Department of Primary Industries
and Regional Development

NSW Stock Status Summary – 2025

Ghost Nipper (*Trypaea australiensis*)

Assessment Authors and Year

Taylor, M.D., Chick, R.C. and Fowler, A. M. 2025. Stock Status Summary 2023/24 – Estuary General Fishery (Hand Gathering) – Ghost Nipper. NSW Department of Primary Industries. Fisheries NSW, Port Stephens Fisheries Institute. 15 pp.

This stock status summary report provides an update to the data series presented in the previous assessment (Chick, 2024), to inform a determination of stock status for the most recent fishing period.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Ghost Nipper are currently assessed as sustainable.

The weight-of-evidence provided suggests that the biomass of Ghost Nipper is at a level sufficient to ensure that on average, future levels of recruitment are adequate and fishing mortality is at a level to avoid the stock being recruitment impaired. However, recent trends in fishery-dependent data provide a reduced level of confidence in the status determination to previous assessments and indicate a decline in the abundance of Ghost Nipper from historically important areas (Port Hacking).

Stock structure & distribution

Stock size and structure of NSW Ghost Nipper populations is dynamic (Chick, 2023 and references therein; Rotherham, 2004). A recent study (Kirby *et al.*, 2024) described the genetic population structure (or indeed, a lack thereof) of Ghost Nipper in NSW from samples collected at 3 locations spanning ~250 km of the NSW central-south coast (Port Hacking, Shoalhaven Heads and Moruya). Kirby *et al.* (2024) described no evidence of genetic population structuring among the locations sampled, inferring panmixia and suggest gene flow among locations enables management of the resource as a single stock. For the purposes of the current assessment and management, Ghost Nipper in NSW are assumed to constitute a single management unit.

Despite genetic panmixia identified by Kirby *et al.* (2024), local-scale biological processes for the species are likely to be impacted by environmental drivers and human activities (such as fishing). It is also likely that estuarine and oceanographic processes facilitate dispersal of Ghost Nipper across a range of scales. Both these factors may influence local populations, and highlight the importance of considering areas that are important sources for Ghost Nipper recruits in future management.

Scope of this assessment

This stock status summary presents an update of key information and results presented in the most recent assessment of the NSW Ghost Nipper stock (Chick, 2024) that aimed to: 1) define the stock structure and provide a summary of the biology of the species; 2) assess and determine the biological status of NSW Ghost Nipper; 3) summarise the available fishery statistics and additional data sources to inform the assessment; 4) outline information and data limitations and uncertainty; and 5) comment on the strategic direction of future research and the assessment. Assessment of the NSW Ghost Nipper stock is based on a weight-of-evidence approach, as available data do not support the application of a reliable model-based stock assessment at an appropriate spatial scale.

Biology

Ghost Nipper are dioecious, female-brooding, decapod crustaceans. The species has moderately high fecundity (~2000–4000 eggs per female) and, although size at maturity (~5–8 mm carapace length, CL) and reproductive periodicity (ovigerous females generally peak in summer in NSW) vary spatially and temporally. There is an apparent latitudinal gradient in NSW, with more southern populations maturing at smaller sizes and becoming ovigerous earlier than those further north (Rotherham, 2004). Contrasting patterns have been found in Moreton Bay, Queensland, however where ovigerous females as small as 3 mm CL have been found (McPhee and Skilleter, 2002). The length of the post-hatching pelagic larval stage, and the contribution of local and large-scale oceanography and other environmental factors to recruitment success, are not well known. Rotherham (2004) estimated von Bertalanffy growth parameters L_∞ and k ranged 12.6–15.8 mm and 0.37–0.98 y^{-1}, respectively. Estimates of maximum age (3–4 years); natural mortality (M) 1.21-1.81 $year^{-1}$; total mortality (Z) 1.18–3.76 $year^{-1}$, and fishing mortality (F) 0.23–0.94 $year^{-1}$ were also estimated, although with high levels of uncertainty (Rotherham, 2004). Nonetheless, estimates of M are consistent with those for other burrowing mud prawn species (Conides *et al.*, 2012; Filho *et al.*, 2013) — *Upogebia pusilla* M = 0.9, and *Lepidophthalmus siriboia* M = 1.7. Application of Hoenigs method' and a maximum age of 4 years (Hewitt and Hoenig, 2005) yields an estimate of M = 1.1, which is somewhat consistent with previous estimates.

