

## NSW Stock Status Summary – 2023/24

# Australian Sardine (*Sardinops sagax*)

## Assessment Authors and Year

Stewart, J. 2024. NSW Stock Status Summary 2023/24 – Australian Sardine (*Sardinops sagax*). NSW Department of Primary Industries, Fisheries. 11 pp.

## Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Australian Sardine are currently assessed as <b>sustainable</b> .
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## Stock structure & distribution

Australian Sardine (*Sardinops sagax*) is distributed around the entire southern half of the continent. They inhabit continental shelf waters and the lower reaches of estuaries where schools of fish create a single semi-continuous Australian meta-population (Whittington et al. 2008). Within this there are recognized four separate biological stocks: the South-western (off Western Australia); Southern (off South Australia); South-Eastern (off Victoria, Tasmania and southern NSW) and Eastern (off northern New South Wales and southern Queensland) Australian stocks (Izzo et al. 2017, Sexton et al. 2019).

While east coast Australian Sardine is currently assessed through the Status of Australian Fish Stocks (SAFS) framework at the biological stock level— Eastern Australia and South Eastern Australia, the Commonwealth assesses and manages Australian Sardine as a single east coast management unit (AFMA 2022). The NSW Ocean Hauling (Purse Seine) quota fishery for Australian Sardine (*Sardinops sagax*) is similarly managed as a single unit.

## Scope of this assessment

This stock status summary details stock assessment results and relevant fisheries statistics to inform the setting of a Total Allowable Catch (TAC) for the NSW Ocean Hauling Purse Seine (OHPS) Australian Sardine quota fishery for the 2024/25 fishing season. Assessment of stock status for Australian Sardine is principally based on the Commonwealth Small Pelagic Fishery (SPF) derived assessment that utilizes estimates of spawning biomass from periodic egg surveys using the Daily Egg Production Method (DEPM). NSW catches of Australian Sardine have always greatly exceeded the Commonwealth catch and as such it is appropriate to consider the DEPM derived assessment when assessing the NSW component of the stock.

## Biology

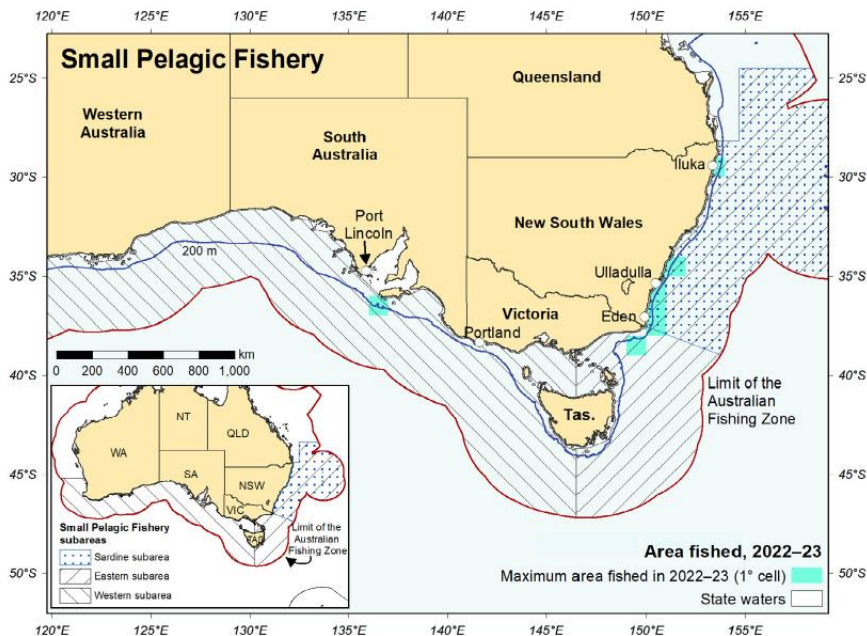
The main spawning area off the east-coast is located round northern NSW and southern Queensland during late winter and early spring, with a smaller summer spawning area off eastern Tasmania and Victoria, extending into southern NSW (Sexton et al., 2019). Peak spawning of east coast sardines is reported to occur in water temperatures between 18-22°C. Australian Sardine in NSW matures at around 14 cm fork length (FL). Sardines grow rapidly, reaching a maximum length of 23 cm FL and maximum age of 8 years.

