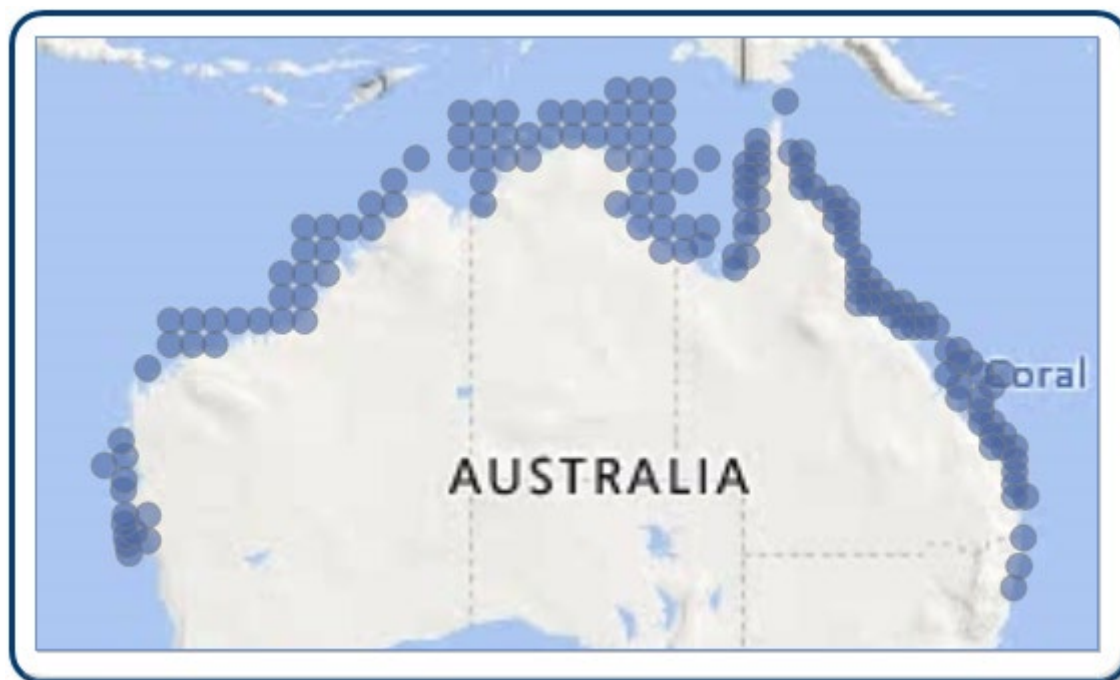
On the basis of the evidence provided above, the Torres Strait Spanish Mackerel Fishery (Commonwealth) biological stock is classified as a **sustainable stock**.

BIOLOGY

Spanish Mackerel biology [McPherson 1992, McPherson 1993, QDAFF 2013]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Spanish Mackerel	26 years, 2400 mm FL	~2 years, 800 mm FL

DISTRIBUTION



Distribution of reported commercial catch of Spanish Mackerel

TABLES

Commercial Catch Methods	Commonwealth	New South Wales	Northern Territory	Queensland	Western Australia
Beach Seine			✓		
Demersal Longline			✓		
Dropline			✓		
Fish Trap			✓		
Gillnet			✓		
Hand Line, Hand Reel or Powered Reels					✓
Hook and Line		✓		✓	✓
Lift nets			✓		
N/A				✓	
Net				✓	
Otter Trawl			✓		
Pelagic Gillnet			✓		
Purse Seine			✓		
Trolling		✓	✓		✓
Unspecified	✓	✓			✓

Fishing methods					
	Commonwealth	New South Wales	Northern Territory	Queensland	Western Australia
Charter					
Handline		✓		✓	✓
Spearfishing					✓
Commercial					
Beach Seine			✓		
Demersal Longline			✓		
Fish Trap			✓		
Hand Line, Hand Reel or Powered Reels					✓
Hook and Line		✓		✓	✓
Net				✓	
Otter Trawl			✓		
Pelagic Gillnet			✓		
Trolling		✓	✓		✓
Unspecified	✓	✓			✓
Indigenous					
Handline		✓	✓	✓	✓
Spearfishing		✓		✓	
Recreational					
Handline		✓	✓	✓	✓
Spearfishing		✓	✓	✓	✓
Management Methods					
	Commonwealth	New South Wales	Northern Territory	Queensland	Western Australia
Charter					
Bag and possession limits		✓			
Bag limits		✓			
Gear restrictions		✓		✓	
Licence		✓			
Limited entry			✓		
Marine park closures		✓			
Passenger restrictions			✓		
Possession limit				✓	