Fishery statistics

Catch information

Commercial

Statewide annual Estuary General Fishery (EGF) Ghost Nipper harvest increased to ~2 t from FY1985 to FY1995, and ranged between 2 t and 4 t per year between FY1996 and FY2009 (Figure 1). Since FY2010, annual reported commercial harvest generally continued to increase, with >4 t being harvested in 4 out of the last 5 years, including 4.4 t harvested in FY2024 (Figure 1). Since FY2010, EGF harvest has been consistently dominated by one estuary — Port Hacking (average 93% [range 87% – 99%] of statewide EGF harvest over this period). Over the past 10 years a comparatively small annual harvest (~100 kg) has been reported from the Shoalhaven/Crookhaven River, and sporadic harvest has been reported in the Karuah River, Myall River, and Tuggerah Lake. Lake Illawarra had the largest harvest (325 kg) yet reported for that estuary in FY2024. The relatively low catch in

FY2011 can mostly be explained by the unusually low catch of a regular, dominant (by catch volume) fisher who reported an annual harvest in that year <50% of their normal average annual catch. Since FY2020, with the introduction of the TAC (5.6 t), annual harvest has normally exceeded 4 t and catch volumes remain among the highest levels reported in the EGF over the entire timeseries (Figure 1). Variability in annual harvest across the EGF (since FY2010) is not necessarily consistent with harvest patterns at the estuary level.

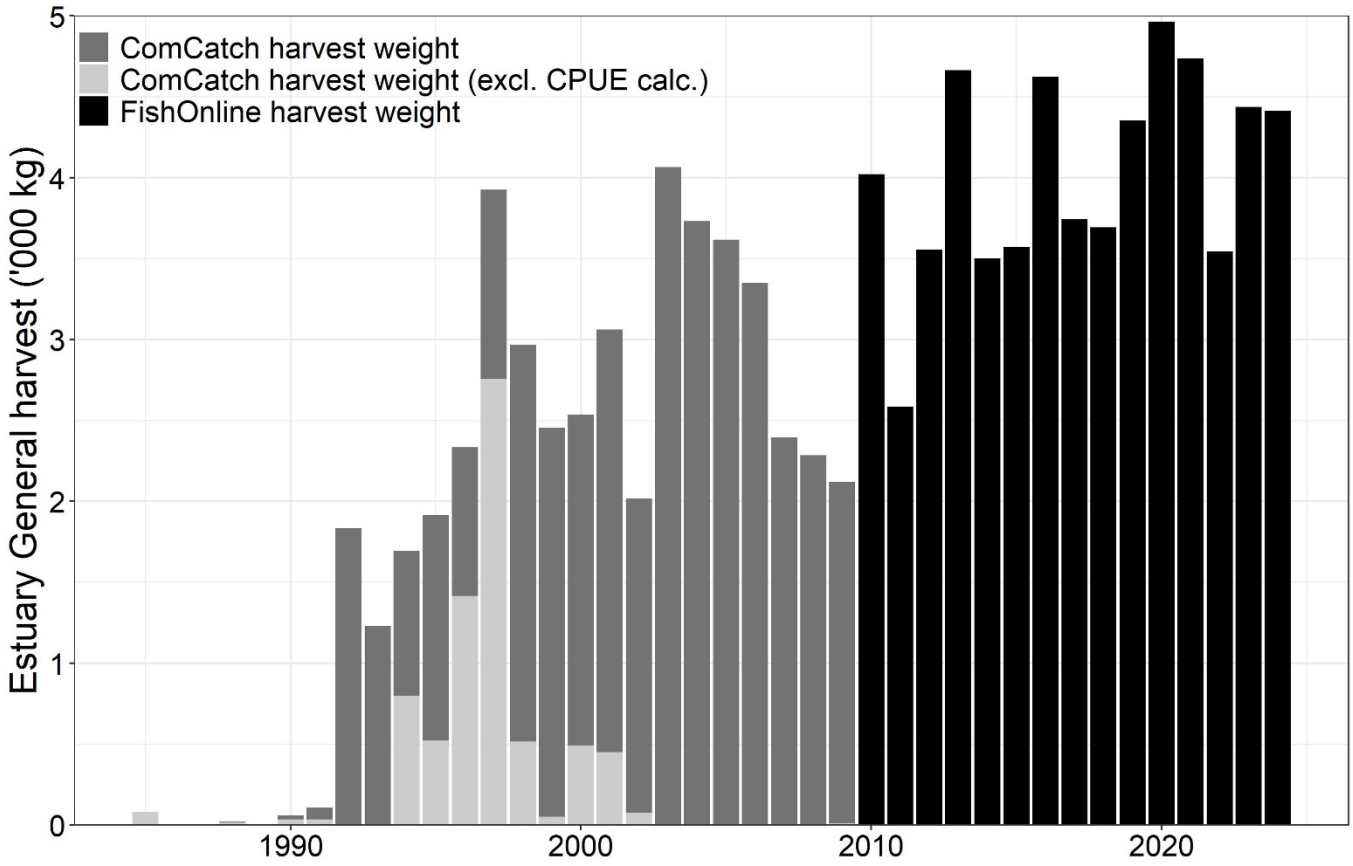

Figure 1 Total annual Ghost Nipper harvest reported for the Estuary General Fishery (i.e., excluding the NSW Charter Fishery) within NSW from FY1985 – FY2024. Data derived from different catch reporting systems (ComCatch and FishOnline) are indicated in the figure legend, as are harvest volumes that were excluded from catch rate calculations presented in Figure 3.