## Fishery statistics

## Catch information

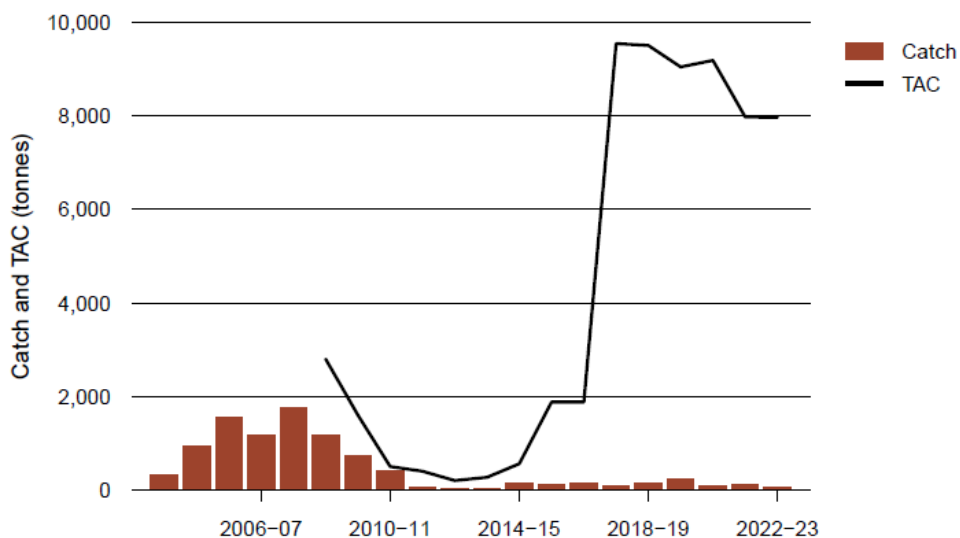
### Commercial

The Australian Fisheries Management Authority (AFMA) defined sardine sub-area off eastern Australia is the only area of the SPF that is fished for Australian Sardines (Fig. 1). This area is managed as a single unit stock and as such the data presented do not separate the Eastern and South Eastern Australia biological stocks.



**Figure 1. Map showing the sardine sub-area of the Commonwealth SPF (from Butler et al. 2023).**

State catches of Australian Sardine comprise most of the total catch. Australian sardine catch for 2021/22 was 525 t, comprising 112 t of Commonwealth catch and 413 t from New South Wales (Butler et al., 2023). The Commonwealth sardine catch for the 2022/23 season was 71 t (Fig. 2) and reported NSW catch 351 t (Fig. 3). The Commonwealth fishery landed less than 1% of the proposed TAC for the 2022/23 season of 7,970 t (Fig. 2). The NSW Ocean Hauling Purse Seine catch has averaged around 520 t p.a. since 2009, substantially less than the current NSW TAC of 2,744 t (Fig. 4).



**Figure 2. Commonwealth Australian Sardine catch and TAC in the SPF, fishing seasons 2003/04 to 2022/23 (from Butler et al. 2023).**

## Recreational & Charter boat

The recreational catch of Australian Sardine is considered to be minor and is not considered in the assessment.

## Indigenous

There is no information available on the Aboriginal catch of Australian Sardine in NSW waters.

## Illegal, Unregulated and Unreported

The level of Illegal Unregulated and Unreported (IUU) fishing is unknown.

## Fishing effort information

Fishing effort is not a consideration for the stock assessment.

## Catch rate information

Catch rate is not a consideration for the stock assessment.

# Stock Assessment

## Stock Assessment Methodology

Australian Sardine is assessed in terms of harvest as a fraction of spawning biomass. Spawning biomass is estimated through Daily Egg Production Method (DEPM) surveys. Management Strategy Evaluation (MSE) of the Commonwealth SPF Harvest Strategy (Smith et al., 2015) established that an exploitation rate of up to 33% was suitable for Eastern Australian Sardine under the Commonwealth SPF harvest strategy. The current harvest strategy exploitation rate following a Tier 1 assessment is only 20%, applied to maintain the stock in the vicinity of the target reference point of 50% of unfished levels and therefore ensuring a very low probability of the stock falling below 20% of unfished levels.

## Year of most recent assessment:

2023

2019 - Daily Egg Production Method (DEPM) biomass estimate Eastern Australian Stock

2014 - Daily Egg Production Method (DEPM) biomass estimate South Eastern Australian Stock

2015 - Management Strategy Evaluation (MSE) of the Commonwealth SPF Harvest Strategy

## Assessment method:

DEPM spawning biomass estimates (Ward et al., 2021; Ward et al., 2015).

