Stock Status Summary 2021

NSW Stock Status Summary Southern Shortfin Eel (*Anguilla australis*)

Assessment Authors and Year

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Stock Status

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

Stock Structure

The Southern Shortfin Eel (*Anguilla australis*) 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 (Beumer 1996; Allen et al. 2002). 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 and 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.

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). This life history strategy can make eels particularly vulnerable to recruitment overfishing (Hoyle and 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.

Stock Status – New South Wales

Catch Trends - Commercial Fisheries

Total annual commercial catches of Southern Shortfin Eel in NSW waters have fluctuated widely, with a rapid increase in the early 1990s to a peak of 82.2 tonnes (t) in 1993/94 before decreasing to 3.2 t in 1996/97 and then increasing to a second peak of 46.8 t in 1998/99 before steadily decreasing to 4.3 t in 2005/06 (Fig. 1). Since then catches have remained at less than 10 t, and have been less than 1 t over the last four years.

Commercial catches of Southern Shortfin Eel are taken almost exclusively by eel trapping in the Estuary General Fishery (EGF). Historical catches were reported from across the seven broad estuary regions along the NSW coastline, with eleven main estuaries dominating the catches (Fig. 2). Many of these estuaries are still fished for Longfin Eel (*A. reinhardtii*) and it is unknown why Shortfin Eel have almost disappeared from catches since 2009/10. Anecdotal information from fishers suggests that their lower market value relative to Longfin Eels has resulted in reduced targeting of eels in the stillwater habitats preferred by Shortfin Eel and increased discarding of the species. Historic species misidentification may have also contributed towards changes in recent catch trends.

Southern Shortfin Eel are also targeted by commercial trap fisheries in Queensland, Victoria and Tasmania. About 80% of the commercial catch 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.

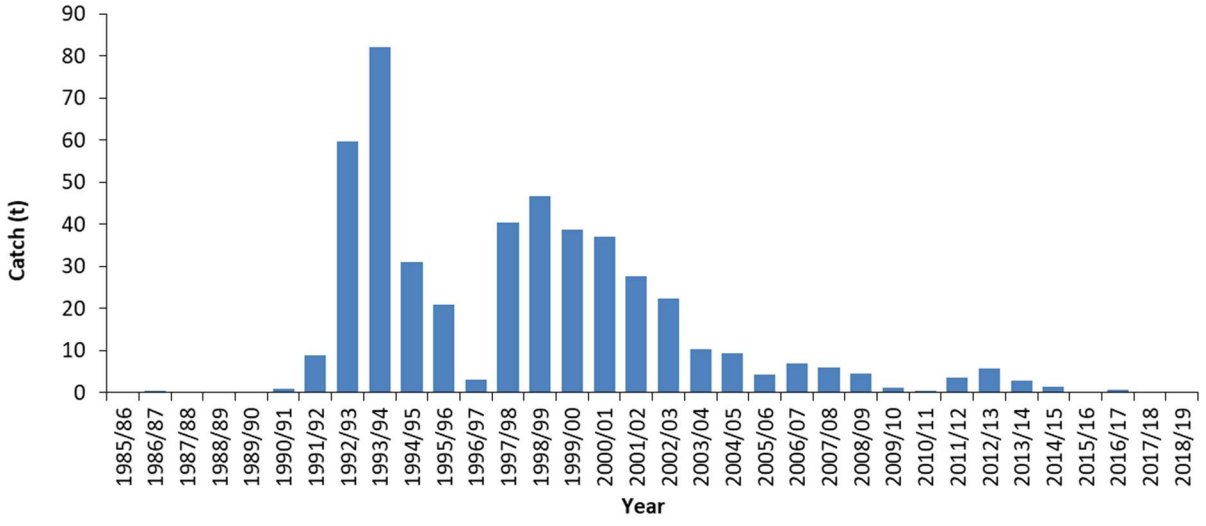

Figure 1. Annual commercial catches (tonnes) of combined River Eels (*Anguilla* spp.) for NSW waters (1986/87–2018/19) for all fishing methods.

