Department of Primary Industries
Department of Regional NSW

NSW Stock Status Summary – 2023/24

Southern Shortfin Eel (*Anguilla australis*)

Assessment Authors and Year

This stock status summary report, summarises information from the combined River Eels stock assessment report:

Hall, K. C. (2024) Stock assessment report 2023/24 – River Eels – Longfin Eel (*Anguilla reinhardtii*) and Southern Shortfin Eel (*Anguilla australis*). NSW Department of Primary Industries, Coffs Harbour, 64 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Southern Shortfin Eel is currently assessed as an **undefined** stock for the NSW component of the stock.

Stock structure & distribution

The Southern Shortfin Eel (*Anguilla australis*, CAAB 37 056001) is widespread in coastal streams of south-eastern Australia, from the Pine River in southern Queensland to the Murray River in South Australia, and Tasmania, and also occurs in New Zealand and western Pacific Islands (Allen *et al.*, 2002; Beumer, 1996). This species is occasionally reported in inland systems west of the Great Dividing Range and typically prefers low-flow or still habitats. Genetic studies indicate that Shortfin Eel represents two geographically separate subspecies; *A. australis australis* in Australia and *A. australis schmidtii* in New Zealand and western Pacific islands (Shen & Tzeng, 2007). Because there is currently no cross-jurisdictional stock assessment undertaken for the shared stock, the assessment of the stock status is completed at the jurisdictional level.

The data presented in this summary relate to the New South Wales (NSW) part of the stock.

Scope of this assessment

This report provides a determination of stock status for Southern Shortfin Eel according to the Status of Australian Fish Stocks (SAFS) framework (Piddocke *et al.*, 2021), using data up to and including 2022/23. Where necessary data for Southern Shortfin Eel were adjusted or combined with data for Longfin Eel (*A. reinhardtii*), to support determination of a basket total allowable catch (TAC) for 'River Eels' in NSW waters, for the 2024-25 fishing season (1 July 2024 to 30 June 2025). An interim total commercial access level (ITCAL, or transitional TAC) of 137 t for River Eels was first introduced in December 2017 and was set at the maximum annual combined catch weight reported during the 10-year period 2002/03 to 2011/12 (NSW DPI, 2014). This will transition to an adjustable TAC from July 2024.

Biology

The Southern Shortfin Eel is a slow growing species with a lifespan of 18–35 years for females and 14–24 years for males (Todd, 1980). The species is sexually dimorphic, with females reaching a larger maximum size (110 cm total length, TL) than males (60 cm TL) (Beumer, 1996). Both sexes are semelparous, spawning once at the end of their lifecycle and then dying, with a late age at maturity of 10–35 years and 48–102 cm TL for females and 6–24 years and 34–60 cm TL for males (Todd, 1980).

Most of their lifecycle occurs in estuarine and freshwater systems, followed by migration downstream as mature adults to spawn in deep tropical ocean waters of the Coral Sea (Jellyman, 2016). In NSW, Southern Shortfin Eel is found primarily in coastal drainages east of the Great Dividing Range and in the Snowy River catchment; however, because the latter drains into east Gippsland, Victoria, it is not fished for eels in NSW. Recent studies using otolith chemistry suggest that spawning migration patterns and behaviour may be more complex than originally thought, and that some eels may spend considerable time resident in tidal waters before leaving the estuary to spawn (e.g., Crook *et al.*, 2014). This would expose adult eels to greater exploitation by commercial fishing in tidal waters than predicted by the more generalised model of swift migration out to sea. The semelparous life history of eels already renders them more vulnerable to impacts from fishing, because of the exceptionally long generation time and long larval period (Hoyle & Jellyman, 2002). Larval eels pass through a range of developmental stages in the ocean before re-entering estuaries as juvenile glass eels, where they are targeted by commercial fisheries as they undergo initial pigmentation to yellow eels, after which they migrate further upstream to become resident and continue development into adults. Due to their smaller size at maturity and adult size, Southern Shortfin Eels have a smaller minimum legal length than Longfin Eels (30 cm TL versus 58 cm TL).

Fishery statistics

Catch information

Commercial

Commercial catches of river eels landed from NSW waters rapidly increased in the early 1990s to supply a newly established live export market to China, with combined catches peaking at 469 tonnes (t) in 1992/93 (Figure 1). Species identification and reporting prior to 1997/98 was questionable and over half of the catches were reported as 'Eel, unspecified'; therefore, all historical data have been aggregated as mixed eels. Since 1997/98, species identification and reporting are considered more reliable, and catches have been dominated by Longfin Eel (Fig. 1).

Reported commercial catches of Southern Shortfin Eel in NSW waters decreased rapidly during the early 2000s from 46.8 t in 1998/99 to 4.3 t in 2005/06 and since then have remained at less than 10 t (Fig. 2). During 2016, the live export market for eels waned and processing facilities closed in NSW. As a result, the NSW Southern Shortfin Eel catches have been less than 1 t over the last seven years (Fig. 2).