## Main data inputs:

Egg survey during September 2019 between Sandy Cape, Queensland and Ulladulla, NSW. The survey produced estimates of Sardine egg abundance, egg age and spawning area. Adult reproductive parameters: average weight, sex ratio, batch fecundity, spawning fraction.

## Sources of uncertainty evaluated:

Considerable uncertainty exists around key input data for the Australian Sardine DEPM assessment. Sensitivity analyses were done for all parameters to determine which had the largest influence on estimated spawning biomass. These were done by varying each individual parameter whilst keeping the others constant at the value used to calculate spawning biomass. Conclusions were drawn based on the most precautionary parameter estimates, resulting in the spawning biomass likely to be under-estimated.

### Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	DEPM derived estimate of spawning biomass.
Biomass Limit Reference Point	20% of unfished levels.
Biomass Target Reference Point	50% of unfished levels.
Fishing mortality indicator or proxy	Catch as a proportion of spawning biomass.
Fishing mortality Limit Reference Point	<p>Annual catch is less than 20% of the DEPM derived estimate of spawning biomass. This is the Tier 1 exploitation rate in the Commonwealth SPF Harvest Strategy for setting a Recommended Biological Catch (RBC) for each of five fishing seasons following a DEPM assessment.</p> <p>Five years after a Tier 1 assessment, the RBC is set at the Tier 2 level that is 10% of the DEPM derived estimate of spawning biomass.</p> <p>Five years after a Tier 2 assessment, if no updated DEPM is done, the RBC is set at the Tier 3 level that is 5% of the DEPM derived estimate of spawning biomass.</p>
Fishing Mortality Target Reference Point	

### Stock Assessment Results

Recent harvests of east coast Australian Sardine have been well below the reference level of 20% of the 2019 derived DEPM estimate of spawning biomass (~ 42,724 t) (Ward et al., 2021) with the RBC calculated as 20% x 42,724 t ~8,454 t. Total landings (Commonwealth and state combined) in recent years have been < 2% of the estimated spawning biomass in 2019. This level of fishing mortality is unlikely to have substantially reduced spawning biomass. On this basis, the Australian Sardine stock is classified as not overfished and not subject to overfishing (Butler et al., 2023).

### Stock Assessment Result Summary

Biomass status in relation to Limit	Catches have always been low relative to the estimated spawning biomass and well below the Tier 1 exploitation rate of 20%. Fishing is not believed to have substantially reduced spawning biomass.
Biomass status in relation to Target	As above

Fishing mortality in relation to Limit	Total landings (Commonwealth and state combined) in recent years have been < 2% of the estimated spawning biomass in 2019 and well below the reference level of 20%.
Fishing mortality in relation to Target	As above
Current SAFS stock status	Sustainable in 2020
Current Commonwealth stock status	Not overfished and not subject to overfishing

## Fishery interactions

The Commonwealth SPF (purse-seine and midwater trawl) interacts with the NSW commercial fishery in accessing the same biomass of Australian Sardines. The SPF sets their TACs based on RBCs derived from the SPF harvest strategy rules and then subtracting state catches. Several NSW endorsed fishers also hold Commonwealth SPF endorsements.

NSW Estuary General Fishery – only minor landings of Australian Sardines.

Recreational fishers - only minor landings of Australian Sardines; however a very large user of sardines as bait.

## Qualifying Comments

The DEPM-based estimates of eastern Australian Sardine spawning biomass are highly likely to be under-estimates, due to potential biases in terms of key parameters (such as spawning area and the assumption that surveys are done at the peak spawning time) always leading to under-estimating spawning biomass. In addition the SPF harvest strategy is precautionary in terms of exploitation rates in recognition of the importance of small pelagic species to ecosystem functioning, uncertainty in DEPM-derived estimates of spawning biomass, and the assumption that Australian Sardines, like many other small pelagic stocks globally, undergo huge fluctuations in abundance as a result of environmental factors beyond the control of fishery managers.

Neither the Commonwealth nor NSW recognize the existence of two biological stocks in terms of management of east coast Australian sardines. This is unlikely to represent any substantial risk to sustainability while the fishery is relatively lightly exploited; however it needs to be acknowledged should the fishery expand. Related to this is an updated spawning biomass estimate of the eastern component of the South Eastern biological stock of Australian Sardines (Ward et al., 2022a). An egg survey done during 2019 produced an estimate of spawning biomass to be approximately 185,000 t; however given the precautionary nature of the analysis it was suggested that the spawning biomass was likely in excess of 200,000 t. This relatively unexploited resource is now the subject of a proposed Tasmanian sardine fishery (Ward et al., 2022b). Clearly any increased exploitation of the South Eastern biological stock of Australian Sardines will have implications for the southern NSW fishery. Current (2020) SAFS stock statuses are Sustainable for both the Eastern and the South Eastern Australia stocks of Australian Sardine.

