

Australian Sardine (2016)

Sardinops sagax



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Commonwealth, New South Wales, Victoria	Eastern Australia	OHF, OPSF, SESSF (CTS), SPF	Sustainable	Spawning biomass, exploitation rate
Western Australia	Western Australia South Coast	SCPSMF	Sustainable	Spawning biomass, catch-and-effort data
Western Australia	Western Australia West Coast	SBPMF, WCPSMF	Sustainable	Spawning biomass, catch-and-effort data
Victoria, South Australia	Southern Australia	PPBPSF, SASF	Sustainable	Exploitation rate, catch data

SESSF (CTS) Southern and Eastern Scalefish and Shark Fishery (Commonwealth Trawl Sector) (CTH), SPF Small Pelagic Fishery (CTH), OHF Ocean Hauling (NSW), SASF South Australian Sardine Fishery (SA), OPSF Ocean Purse Seine Fishery (VIC), PPBPSF Port Phillip Bay Purse Seine Fishery (VIC), SBPMF Shark Bay Prawn Managed Fishery (WA), SCPSMF South Coast Purse-Seine Managed Fishery (WA), WCPSMF West Coast Purse-Seine Managed Fishery (Condition) (WA)

STOCK STRUCTURE

For the purposes of fisheries management, the Australian Sardine population is currently considered to be comprised of four separate biological stocks[1,2]. Bass Strait separates the biological stock that occurs off eastern Australia[3] from three biological stocks to the west. One stock occurs off South Australia and western Victoria[1], and the other two occur off the south and west coasts of Western Australia[4]. Some evidence is beginning to emerge to suggest that two stocks may occur off eastern Australia, but this requires further investigation[2].

As stock delineation for Australian Sardine is reasonably well known, here assessment of stock status is presented at the biological stock level—Eastern Australia, Western Australia west coast, Western Australia south coast and Southern Australia.

STOCK STATUS

Eastern Australia Biomass estimates obtained in 1997, 1998 and 2004 using the daily egg production model indicated that the spawning biomass of Australian Sardine off eastern Australia was at least 25 000–30 000 tonnes (t)[14–16]. A survey conducted in 2014 that covered the entire spawning area (Sandy Cape to just south of Newcastle) during the peak spawning season (August–September) estimated that the spawning biomass of Australian Sardine off the east coast was around 49 600 t (95 per cent confidence interval [CI] = 24 200–213 300 t)[17]. Another survey conducted during 2014 suggested that a spawning biomass of approximately 6825 t (95 per cent CI = 78 854–287 533) was present off northern Tasmania and in Bass Strait during summer, suggesting the potential for separate spawning stocks along the east coast[18]. However, the level of separation or linkage of these northern and southern spawning groups is poorly understood[19]–[21].

Catches off eastern Australia reached almost 5000 t in 2008–09, but declined to 1097 t in 2012–13 as a result of a reduction in fishing effort; this was partly caused by the destruction of a processing plant in Eden, New South Wales[20]. Catches from a vessel operating out of Lakes Entrance in Victoria have increased in recent years[20]. A developmental fishery was established in Tasmania in 2015, but no catches have yet been taken. The highest annual catch (around 5000 t in 2009) was around 10 per cent of the best estimate of spawning biomass (around 49 600 t)[20]. The catch in 2014–15 was only 854 t[20]. Recent catches equate to exploitation rates of less than 10 per cent[20], which is well below the level considered safe for this species (30 per cent)[8]. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished and that this level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

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

Southern Australia The majority of the catch from the southern Australian stock is taken from South Australia, with much smaller catches from Port Phillip Bay, Victoria. Assessment of the South Australian Sardine Fishery has involved annual and, more recently, biennial daily egg production models surveys, as well as population modelling based on spawning biomass estimates, catch and catch-at-age data[23,24]. The most recent estimate of spawning biomass have been above 150 000 t[11,23,24], which is well above the limit reference point of 75 000 t identified in the management plan for this fishery[11]. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished. The current exploitation rate is around 23 per cent (that is, 38 000 t landed from a minimum estimate of spawning biomass of approximately 166 000 t), which is below the level considered safe for this species (30 per cent[9]). The above evidence indicates that this level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

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

Western Australia South Coast Population modelling, based on spawning biomass estimates (estimated using the daily egg production model), catch-at-age and catch data[22], showed that by the mid-2000s the stock had recovered from a mass mortality event in 1998–99 caused by a herpes virus. The mid-2000s exploitation rate for the Western Australian south coast stock was around three per cent (less than 3000 t from an estimated spawning biomass of approximately 97 000 t), and the total annual

catch has not exceeded 3000 t since then. The nominal catch rate (tonnes per boat day) in the South Coast Purse-seine Fishery since 2008–09 has been consistently close to record highs. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished and that this level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