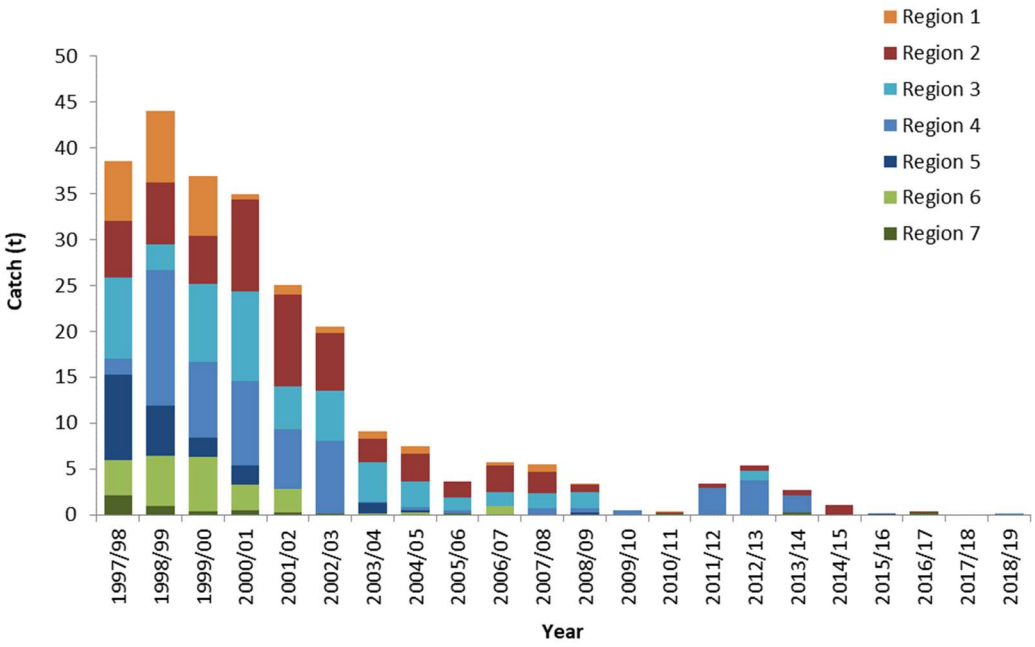

Figure 2. Annual commercial catches of Southern Shortfin Eel by the eel trapping sector in different regions of the NSW Estuary General Fishery from 1997/98 to 2018/19.

Catch Trends - Recreational and Indigenous

Recreational catches of freshwater eels are not separated according to species. The most recent estimate of the recreational harvest of combined freshwater eels in NSW was approximately 2 955 eels or around 2.2 t during 2017/18 (Murphy et al. 2020). A further 8,744 eels were estimated to be caught and released. These estimates were based on a survey of Recreational Fishing Licence (RFL) Households, comprised of at least one fisher possessing a long-term (1 or 3 years duration) fishing licence and any other fishers resident within their household. The equivalent estimated recreational harvest in 2013/14 was approximately 60% smaller at around 1,024 eels, but an additional 16,479 eels were estimated to be caught and released (Murphy et al. 2020). Historically, relative to the commercial catch, these recreational harvests are very small, comprising approximately 3.7% of the total harvest of freshwater eels from NSW waters in 2013/14.

A survey of Aboriginal cultural fishing in the Tweed River catchment identified river eels as one of the main components of freshwater catches (Schnierer and Egan 2016). However, Southern Shortfin 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 105–290 Southern Shortfin Eel per annum (Schnierer 2011). Statewide estimates of the annual Aboriginal harvest of Southern Shortfin Eel in NSW waters are unknown.

Fishing Effort Trends - Commercial Fisheries

Commercial fishing effort data 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.

In the eel trapping sector of the EGF, 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. 3). Since then, reported annual effort has remained below 200 days fished in all years and was 157 days fished in 2018/19.

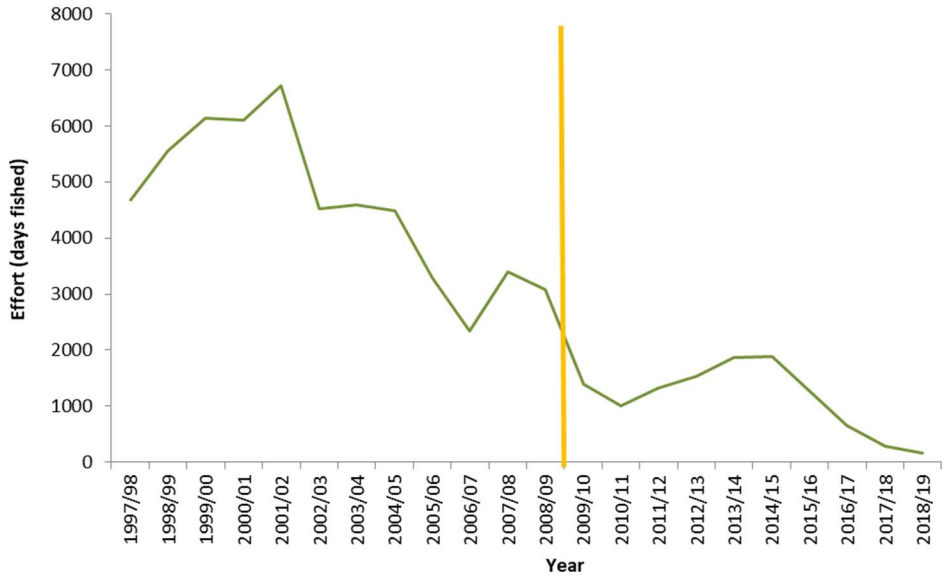

Figure 3. Annual effort (in days fished) for eel trapping fishers of the NSW Estuary General Fishery that reported landing Southern Shortfin Eel on at least one day in each month. The gold vertical line indicates the change from monthly to daily catch reporting.

Catch Rate Trends - Commercial Fisheries

Monthly catch rates (catch-per-unit-effort, CPUE in kg per day fished) for Southern Shortfin Eel taken by eel traps in the EGF were compiled from monthly records between 1993 and 2009. Insufficient data were available to compile a catch rate series from daily event records between 2010 and 2019. Monthly catch rates were standardized for month, region and authorised fisher using the r-package 'cede' (Haddon 2018).