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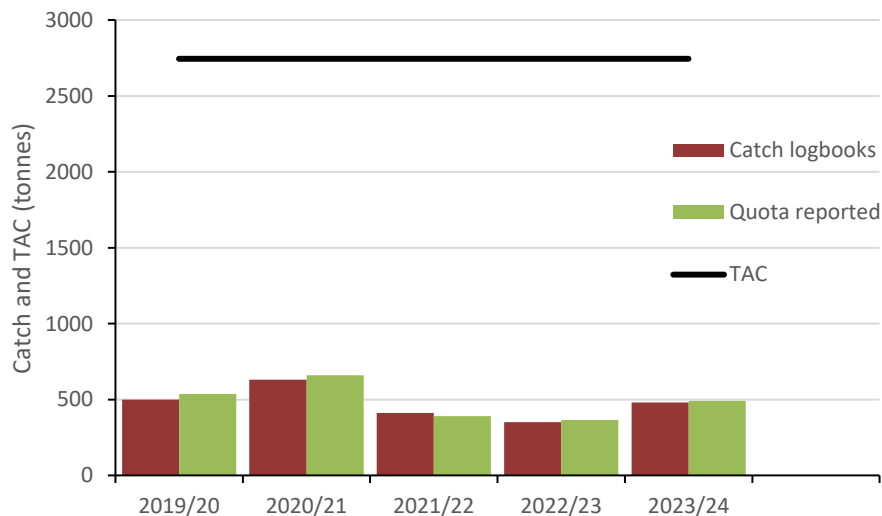
# Appendices

## Appendix 1. New South Wales fishery statistics for Australian Sardine.

The stock status summary for Australian Sardine summarizes information mainly from the Commonwealth assessment. Here, additional information is presented that may assist in understanding the dynamics of the NSW fishery for Australian Sardine.

### Quota usage

Landings of Australian Sardine reported through the real-time quota reporting system, and the mandatory logbooks, were similar each year (fishing season May to April), (Fig. 3). Quota used by the NSW fishery is a small percentage of the available quota (2,744 t), being only 13% during 2022/23.

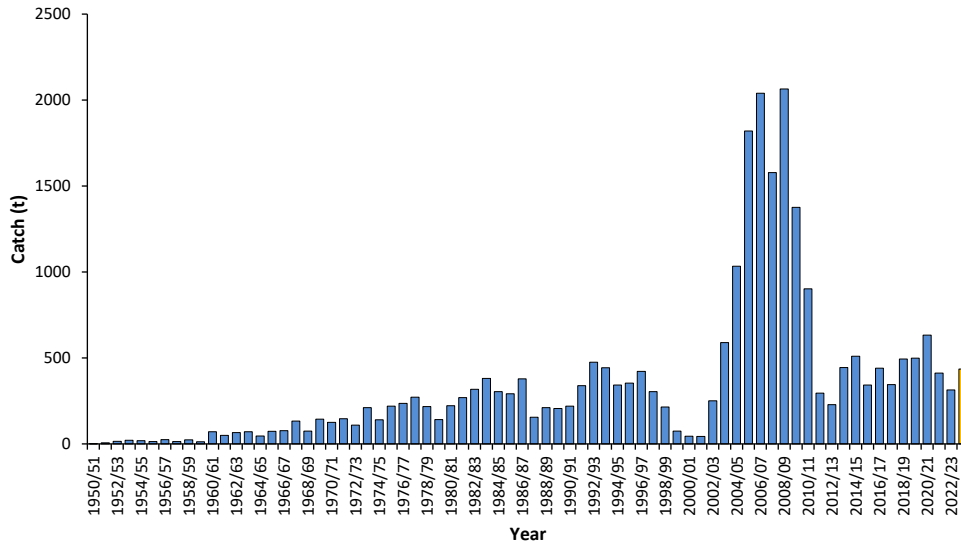


**Figure 3. New South Wales Ocean Hauling Purse Seine landings of Australian Sardine reported by compulsory logbooks and catch quota reporting, and TAC 2009/10 to 2023/24. Note that the 2023/24 fishing season was only 6.5 months completed when these data were collated.**