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Size limit		✓		✓	✓
Spatial closures		✓		✓	✓
Spatial zoning					✓
Commercial					
Catch restrictions			✓		
Effort limits			✓		
Gear restrictions		✓			
Individual transferable quota				✓	
Limited entry	✓	✓	✓	✓	✓
Marine park closures		✓			
Quota					✓
Size limit	✓	✓		✓	✓
Spatial closures	✓	✓		✓	✓
Total allowable catch				✓	
Vessel restrictions	✓	✓	✓	✓	✓
Indigenous					
Bag limits		✓			
Laws of general application apply					✓
Native Title		✓			
Section 37 (1d)(3)(9), Aboriginal cultural fishing authority		✓			
Recreational					
Bag and possession limits		✓			
Bag limits		✓			✓
Gear restrictions		✓	✓	✓	
Licence		✓			✓
Marine park closures		✓			
Possession limit			✓	✓	✓
Size limit		✓		✓	✓

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Spatial closures		✓	✓	✓	✓	
Active Vessels						
	Commonwealth	New South Wales	Northern Territory	Queensland	Tasmania	Western Australia
	6 Vessel in TSSMF,	40 Fishing Business in OTLF,	8 LICENCES in DF, 7 LICENCES in ONLF, 14 LICENCES in SMF, 12 LICENCES in ACL,	167 in ECSMF, 27 in GOCIFFF, 19 in GOCLF,	6 Vessels in TSF,	13 in MMF, 62 in Charter,

TSSMF Torres Strait Spanish Mackerel Fishery(CTH)

OTLF Ocean Trap and Line Fishery(NSW)

DF Demersal Fishery(NT)

ONLF Offshore Net and Line Fishery(NT)

SMF Spanish Mackerel Fishery(NT)

ECSMF East Coast Spanish Mackerel Fishery(QLD)

GOCIFFF Gulf of Carpentaria Inshore Fin Fish Fishery(QLD)

GOCLF Gulf of Carpentaria Line Fishery (QLD)

TSF Tasmanian Scallop Fishery(TAS)

MMF Mackerel Managed Fishery(WA)

ACL Aboriginal Coastal License(NT)

Charter Tour Operator(WA)

Catch	Commonwealth	New South Wales	Northern Territory	Queensland	Western Australia
Commercial	93.2351t in TSFF,	5.847t in OTLF,	0.0222t in ACL, 2.068t in DF, 20.9511t in ONLF, 389.827t in SMF,	267.565t in ECSMF, 248.13t in GOCDFFTF GOCLF,	282.996t in MMF,
Indigenous	Unknown	Unknown	Unknown	Negligible	Unknown
Recreational	Unknown	26 t (in 2013–14)	27 t (in 2010)	211 t (in 2013–14)	44 t (+/- 5 t se, 2015–16)

TSFF Torres Strait Finfish Fishery (CTH), OTLF Ocean Trap and Line Fishery (NSW), DF Demersal Fishery (NT), ONLF Offshore Net and Line Fishery (NT), SMF Spanish Mackerel Fishery (NT), ECSMF East Coast Spanish Mackerel Fishery (QLD), GOCIFFF Gulf of Carpentaria Inshore Fin Fish Fishery (QLD), GOCLF Gulf of Carpentaria Line Fishery (QLD), MMF Mackerel Managed Fishery (WA), ACL Aboriginal Coastal License (NT), GOCDFFTF || GOCLF Gulf of Carpentaria Developmental Fin Fish Trawl Fishery ||Gulf of Carpentaria Line Fishery (QLD),

Commonwealth and Queensland – The reporting period for the Commonwealth (Torres Strait Spanish Mackerel Fishery) and Queensland (East coast [Queensland]) is the 2016–17 financial year.

Commonwealth – Commercial (active vessels) Total number of TIB licences; this is not an indicator of licence activity.

Commonwealth – Recreational The Australian Government does not manage recreational fishing, including charter fishing, in Commonwealth waters. Recreational and charter fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those

waters, under its management regulations.