Commercial catches of Southern Shortfin Eel are taken almost exclusively by eel trapping in the Estuary General Fishery (EGF), which targets the fully pigmented sub-adults or yellow eels as they return to estuaries on their migration back into freshwater systems (Fig. 2). No eel trapping in freshwater rivers above tidal waters is permitted in NSW. However, since 1992, a limited number of Section 37 permits for commercial eel trapping in nominated dams and specific impoundments were issued to eligible commercial fishers who held EGF Eel trapping shares. The number of these permits has decreased each year from 39 farm dam and 6 impoundment permits in 1992 to just 5 eligible fishers in 2017 and only two with active permits. While there were some larger catches taken against these permits in the 1990s and 2000s, these were mostly Longfin Eel.

Reported commercial catches in the EGF are reported across seven broad regions along the NSW coast. Catches of Southern Shortfin Eel have been reported from all seven regions, with 80% of the catch typically taken from 15 main estuaries that have remained consistent through time (Figs 3 and 4). Many of the estuaries where Southern Shortfin Eel were historically taken, are still fished for Longfin Eel and it is unknown why Shortfin Eel have almost disappeared from commercial catches since 2009/10. The regional distribution of reported Southern Shortfin Eel catches contrasts with results from research electrofishing surveys during the NSW Rivers Survey in the 1990s, which reported few Southern Shortfin Eel from northern catchments (Harris & Gehrke, 1997). Therefore, it is likely that historical species reporting was inaccurate and that some Longfin Eel were reported as Southern Shortfin Eel, particularly from northern catchments (i.e., Regions 1 to 4) (Hall, 2024).

Southern Shortfin Eel are primarily targeted by commercial trap fisheries in Victoria and Tasmania, with smaller catches also taken in Queensland (Victorian Fisheries Authority *et al.*, 2021a) (Figure 4). About 80% of the commercial catch of freshwater eels in Australia comes from Victoria, and Southern Shortfin Eel comprise up to 95% of the total catch (Jellyman, 2016). Victorian catches ranged between 131–310 t in the 1980s and 1990s, before declining to 32 t in 2010/11. This decline was attributed to the Millennium drought between 2000 and 2010. Since then, annual catches in Victoria have ranged between 36–95 t and are much larger than current NSW catches. Tasmanian catches of combined eels have historically ranged between 30–70 t and comprise approximately 95% Southern Shortfin Eel (Victorian Fisheries Authority *et al.*, 2021a).