The mean monthly catch rates fluctuated around an overall decreasing trend from 1993 to 2009 (Fig. 4). Prior to 2000, most annual catch rates were above the long-term average; whereas after 2000, most were below the long-term average. It is unknown where current catch rates may be relative to these historic levels.

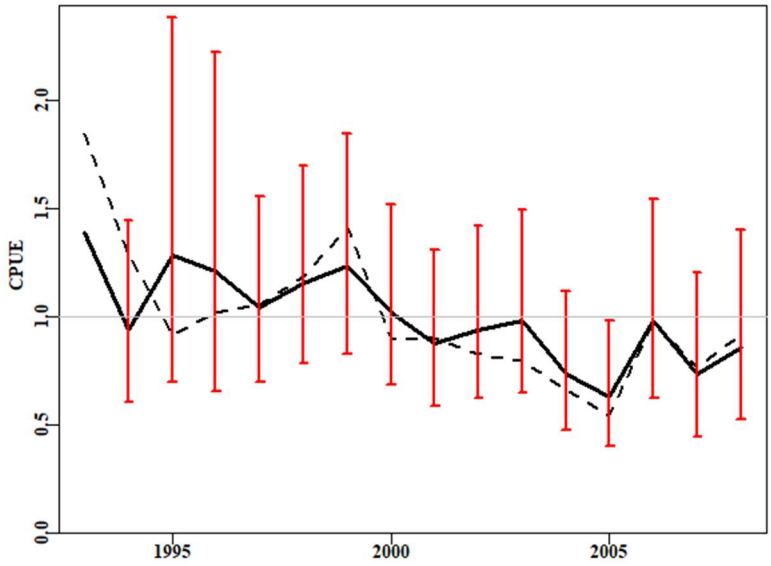

Figure 4. Mean standardised catch rates (catch-per-unit-effort, CPUE) of Southern Shortfin Eel for the eel trapping sector in the NSW Estuary General Fishery, estimated from monthly records (1993–2009) in kg per days fished. The dashed and solid lines indicate the nominal and standardised mean CPUE, respectively; and the grey horizontal line indicates the long-term average for the series.

Stock Assessment Methodology

Year of most recent assessment	2020 No quantitative joint stock assessment of the entire biological stock is undertaken.
Assessment method	A weight-of-evidence approach was used for the current stock status assessment of Southern Shortfin Eel in NSW waters, relying on analyses of catch and effort data from the eel trapping sector of the EGF.
Main data inputs	Commercial catch and effort data – for all NSW commercial fisheries by fiscal years (1990/91– 2018/19). Recreational catches – estimated annual catches for combined freshwater eels from three periods – national recreational and indigenous fishing survey (2000/01) and NSW recreational fishing surveys (2013/14 and 2017/18). Commercial catch rates historical – reported annual monthly CPUE data for the eel trapping sector of the EGF by calendar years in kg per days fished (1993–2008) – standardised.
Key model structure and 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. Catch rates were standardised for the influences of different months, estuary regions and authorised fishers.

	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	None assessed.

Status Indicators and Limit Reference Levels

Biomass indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment the trend in commercial catch rates of the eel trapping sector of the EGF was used as a relative index of abundance.
Biomass Limit Reference Level	None specified in a formal harvest strategy. There were insufficient recent catch rate data to compare current catch rates relative to historic levels.
Fishing mortality indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment trends 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 Level	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment current effort levels were compared against historic levels.

Stock Assessment Results

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. The assessment of current level of biomass is considered too uncertain to use confidently for SAFS status determination.
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; although targeted fishing for Longfin Eel (*Anquilla reinhardtii*) 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 weight of evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

Previous SAFS stock status	Southern Shortfin Eel is being assessed nationally according the Status of Australian Fish Stocks (SAFS) framework for the first time in 2020.
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.**

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 caught 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;
- or of greatest concern, the species is no longer caught due to recruitment failure in the main estuaries where commercial eel trapping still occurs.

The commercial EGF is permitted to operate in only a limited number of estuaries along the NSW coast, which provides some protection for a potentially large percentage of eel stock. Nevertheless, 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.

Compliance activity suggests that some unreported, illegal fishing in freshwater systems closed to fishing may have occurred, which is not considered in this assessment.

References

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

Beumer, J. P. 1996. Family Anguillidae: freshwater eels. Pages 39-43 in R. M. McDowall, editor. Freshwater fishes of south-eastern Australia. Reed Books Australia, Chatswood, NSW, Australia.

Haddon, M. 2018. cede: functions for fishery data exploration and CPUE Standardization. R package version 0.0.4.

Hoyle, S. D., and D. J. Jellyman. 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). Pages 274-289 in T. Arai, editor. Biology and ecology of Anguillid eels. CRC Press, Boca Raton, Florida, USA.

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

Shen, K. N., and W. N. Tzeng. 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.