Recreational and charter boat

Recreational fishers either catch Ghost Nipper or purchase commercially-caught Ghost Nipper for bait. In NSW, recreational fishers require a recreational fishing licence (unless exempt) to fish, including to harvest Ghost Nipper. Recreational harvest is limited to a bag limit of 100 Ghost Nipper per fisher. Estimates of recreational harvest (total number retained) are available from the National Recreational and Indigenous Fishing Survey (FY2001, Henry and Lyle, 2003), and more recently through ongoing surveys of harvest by NSW long-term Recreational Fishing Licence (ltRFL) holders and their household members, through the Recreational Fisheries Monitoring Program (RFMP). These surveys provide estimates of harvest in 2013/14 (West *et al.*, 2015), and then biennially from 2017/18-2021/22 (Murphy *et al.*, 2020; Murphy *et al.*, 2022, 2024).

In 2000/01, the recreational harvest (kept numbers) of Ghost Nipper in NSW was estimated to be 3.03 million individuals (±0.45 million SE; Henry and Lyle 2003). At an average weight of 3 g (whole, live weight, ≥10 mm carapace length, NSW DPI unpublished data), this retained harvest estimate and average weight equates to a total recreational harvest of ~9.1 t (± 1.3 t). In 2013/14, 2017/18, 2019/20 and 2021/22, the statewide survey estimated the recreational harvest of Ghost Nipper was ~1.3 ± 0.4 million, ~0.66 ± 0.16 million, ~0.74 ± 0.16 million individuals, and ~0.67 ± 0.17 million individuals (i.e. ~3.9 t, ~2.0 t, ~2.2 t and ~2.0 t, respectively, Table 1). Calibrations made to the 2013/14 survey expansion, to account for differences in survey design in 2017/18, indicated there was relatively little difference in recreational harvest between the two times (2013/14: 2.4 t ± 0.7 t; Murphy et al. 2020). Estimates of recreational harvest from the raw survey outputs represent 297%, 108%, 50%, 44% and 44% of the reported commercial harvest for each survey year, respectively.

Information collected as part of the 2013/14 survey indicates about half of the total recreational fisheries harvest (0.61 ± 0.24 million SE) occurred during the summer months (December–February), and ~0.75 million animals were harvested from areas on the northern coast of NSW (Port Stephens to Tweed Heads). Recreational Ghost Nipper harvest was estimated at the bioregional level (northern, central and southern) from 2017/18 onwards (Table 1). In 2017/18, 95% of the recreational harvest occurred in the northern and southern bioregions, accounting for 54% and 41% of harvest respectively (Table 1). This contrasts with the distribution of recreational harvest in 2019/20 but is similar to the spatial distribution in 2021/22, where 46% and 31% of the estimated recreational harvest occurred in the northern and southern bioregions, respectively (Table 1). Notably, the central bioregion includes Port Hacking, and consecutive recreational fishing surveys show an increasing percentage of the recreational harvest of Ghost Nipper from this bioregion, from 5% in 2017/18 to 23% in 2021/22.

Estimates of retained harvest across all survey periods, from 2000/01 indicate a decline in the recreational harvest of Ghost Nipper to 2017/18, which may be partially explained by the differences in the survey sample frame but also changes in recreational fishing activity (e.g., increasing availability and use of artificial baits and lures over this period). From 2017/18, estimates of the NSW recreational Ghost Nipper harvest have remained stable at ~2 t y^{-1} and ~46% of the annual commercial harvest.

Table 1 Annual recreational Ghost Nipper harvest (t), for surveys conducted from 2017/18 to 2021/22.

Year	Bioregion	Harvest (t)	Harvest SE (t)	% by Bioregion	% EGF harvest
2017/18	Northern	1.07	0.32	54%	
	Central	0.10	0.05	5%	
	Southern	0.82	0.37	41%	
	Total	**2.0**	**0.7***	**100%**	**50%**
2019/20	Northern	1.68	0.43	75%	
	Central	0.29	0.13	13%	
	Southern	0.25	0.14	11%	
	Total	**2.2**	**0.7***	**100%**	**44%**
2021/22	Northern	0.93	0.29	46%	
	Central	0.45	0.23	23%	
	Southern	0.63	0.34	31%	
	Total	**2.0**	**1.1***	**100%**	**44%**