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

Western Australia West Coast Population modelling, based on spawning biomass estimates (obtained using the daily egg production model), catch-at-age and catch data[22], suggested that by the mid-2000s the stock had recovered from a mass mortality event in 1998–99 caused by a herpes virus. The mid-2000s exploitation rate for the Western Australian west coast stock was less than five per cent (around 400 t from an estimated spawning biomass of approximately 25 000 t)[22]. Since 2007, the total annual catch has never exceeded 100 t, as the West Coast Purse-seine Fishery has transitioned to take mostly Tropical Sardine *Sardinella lemuru*. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished and that this level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

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

BIOLOGY

Australian Sardine biology[19,20]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Australian Sardine	9 years; 200–250 mm Standard Length	1–2 years; 145 mm Standard Length

DISTRIBUTION



Distribution of reported commercial catch of Australian Sardine

TABLES

Commercial Catch Methods	Commonwealth	New South Wales	South Australia	Victoria	Western Australia
Mesh Net				✓	
Otter Trawl	✓			✓	
Purse Seine	✓	✓	✓	✓	
Unspecified				✓	
Various					✓

Fishing methods					
	Commonwealth	New South Wales	South Australia	Victoria	Western Australia
Commercial					
Otter Trawl	✓				
Purse Seine	✓	✓	✓	✓	
Various					✓
Indigenous					
Hand Line, Hand Reel or Powered Reels		✓			
Recreational					
Hand Line, Hand Reel or Powered Reels		✓			

Management Methods					
	Commonwealth	New South Wales	South Australia	Victoria	Western Australia
Commercial					
Effort limits				✓	✓
Gear restrictions	✓	✓	✓		
Limited entry	✓	✓	✓	✓	✓
Spatial closures		✓		✓	✓
Total allowable catch	✓		✓		✓
Indigenous					
Bag limits		✓		✓	
Section 31 (1)(c1)		✓			

STATUS OF AUSTRALIAN FISH STOCKS REPORT
Australian Sardine (2016)

Aboriginal cultural fishing authority					
Spatial closures		✓		✓	
Recreational					
Bag limits		✓		✓	✓
Spatial closures		✓		✓	✓
Active Vessels					
	Commonwealth	New South Wales	South Australia	Victoria	Western Australia
	3 License in SPF, 3 Vessel in SESSF (CTS),	8 License in OHF, 10 License in OTF,	14 license in SASF,	1 Vessel in OPSF,	13 Vessel in SCPSMF, 3 Vessel in WCPSF,

SESSF (CTS) Southern and Eastern Scalefish and Shark Fishery (Commonwealth Trawl Sector)(CTH)

SPF Small Pelagic Fishery(CTH)

SCPSMF South Coast Purse-Seine Managed Fishery(WA)

WCPSF West Coast Purse-seine Fishery (Condition)(WA)

OHF Ocean Hauling(NSW)

OTF Ocean Trawl Fishery(NSW)

OPSF Ocean Purse Seine Fishery(VIC)

SASF South Australian Sardine Fishery(SA)

Catch					
	Commonwealth	New South Wales	South Australia	Victoria	Western Australia
Commercial	117.917t in SPF,	374.733t in OHF,	36110t in SASF,	295.908t in PPBPSF,	18.31t in SBPMF, 1853.91t in SCPSMF, 44.505t in WCPSMF,
Indigenous	No catch	Unknown	Unknown	No catch	Unknown
Recreational	No catch	Negligible	No catch	No catch	No catch

SESSF (CTS) Southern and Eastern Scalefish and Shark Fishery (Commonwealth Trawl Sector) (CTH), SPF Small Pelagic Fishery (CTH), OHF Ocean Hauling (NSW), SASF South Australian Sardine Fishery (SA), OPSF Ocean Purse Seine Fishery (VIC), PPBPSF Port Phillip Bay Purse Seine Fishery (VIC), SBPMF Shark Bay Prawn Managed Fishery (WA), SCPSMF South Coast Purse-Seine Managed Fishery (WA), WCPSMF West Coast Purse-Seine Managed Fishery (Condition) (WA),

a Commonwealth – Recreational The Australian Government does not manage recreational fishing in Commonwealth waters. Recreational fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters, under its management regulations.