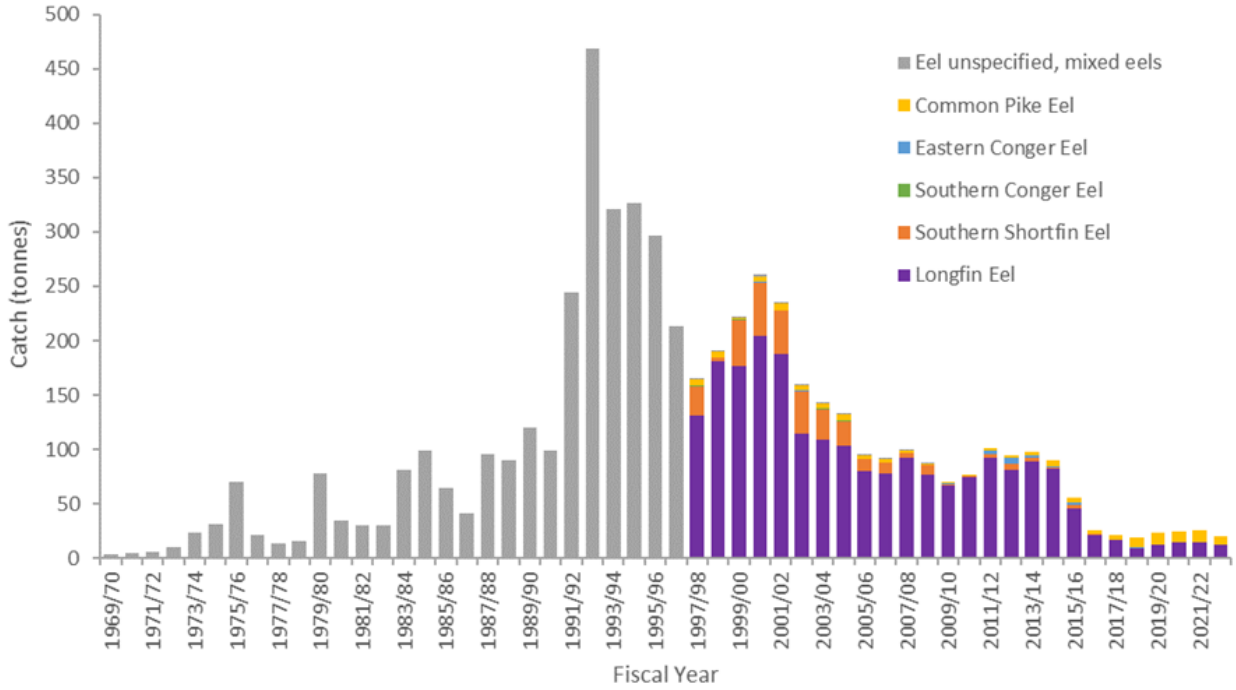

Figure 1 Annual commercial catches (tonnes) of river eels (all species) from estuarine and inland NSW waters (1969/70–2022/23). Prior to 1997/98 species reporting was considered unreliable and all catches have been combined as mixed eels.

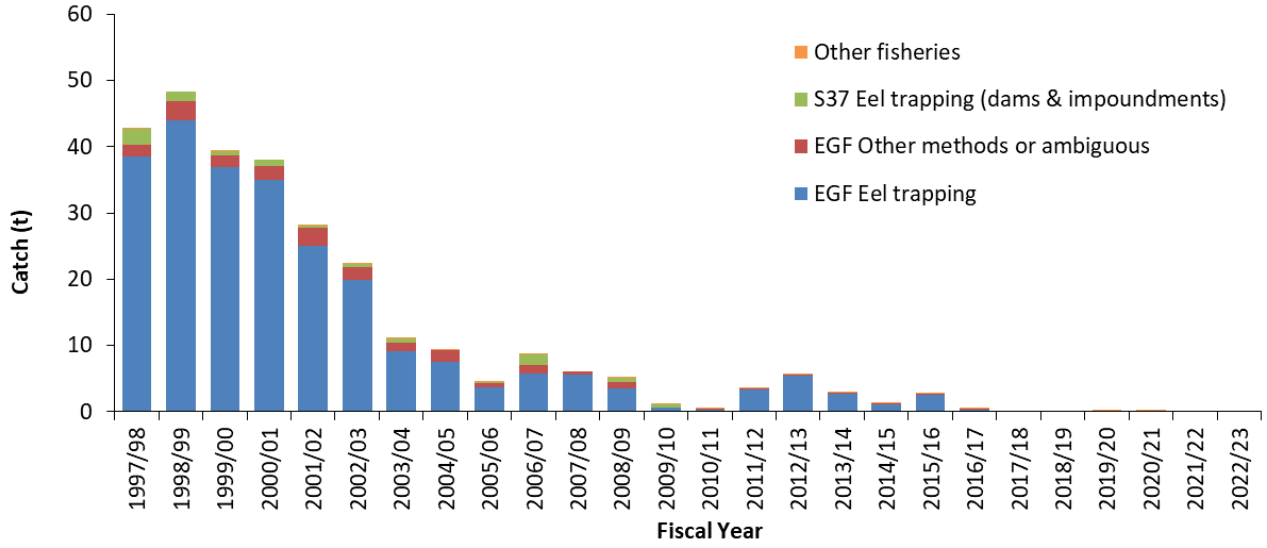

Figure 2 Annual commercial catches of Southern Shortfin Eel from NSW waters from 1997/98 to 2022/23 by different fisheries and methods. EGF = Estuary General Fishery, S37 = Section 37 permits.

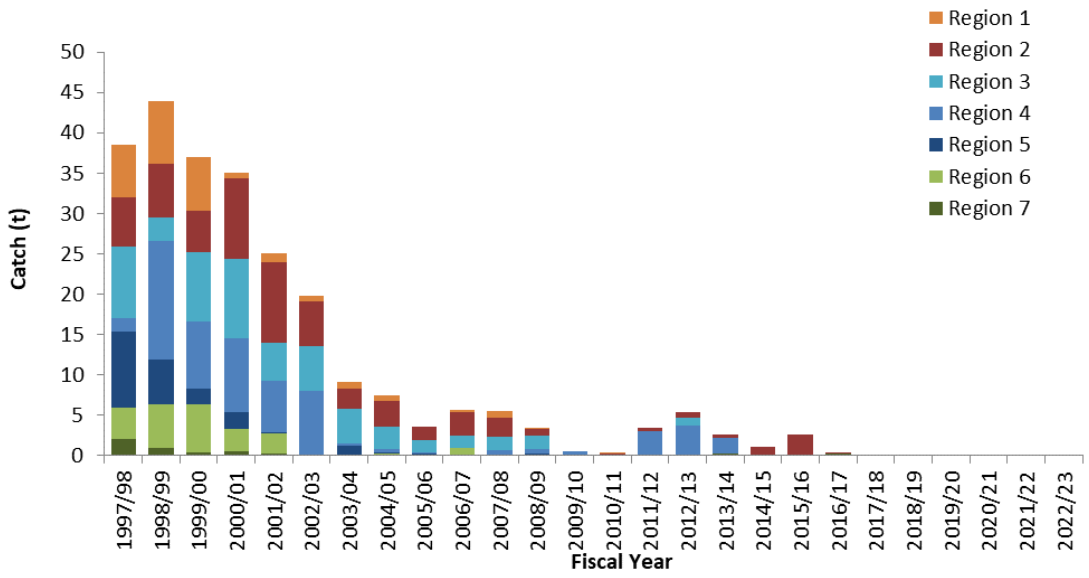

Figure 3 Annual commercial catches of Southern Shortfin Eel by the eel trapping sector in different regions of the NSW Estuary General Fishery from 1997/98 to 2022/23.