Commonwealth – Indigenous (a) The Australian Government does not manage non-commercial Indigenous fishing in Commonwealth waters, with the exception of the Torres Strait. In general, non-commercial Indigenous fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters. In the Torres Strait, both commercial and non-commercial Indigenous fishing is managed by the Torres Strait Protected Zone Joint Authority (PZJA) through the Australian Fisheries Management Authority (Commonwealth); the Department of Agriculture, Fisheries and Forestry (Queensland); and the Torres Strait Regional Authority. The PZJA also manages non-Indigenous commercial fishing in the Torres Strait; and (b) Subject to the defence that applies under Section 211 of the *Native Title Act 1993* (Cth), and the exemption from a requirement to hold a recreational fishing licence, the non-commercial take by Indigenous fishers is covered by the same arrangements as that for recreational fishing.

Western Australia – Recreational (catch) Western Australian boat-based recreational catch from 1 May 2015–30 April 2016. Shore-based recreational catches are largely unknown.

Western Australia – Recreational (Management Methods) Western Australian boat-based recreational licence required.

Western Australia – Charter (catch) is an estimate based on numbers of fish caught multiplied by their average weight.

Northern Territory – Charter (management methods) In the Northern Territory, charter operators are regulated through the same management methods as the recreational sector but are subject to additional limits on license and passenger numbers.

Northern Territory – Indigenous (management methods) The *Fisheries Act 1988* (NT), specifies that "...without derogating from any other law in force in the Territory, nothing in a provision of this Act or an instrument of a judicial or administrative character made under it limits the right of Aboriginals who have traditionally used the resources of an area of land or water in a traditional manner from continuing to use those resources in that area in that manner".

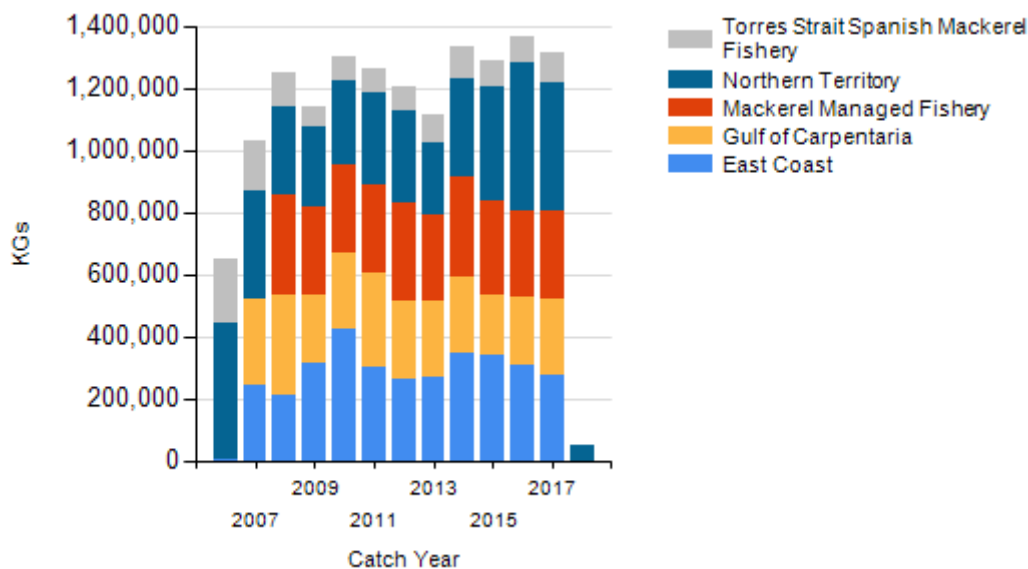
Queensland – Recreational (catch) Survey of Queensland residents only from August 2013–October 2014 [Webley et al. 2015].

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.

New South Wales – Recreational (Catch) Estimated from West et al. 2015 (5 283 fish retained by NSW residents) and average weight [NSWDPI Unpublished data].

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; (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.

CATCH CHART



Commercial catch of Spanish Mackerel - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