### Catch

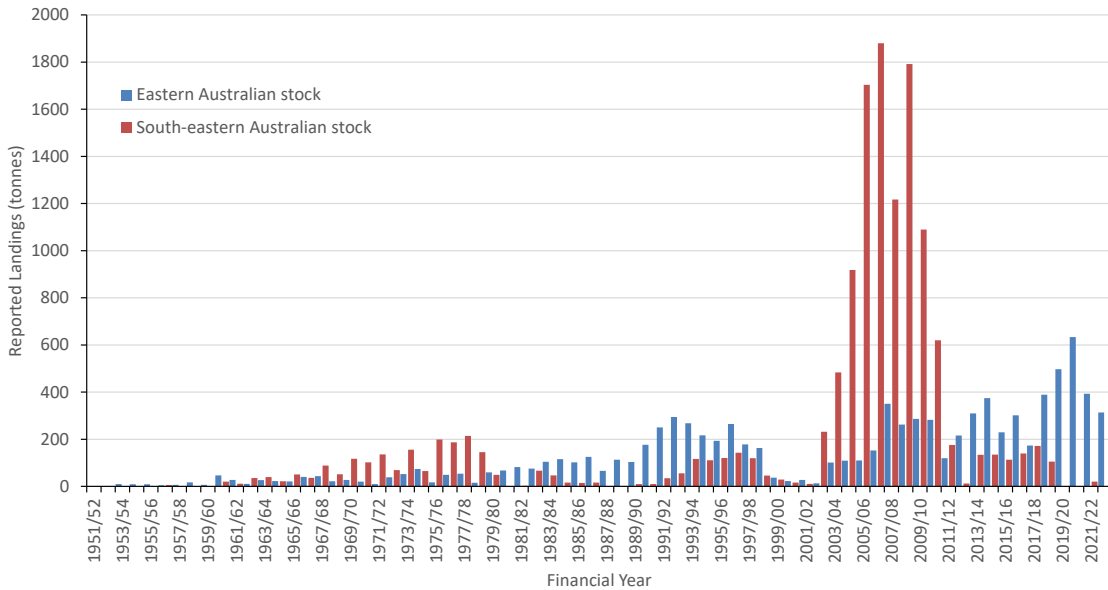
#### Commercial

Australian Sardine in NSW is mainly caught by the Ocean Hauling Fishery in purse seine nets. Commercial landings of Australian Sardines in NSW were historically below 500 t p.a. until the early 2000s, when industry investment in processing and marketing, coupled with a considerably larger purse-seine vessel being introduced to the fishery, resulted in annual landings increasing rapidly to more than 2,000 t (Fig. 4). Landings declined considerably following the destruction of the main processing factory in late 2010 and the subsequent departure of the main catching vessel from the fishery, averaging around 550 t p.a. since 2009/10.



**Figure 4. Commercial landings in NSW of Australian Sardine for NSW from 1950/51 to 2023/24 for all fishing methods. Note that the data for 2023/24 is for a partial year having been extracted during November 2023.**

Based on the ocean zone of reported landings (zones 1 to 6 being the Eastern Australian biological stock and zones 7 to 10 the South Eastern Australian biological stock) landings from NSW fishers have oscillated between the two stocks (Fig. 5). During the past four years (since the implementation of quota management) almost the entire catch is being taken from the more northern Eastern Australian stock.



**Figure 5. Commercial landings of east coast Australian Sardines by biological stock from NSW fisheries.**

Recreational

The recreational harvest of Australian Sardine is thought to be minor. Recent surveys have detected very small numbers of retained ‘pilchards’ (Murphy et al., 2022, Murphy et al., 2020, West et al., 2015).

Indigenous

There are no data available on Aboriginal harvest.