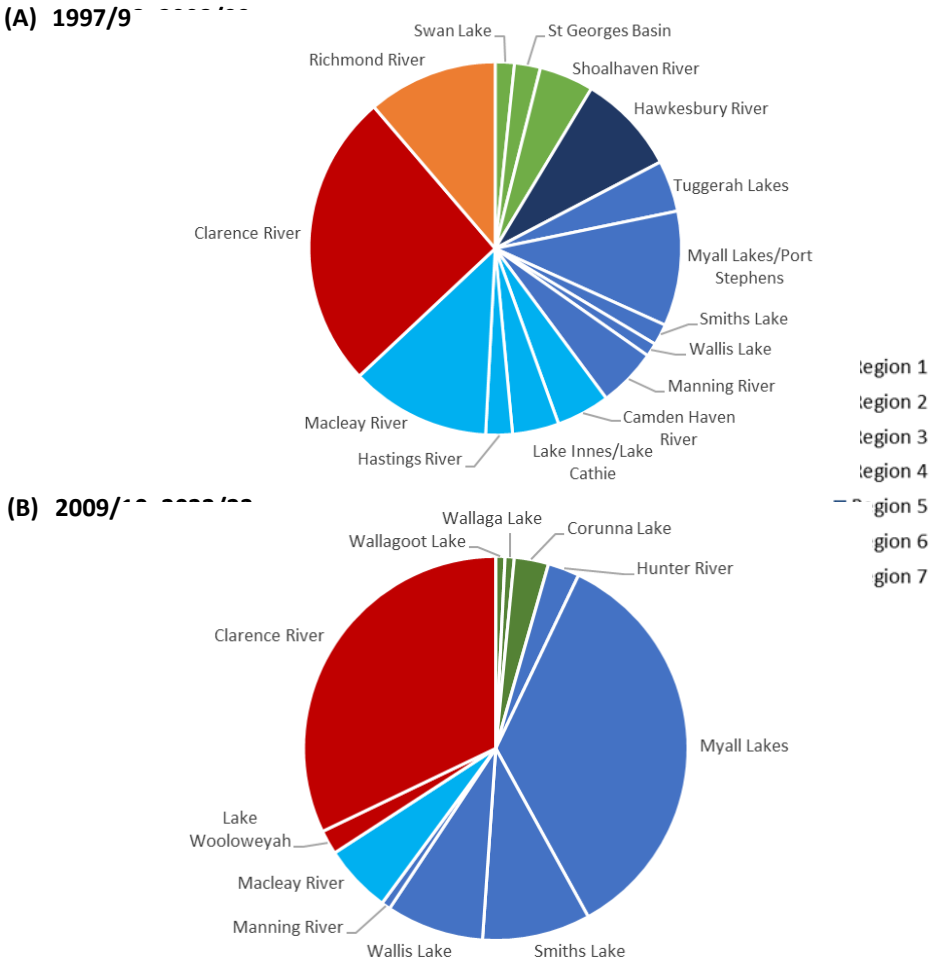

Figure 4 Southern Shortfin Eel catches landed from 15 main estuaries between 1997/98–2008/09 and 11 main estuaries between 2009/10–2022/23 (that accounted for 80% of total catches in each period) taken by eel trapping in the NSW Estuary General Fishery (colours indicate EGF regions).

Recreational & Charter boat

Recreational fishing for eels is covered in a biennial survey of recreational fishing in NSW, which collects data through telephone interviews of long-term (1- and 3-year duration) recreational fishing licence (ltRFL) holders and their household members over a 12-month survey period. Freshwater and saltwater eels are only reported as an undifferentiated group, so no species-specific information is available. In the most recent survey (2021/22, Murphy et al. unpub. data), approximately 2% of households caught eels over the 12-month period, and only 0.2% of households retained any eel catch. This suggests that harvesting of eels is conducted by only a very small proportion of recreational fishers.