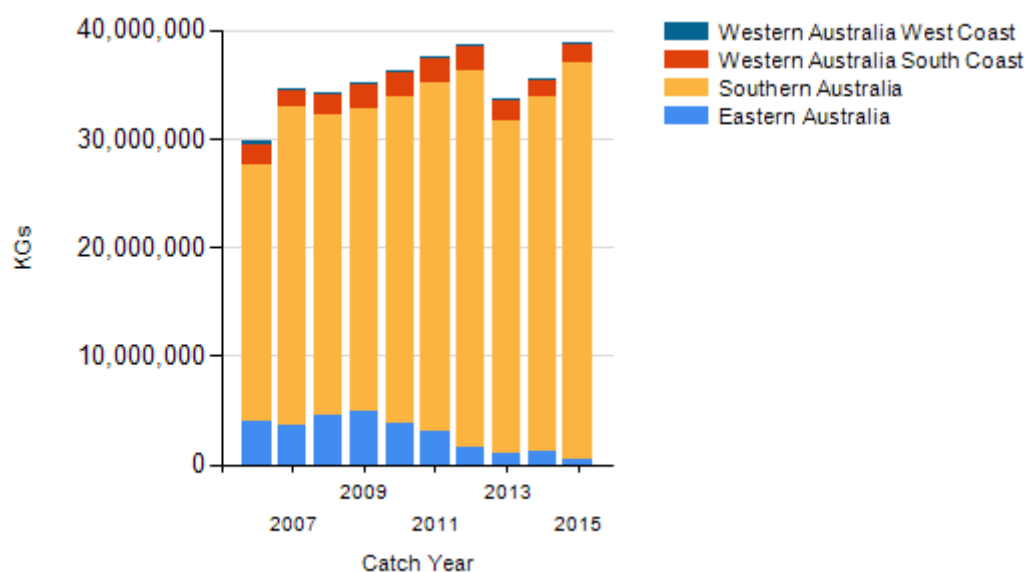
b Commonwealth – Indigenous The Australian Government does not manage non-commercial Indigenous fishing in Commonwealth waters, with the exception of the Torres Strait. In general, non-commercial Indigenous fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters.

c New South Wales – Indigenous (management methods) Aboriginal cultural fishing authority, the authority that Indigenous persons can apply for to take catches outside the recreational limits under the Fisheries Management Act 1994 (NSW), Section 37 (1)(c1), Aboriginal cultural fishing authority

d Victoria – Indigenous (management methods) 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 2014–15, there were no applications for customary fishing permits to access Australian Sardine.

e Victoria – Indigenous (management methods) 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 Victorian recreational fishing licence, the non-commercial take by indigenous fishers is covered by the same arrangements as that for recreational fishing.

CATCH CHART



Commercial catch of Australian Sardine - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

- The rapid growth of the South Australian Sardine Fishery (SASF) led to community concerns that taking large catches could change the balance of the ecosystems in South Australia's gulfs and the Great Australian Bight, and potentially affect the region's higher-level marine predators, including Southern Bluefin Tuna (*Thunnus maccoyii*), seabirds and marine mammals. A large study was conducted to investigate the roles of Australian Sardine in the ecosystem and assess the potential ecological impacts of the fishery[7]. Despite the rapid growth of the fishery, negligible impacts were found on any species groups, even though several seabirds (for example, Crested Terns—*Sterna bergii*) were potentially sensitive to changes in the biomass of Australian Sardine.
- The SASF was closed for two months in 2005 because of high levels of encirclement and mortality of the Short-beaked Common Dolphin (*Delphinus delphis*)[26]. A Threatened, Endangered or Protected Species Code of Practice was developed during the closure period that outlined procedures for avoiding encirclements and releasing encircled animals[27]. Interaction rates decreased significantly following the introduction of the code of practice[26,28]. A working group that includes industry,

fisheries managers, scientists and representatives of conservation agencies meets every quarter to review logbook and observer data, and assess the effectiveness of the code of practice in reducing interaction rates. A report on interaction rates and the effectiveness of the code of practice is published annually[27].

- A code of conduct was established in 2006 to reduce Fleshly Footed Shearwater (*Ardenna carneipes*) interactions in the Western Australian South Coast Purse Seine Fishery[29].
- A Purse Seine Code of Practice was established in 2008 by the Commonwealth industry operators that outlined best practice methods for minimising harmful interactions with threatened, endangered and protected species[30].
- A New South Wales Purse Seine Industry Code of Practice was adopted March 2008 establishing standard practice for minimising harmful interactions with Threatened, Endangered or Protected species.

ENVIRONMENTAL EFFECTS on Australian Sardine

- In 1995 and 1998–99, two mass mortality events each killed more fish, over a larger area, than any other monospecific fish kill ever recorded[1]. These events were caused by a herpes virus to which the population had minimal or no immunity[31]. Rates of recovery have been different between stocks; spawning biomass increased quickly in the Southern Australian stock and strong recovery was achieved in the two Western Australian stocks by the mid 2000s[13,15,22].
- Fishers in Western Australia have reported reductions in the availability of large fish on historical fishing grounds in recent years. This may reflect changes in distribution and behaviour associated with warmer oceanic conditions, dredge plumes associated with port expansion, and increased abundance of the predatory West Australian Salmon (*Arripis truttaceus*)[32,33].
- There is a relationship between fish condition and upwelling strength. Recent industry reports of increases in fat content of South Australian Sardines may reflect the occurrence of several strong upwelling seasons over the past few years[24].

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STATUS OF AUSTRALIAN FISH STOCKS REPORT
Australian Sardine (2016)

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STATUS OF AUSTRALIAN FISH STOCKS REPORT
Australian Sardine (2016)

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