ENVIRONMENTAL EFFECTS on Spanish Mackerel

References	
519	Begg, GA, Chen, CM, O'Neill, MF and Rose, DB 2006, Stock assessment of the Torres Strait Spanish Mackerel Fishery, technical report 66, CRC Reef Research Centre, Townsville.
520	Buckworth, R, Newman, S, Ovenden, J, Lester, R and McPherson, G 2007, The stock structure of northern and western Australian Spanish Mackerel, Fishery report 88, final report, Fisheries Research and Development Corporation Project 1998/159, Fisheries Group, Northern Territory Department of Business, Industry and Resource Development, Darwin.
521	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.
522	Grubert, M, Saunders, T, Martin, J, Lee, H and Walters, C 2013, Stock assessments of selected Northern Territory fishes, Fishery report 110, Northern Territory Government, Darwin.
523	Lester, RJG, Thompson, C, Moss, H and Barker, SC 2001, Movement and stock structure of narrow-barred Spanish Mackerel as indicated by parasites, <i>Journal of Fish Biology</i> , 59: 833–842.
524	Mackie, M, Gaughan, DJ and Buckworth, RC 2003, Stock assessment of narrow-barred Spanish Mackerel (<i>Scomberomorus commerson</i>) in Western Australia, final report, Fisheries Research and Development Corporation project 1999/151, Western Australian Department of Fisheries, Perth.
525	Marton, N, Williams, A and Mazur, K 2017, Torres Strait Finfish Fishery, in H Patterson, R Noreiga, L Georgeson, J Larcombe and R Curtotti (eds), <i>Fishery status reports 2017</i> , Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, 305–315.
526	McPherson, GR 1992, Age and growth of the narrow-barred Spanish Mackerel (<i>Scomberomorus commerson</i> Lacepede, 1800) in north-eastern Queensland waters, <i>Australian Journal of Marine and Freshwater Research</i> , 43: 1269–1282.
527	McPherson, GR 1993, Reproductive biology of the narrow-barred Spanish Mackerel (<i>Scomberomorus commerson</i> Lacepede, 1800) in Queensland waters, <i>Asian Fisheries Science</i> , 6: 169–182.
528	Moore, BR, Buckworth, RC, Moss, H and Lester, RJG 2003, Stock discrimination and movements of narrow-barred Spanish Mackerel across northern Australia as indicated by parasites, <i>Journal of Fish Biology</i> , 63: 765–779.
529	Northern Territory Government (NTG) 2018, Status of Key Northern Territory Fish Stocks Report 2016, Northern Territory Government, Department of Primary Industry and Fisheries, Fishery Report No. 119.
530	O'Neill, MF and Tobin, A (unpublished), Torres Strait Spanish mackerel stock assessment II, 2015. Torres Strait AFMA Project Number: RR2014/0823, Department of Agriculture and Fisheries, Queensland Government.

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531	O'Neill, MF, Langstreth, JC, and Buckley, SM 2018. Stock assessment of Australian east coast Spanish mackerel: predictions of stock status and reference points. Department of Agriculture and Fisheries, Brisbane. 107 pp.
532	Ovenden, JR and Street, R 2007, Genetic population structure of Spanish Mackerel, in R Buckworth, S Newman, JR Ovenden, RJ Lester and G McPherson (eds), The stock structure of Northern and Western Australian Spanish Mackerel, Fishery report 88, Fisheries Research and Development Corporation project 98/159, Northern Territory Government, Darwin.
533	Pearce, A, Lenanton, R, Jackson, G, Moore, J, Feng, M and Gaughan, D 2011, The 'marine heat wave' off Western Australia during the summer of 2010/11, Fisheries research report 222, Western Australian Department of Fisheries, Perth.
534	Queensland Department of Agriculture and Fisheries 2018, Queensland Stock Status Assessment Workshop Proceedings 2018. Species Summaries. 19–20 June 2018, Brisbane.
535	Queensland Department of Agriculture, Fisheries and Forestry 2013, Stock status of Queensland's fisheries resources 2012, Queensland DAFF, Brisbane.
536	Ryan, KL, Hall, NG, Lai, EK, Smallwood, CB, Taylor, SM, Wise, BS 2017, State-wide survey of boat based recreational fishing in Western Australia 2015/16, Fisheries Research Report 287, Department of Fisheries, Western Australia.
537	Sainsbury, K 2008, Best practice reference points for Australian Fisheries. Australian Fisheries Management Authority Report R2001/0999, 169pp.
538	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.
539	Tobin A, Currey L and Simpfendorfer, C 2013, Informing the vulnerability of species to spawning aggregation fishing using commercial catch data, Fisheries Research, 143: 47–56.
540	Tobin, A, Heupel, M, Simpfendorfer, C, Buckley, S, Thurstan, R and Pandolfi, J 2014, Utilising innovative technology to better understand Spanish Mackerel spawning aggregations and the protection offered by Marine Protected Areas, Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, Townsville.
541	Webley, J, McInnes, K, Teixeira, D, Lawson, A, Quinn, R 2015, Statewide Recreational Fishing Survey 2013–14, Queensland Department of Agriculture and Fisheries, Brisbane.
542	West, LD, 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.