Expansion of survey data to the broader population of ltRFL households provided an estimated harvest of 2,994 eels in 2021/22, but given that only 2 households reported eel harvests this estimate had an equally high standard error (SE, 2,819 eels). A further 18,189 eels were estimated to be released following capture, and of the harvested eels, about 6% were reported to be taken from estuarine waters with the remainder harvested from freshwater rivers. Estimates of eel harvest from previous surveys were similarly low and with similarly high standard errors—i.e., 2,955 (± 2,636 SE) in 2017/18 and 2,605 (± 1,198 SE) in 2019/20 (Murphy *et al.*, 2020, 2022). Historically, relative to the commercial catches, recreational harvests were comparatively small, comprising less than 1–2% of the total harvest of eels from NSW waters. Weight-converted estimates of recreational catch have been <2.5 t in recent years, however, as the commercial catch has declined this has represented as much as 14% of the total (commercial and recreational) catch.

Indigenous

A survey of Aboriginal cultural fishing in the Tweed River catchment identified river eels as one of the main components of freshwater catches (Schnierer & Egan, 2016). However, Longfin Eel only accounted for 0.8% of the total Aboriginal catch from the area (Schnierer, 2011). Total catches in the region were estimated to range between 117–350 Longfin Eel per annum (Schnierer, 2011) Statewide estimates of the annual Aboriginal harvest of Longfin Eel in NSW waters are unknown, but likely to be significant.

Illegal, Unregulated and Unreported

The level of illegal, unregulated and unreported fishing is unknown; however, eels were specifically mentioned in submissions to a comprehensive compliance review of potential black market issues in NSW waters (Palmer, 2004). Evidence from compliance investigations suggests that considerable illegal fishing for adult eels has occurred historically in prohibited freshwater reaches, and if such harvests were reported by licensed commercial fishers as catch from permitted waters, this could create uncertainty in the catch and catch rate series.

Fishing effort information

Commercial fishing effort for Southern Shortfin Eel was collected as number of days fished on monthly records prior to July 2009 and as numbers of traps fished per daily event after July 2009. To form a longer time series of effort, recent daily events were re-aggregated, with effort in days fished estimated from the number of fishing events entered for each fisher in each month where Southern Shortfin Eel was reported on at least one day.

Reported effort for Southern Shortfin Eel was stable at around 1 800 days fished per annum between 1997/98 and 2001/02, then declined rapidly to 252 days fished in 2006/07 and 16 days fished in 2009/10 (Fig. 5). Since then, reported annual effort has remained below 200 days fished in all years and has been less than 5 days per annum over the last six years.

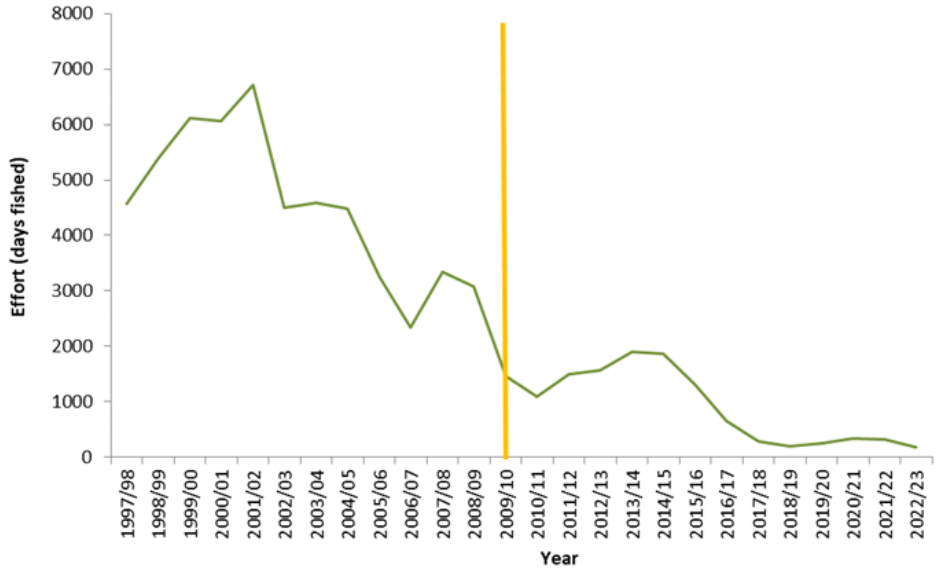

Figure 5 Annual effort (in days fished) for eel trapping fishers of the NSW Estuary General Fishery that reported landing Southern Shortfin Eel on at least one day in each month (1997/98 to 2022/23). The vertical gold line indicates the change from monthly to daily catch reporting.

Catch-rate information

Historical catch rates (catch-per-unit-effort, CPUE in kg per day) for Southern Shortfin Eel taken by eel traps in the EGF were compiled from monthly records between 1997/98 and 2008/09. Insufficient data were available to compile a catch rate series from daily event records between 2009/10 and 2022/23.

The historical standardised CPUE series from monthly records (in kg per day fished) of Southern Shortfin Eel declined by over 50% between 1997/98 and 2005/06 and then remained below the long-term average until 2008/09 (Fig. 6). Since then, there are insufficient data to produce a standardised catch rate series.