Illegal Unregulated and Unreported (IUU)

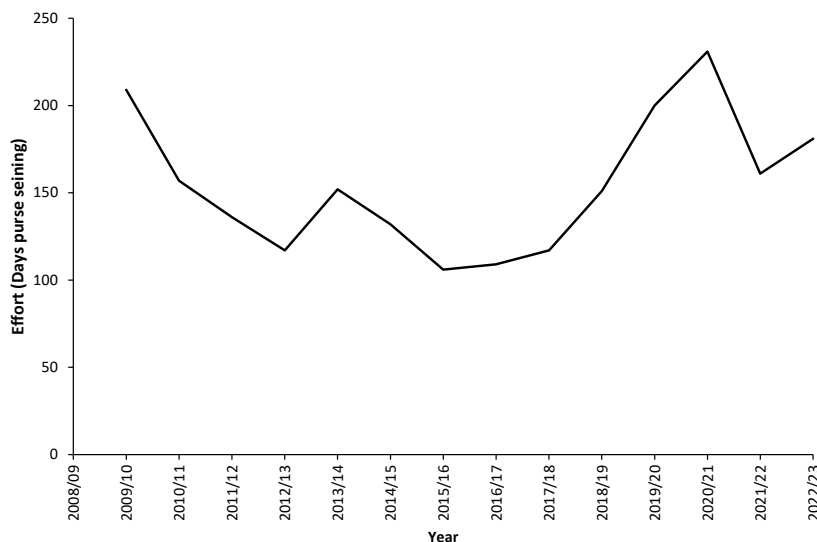


The level of Illegal Unregulated and Unreported (IUU) fishing is unknown.

## Effort

### Commercial

Days fished in the NSW purse seine fishery when Australian Sardine were landed have fluctuating between approximately 100 and 200 days per year since 2009/10 but declined from over 200 days to around 180 during 2022/23 (Fig. 6).



**Figure 6. Effort (days fished) for purse seine fishers that reported landing Australian Sardine in NSW 2009/10 to 2022/23**

### Recreational

There is little information on directed effort by recreational fishers, but it is believed to be very low. (West et al. 2015, Murphy et al. 2020, Murphy et al. 2022).

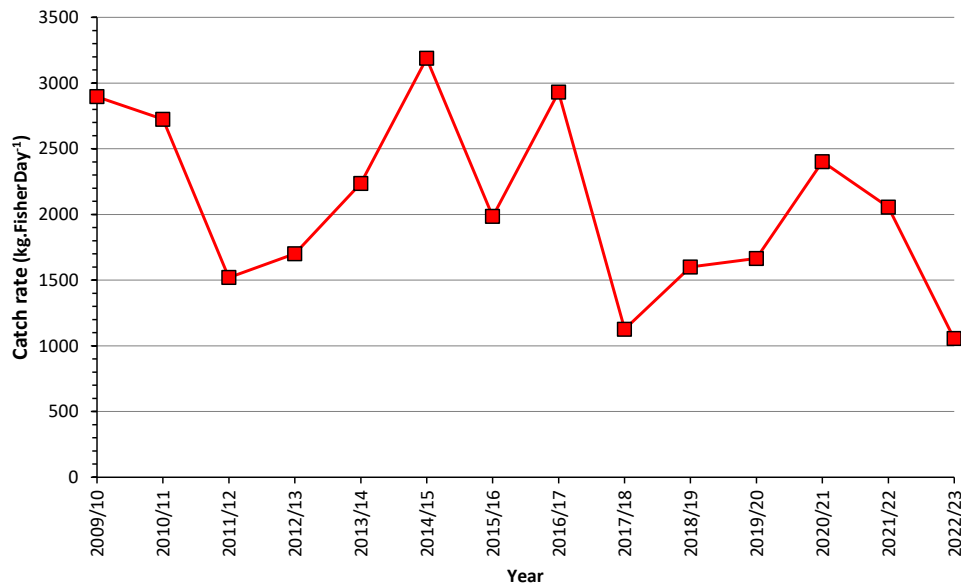
### Indigenous

There are no data available on Aboriginal fishing effort towards Australian Sardine.

## Catch Rates

### Commercial

Catch rates of Australian Sardine by the method of purse seine are unlikely to be useful for inferring relative abundance due to: (i) the schooling nature of the species; (ii) the ability of the gear to encircle entire schools of fish, and; (iii) the market driven nature of fishing operations for this species. Nevertheless, median catch rates of Australian Sardine (kg per day purse seining) have fluctuated considerably between 2009/10 and 2022/23 and were relatively low during 2022/23 (Fig. 7).



**Figure 7. Commercial catch rates (kgs per day) of Australian Sardine using Purse Seining for years 2009/10 to 2022/23 in NSW.**

Recreational

N/A

Indigenous

N/A

**References**

Murphy, J. J., Ochwada-Doyle, F. A., West, L. D., Stark, K. E., Hughes, J. M., Taylor, M.D., 2022. Survey of recreational fishing in NSW, 2019/20 – Key Results. NSW DPI – Fisheries Final Report Series No. 161. ISSN 2204-8669

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