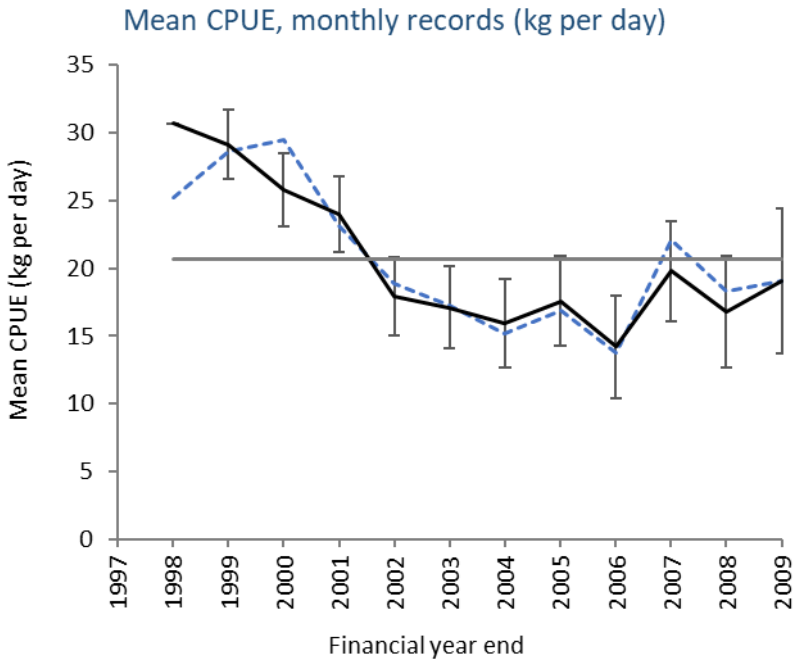

Figure 6 Mean annual standardised catch rates (catch-per-unit-effort, CPUE) of Southern Shortfin Eel for the eel trapping sector in the NSW Estuary General Fishery, estimated from monthly records (1997/98–2008/09) in kg per day. The dashed and solid lines indicate the nominal and standardised mean CPUE, respectively; and the grey horizontal line indicates the long-term average for the series.

Stock Assessment

Stock Assessment Methodology

Year of most recent assessment:

2024, using data up to 2022/23 (Hall, 2024).

Assessment method:

This current stock assessment applied a weight-of-evidence approach to determine stock status of Southern Shortfin Eel and included: (1) updated information for NSW fisheries statistics; and (2) updated statewide standardised catch rates for the eel trapping sector of the EGF, standardised for month, region, estuary and fishing business using the r-package 'rforcpue' (Haddon, 2023).

Main data inputs:

Commercial catch and effort data – for all NSW commercial fisheries by fiscal years (1997/98– 2022/23).

Commercial catch rates historical – reported catch rates (catch-per-unit-effort, CPUE in kg per day) calculated from commercial logbook data provided by fishers of the EGF eel trapping sector by fiscal years (1997/98–2008/09) – standardised.

Fishery independent river survey data was obtained for electrofishing surveys completed in catchments east of the Great Dividing Range. Effort data was not always available and varied considerably across years and different studies, so data were analysed according to the proportion of each species recorded (1973–2024).

Key model structure & assumptions:

The CPUE standardisations and analyses assume that the annual catch rates are a relative index of abundance and are not unduly influenced by other factors that are not accounted for through standardisation.

Using fishing effort as an indicator of relative fishing pressure assumes that fish catchability and fishing power have not changed significantly over the monitoring period.

Sources of uncertainty evaluated:

An alternative catch history scenario was considered along with the raw data as reported, which involved adjusted data with all Southern Shortfin Eel reported north of Hawkesbury River (i.e., in Regions 1 to 4) reallocated to Longfin Eel and all southern data (i.e., in Regions 5 to 7) left as reported. Therefore, in addition to the 'base-case' standardised CPUE series, an second standardised CPUE series was prepared from the adjusted data for comparison (Hall, 2024).

Status Indicators - Limit & Target Reference Levels

There is no harvest strategy in place for Southern Shortfin Eel in NSW, so a weight-of-evidence approach has been applied in this stock assessment with nominated indicators and reference points in line with the current NSW Harvest Strategy Policy (NSW DPI, 2021).

Biomass indicator or proxy	Trend in annual standardised catch rates of the eel trapping sector of the commercial EGF was used as an index of relative abundance.
Biomass Limit Reference Point	Current catch rates were compared to the long-term averages of each time series.
Biomass Target Reference Point	None specified.
Fishing mortality indicator or proxy	Trend in the total fishing effort of the eel trapping sector of the EGF was used as an indicator of relative fishing pressure.
Fishing mortality Limit Reference Point	Current effort levels were compared against historic levels.
Fishing Mortality Target Reference Point	None specified.

Stock Assessment Results

Stock Assessment Result Summary

Biomass status in relation to Limit	There were insufficient recent catch rate data to form a reliable time series for analyses of trends in relative abundance. Current catches are much smaller than historic catch levels prior to 2009, and standardised historical catch rates of the commercial eel trapping sector of the NSW EGF indicated a declining trend. The assessment of current level of biomass is considered too uncertain to confidently assign a status determination.
Biomass status in relation to Target	Not assessed.
Fishing mortality in relation to Limit	Reported fishing effort for the species by eel trapping declined rapidly during the 2000s from 1 866 days in 2000/01 to a mere 16 days in 2009/10 and has been less than 5 days per annum over the last five years. Targeted fishing for Longfin Eel still occurs in many of the estuaries where catches of Southern Shortfin Eel were historically reported. Fisher identification of the two species may not be reliable and current catch and discard rates are unknown. The current low level of fishing pressure is unlikely to cause the stock to become recruitment overfished; however, there is insufficient biomass information to confidently assign a status determination.
Fishing mortality in relation to Target	Not assessed.
Current stock status	There is insufficient information available to confidently classify the status of this stock. On this basis, the NSW part of the Southern Shortfin Eel stock is currently assessed as an **undefined stock**.

Fishery interactions

The EGF eel trapping gears interact with other commercial and non-commercial by-catch species, a range of endangered, threatened and/or protected (ETP) species and freshwater habitats. However, the current regulations for eel trapping in the EGF, which include restricting eel fishing to tidal estuarine waters and some farm dams and artificial impoundments and using wingless baited traps are likely to be limit the amount of interactions with protected species such as platypus.

The use of traps with no wings reduces drowning of platypuses, and prevents mortality of small forage fish species, which might be captured by "gilling" in the wings of fyke nets (Grant, 1993). Furthermore, The EGF share management plan mandates that all eel traps must have a 100 mm rigid ring fit to funnel entrances to prevent air breathing animals (such as freshwater turtles and platypus) from entering the traps. Traps in freshwater dams and impoundments must also include an air pocket in the cod end. Mesh size and other gear restrictions are regulated to increase the target species selectivity of the traps and cod ends. Research results suggest that these measures significantly decrease the levels of by-catch associated with these fishing gears (Grant *et al.*, 2004).

Interactions with animals protected under the *Environment Protection and Biodiversity Conservation Act* 1999 were subjected to a detailed risk assessment in an environmental impact statement (EIS) for the fishery undertaken during fisheries management strategy development (NSW Fisheries 2001). An updated threat and risk assessment for all components of the NSW marine estate was completed in 2017 (Fletcher and Fisk 2017). The EGF was considered a moderate threat to species and communities protected under the *NSW Fisheries Management Act* 1994 and *Biodiversity Conservation Act* 2016. Compulsory logbook reporting of all interactions with ETP species was mandated in 2005 and these are reported annually to the Department of Environment and Energy (NSW DPI, 2017).

Stakeholder engagement

Results of this stock assessment were presented to industry members via video conference on 5 March 2024. Feedback suggested that: current catches are limited by the lack of an export market, with fishers not actively targeting river eels at present; species identification and reporting, particularly for historical data, may not be accurate; catches in the late 2000s may have been influenced by the closure or partial closure of some estuaries as recreational fishing havens; and there was potentially significant illegal fishing in freshwater reaches that was reported as tidal catches. This feedback should be considered while interpreting current stock assessment results.

Qualifying Comments

The extremely low catches of Southern Shortfin Eel in NSW since 2009/10, are difficult to interpret, given that targeting of Longfin Eel is still occurring in estuaries where the former species was historically reported in large numbers. Several possible scenarios could explain the decline in Southern Shortfin Eel catches, including:

- the species is still caught, but is no longer retained because it is not the preferred species for export markets;
- stillwater habitats within estuaries, preferred by Southern Shortfin Eel, are no longer targeted to avoid discarding the species in response to poor market demand;
- species misidentification or misreporting artificially inflated historic catches of Southern Shortfin Eel or current eel catches are all reported as Longfin Eel, irrespective of the species caught;
- the species range has contracted further south in response to climate change and no longer occurs in large numbers in NSW coastal rivers, given that they are more abundant in temperate areas (Victoria and Tasmania); or
- the species is no longer caught due to recruitment failure in the main estuaries where commercial eel trapping still occurs.

Catch rates of Southern Shortfin Eel declined substantially in the early 2000s, when sufficient data were still available for analyses, which raises further concerns regarding the current status of the stock in NSW estuaries. Further research and consultation with industry is warranted to ascertain the underlying causes of the almost complete disappearance of Southern Shortfin Eels from NSW commercial fishery catch data in recent years. Shortfin Eels apparently prefer still water habitats and may be more affected by barriers to upstream migration that require strong swimming in fast running fishways or other tributaries the larger bodied Longfin Eels (Pusey *et al.*, 2004). Recruitment studies of glass eels suggested that Southern Shortfin Eels were sometimes common in estuaries of some catchments where they were not found in large numbers as adults further upstream. Therefore, restricting fishing to tidal areas may have disproportionately targeted Southern Shortfin Eels over Longfin Eels in the past.

References

Allen, G. R., Midgley, S. H., & Allen, M. (2002). *Field guide to the freshwater fishes of Australia*. Western Australian Museum.

Beumer, J. P. (1996). Family Anguillidae: freshwater eels. In R. M. McDowall (Ed.), *Freshwater fishes of south-eastern Australia* (pp. 39–43). Chatswood, NSW, Australia: Reed Books Australia.

Crook, D. A., Macdonald, J. I., Morrongiello, J. R., Belcher, C. A., Lovett, D., Walker, A., & Nicol, S. J. (2014). Environmental cues and extended estuarine residence in seaward migrating eels (*Anguilla australis*). *Freshwater Biology*, *59*, 1710–1720.

Grant, T. R. (1993). The past and present freshwater fishery in New South Wales and the distribution and status of the Platypus *Ornithorhynchus anatinus*. *Australian Zoologist*, *29*, 105–113.

Grant, T. R., Lowry, M. B., Pease, B., Walford, T. R., & Graham, K. (2004). Reducing the by-catch of platypuses (*Ornithorhynchus anatinus*) in commercial and recreational fishing gear in New South Wales. *Proceedings of the Linnean Society of New South Wales*, *125*, 259–272.

Haddon, M. (2023). *rforcpue: functions to assist with the analysis of CPUE data. R package version 0.0.0.3000.*

Hall, K. C. (2024). *NSW Stock assessment report 2023/24 – River Eels – Longfin Eel (*Anguilla reinhardtii*) and Southern Shortfin Eel (*Anguilla australis*)*. Coffs Harbour, NSW, Australia: NSW Department of Primary Industries. p. 38.

Harris, J. H., & Gehrke, P. C. (1997). *Fish and rivers in stress: the NSW rivers survey*. Canberra, ACT: CRC for Freshwater Ecology.

Hoyle, S. D., & Jellyman, D. J. (2002). Longfin eels need reserves: modelling the effects of commercial harvest on stocks of New Zealand eels. *Marine and Freshwater Research*, *53*, 887–895.

Jellyman, D. J. (2016). Management and fisheries of Australasian eels (*Anguilla australis*, *Anguilla dieffenbachii*, *Anguilla reinhardtii*). In T. Arai (Ed.), *Biology and ecology of Anguillid eels* (pp. 274–289). Boca Raton, Florida, USA: CRC Press.

Murphy, J. J., Ochwada-Doyle, F. A., West, L. D., Stark, K. E., & Hughes, J. M. (2020). *The NSW Recreational Fisheries Monitoring Program - survey of recreational fishing, 2017/18. Fisheries Final Report Series No. 158.* p. Wollongong, NSW.

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. Fisheries Final Report Series No. 161.* Nelson Bay, NSW. p. 80.

NSW DPI. (2017). *Assessment of the NSW Ocean Trawl Fishery. Prepared for the Department of Environment and Energy for the purpose of assessment under Part 13 and 13(A) of the Environment Protection and Biodiversity Act 1999*. Coffs Harbour, NSW: NSW Department of Primary Industries. p. 25 pp.

Palmer, M. (2004). *Report on illegal fishing for commercial gain or profit in NSW*. Cronulla, NSW, Australia: NSW Fisheries. p. 53.

Schnierer, S. (2011). *Aboriginal fisheries in New South Wales: determining catch, cultural significance of species and traditional fishing knowledge needs. FRDC Final Report Project No. 2009/038*. 0960–3166. Fisheries Research and Development Corporation. pp. 693–709.

Schnierer, S., & Egan, H. (2016). Composition of the Aboriginal harvest of fisheries resources in coastal New South Wales, Australia. *Reviews in Fish Biology and Fisheries*, *26*, 693–709.

Shen, K. N., & Tzeng, W. N. (2007). Genetic differentiation among populations of the shortfinned eel Anguilla australis from East Australia and New Zealand. *Journal of Fish Biology*, *70*, 177–190.

Todd, P. R. (1980). Size and age of migrating New Zealand freshwater eels (*Anguilla* spp.). *New Zealand Journal of Marine and Freshwater Research*, *14*, 283–293.

Victorian Fisheries Authority, Bartleet, A., Hall, K., Hart, T., Henderson, G., & Hartmann, K. (in press). Southern Shortfin Eel *Anguilla australis*. In T. Piddocke, C. Ashby, K. Hartmann, A. Hesp, P. Hone, J. Klemke, S. Mayfield, et al. (Eds.), *Status of Australian Fish Stocks Reports 2023*. Canberra, ACT: Fisheries Research and Development Corporation.