* estimate from survey total, not the sum of zonal standard error

Indigenous

The benefits (and costs) of fishing to the cultural, broader social, health, wellbeing and prosperity of Indigenous people and communities are substantial (Voyer *et al.*, 2016). Schnierer and Egan (2016) described a case study in NSW of the impact of management changes on the viability of Indigenous commercial fisher businesses, and the contribution that commercial fishing and aquaculture makes to Indigenous communities. Included in this case study are estimates of the contribution Indigenous commercial fishers make to Indigenous communities, including the contribution of between 5% - 20% of their annual commercial harvest. The contribution made to Indigenous communities by Indigenous commercial fishers was, on average, 9.8% of annual harvest and the contribution from broader Indigenous commercial fishers was greater than that made by fishers in the EGF, with this being a consequence of hand gathering being a "…traditional skill that is widely practiced by coastal families so they can fulfil their own needs." (Schnierer and Egan, 2016). Moreover, Schnierer and Egan (2016) report substantial harvests of hand gathered species (principally Pipi) by Aboriginal fishers that are either not reported in commercial harvest records or reported as 'other' species and went unrecorded as species-specific harvest, and were utilised for personal and community use.

Synthesis of harvest composition from Indigenous cultural fishing in NSW indicated that there are at least 18 species in the EGF that overlap with Indigenous fisheries (Schnierer and Egan, 2016). In a survey based in the Tweed region, annual harvest of Ghost Nipper by Indigenous fishers was estimated at between 1,774 and 4,166 individuals (Schnierer, 2011). Based on this estimate and an average weight of 3 g, Aboriginal harvest in the Tweed River Region of NSW would be <15 kg y^{-1}. Schnierer (2011) described Ghost Nipper as among the top 10 most culturally important species, and consisted of between 11% and 5% of the total cultural harvest of invertebrates and total numbers of all species, respectively. Cultural harvest of bait including Ghost Nipper was also seen to be important in delivering economic benefits to the community (Schnierer, 2011).

Illegal, Unregulated and Unreported

The level of total Illegal, Unregulated and Unreported (IUU) fishing has not been quantified.

There are anecdotal reports of IUU fishing occurring at the scale of estuary, related to minor incidents in both the commercial and recreational fishing sectors. NSW Fisheries Compliance provide annual summaries of seizures of fish and invertebrates due to non-compliance (https://www.dpi.nsw.gov.au/fishing/compliance/fisheries-compliance-enforcement). These reports indicate regular seizures of Ghost Nipper in many of the years from FY2011 to FY2023 (no public report is available for FY2024). Annual seizures have ranged between 1,363 and 8,900 individual Ghost Nipper (the equivalent to ~4 kg – 27 kg in any year).

Fishing effort information

During the period FY1985-FY1997 fishers were required to report their catch monthly and effort (in days fished) by gear type, not linked to catch unless only a single gear type was used (and then not even linked to species catch within a gear type). Therefore, prior to FY1998 reported fisher-days attributed to hand gathering within the EGF cannot be specifically allocated to harvest of a particular species, and reflects the total fisher-days reported for hand gathering by the fisher for each month where one method was reported and the species of interest was also reported in that

month. Estimated annual effort in fisher-days increased from less than 100 days (FY1985–FY1991) to >450 days during the late 1990s (Figure 2). Lower annual fisher-days (<200 d) were reported between FY2002 and FY2009 (Figure 2), which is likely a function of an increased targeting of other hand gathering species (e.g., Pipis) and fewer monthly catches reporting multiple species during this period. In FY2010, reported fisher-days jumped to 495 days, coinciding with the introduction of changes in commercial reporting (and a change from the ComCatch to FishOnline reporting system). These changes required fishers to report hours spent hand gathering for each species, and submit a report for each fishing day. The decline in fisher-days from FY2010 to FY2012 is principally due to a reduction in effort from one regular dominant (by catch volume) fisher. The reported fisher-days over the past 5 years (FY2020 to FY2024) has been highly variable, but is generally higher that the preceding 5 years (FY2015 to FY2019). FY2023 saw the maximum 'daily' reported effort in the available timeseries — 596 fisher-days.

Effort in reported fisher-hours (from the implementation of FishOnline in FY2010, Figure 2) was comparatively stable from FY2010 to FY2020, at around ~1,750 hr (range 1,514–2,398 h), with the exception of a spike in FY2014, of 2,398 hours which coincided with new entrants to the fishery and their fishing in previously unfished estuaries (e.g., Shoalhaven/Crookhaven River). Recent spikes in fisher-hours over the past 5 years coincides with the activity of new authorised fishers to the fishery accounting for ~35% of the total hours in those years. There has also been sporadic fishing, reporting between 5 and 50 hrs, in estuaries other than the top four previously noted this report. In FY2024, 2,471 fisher-hours were reported, which represents the highest effort on record in terms of fisher-hours. Over the FishOnline reporting series, there was only a weak relationship between fisher-hours and fisher-days (fisher-days explains only 12% of the variation in fisher-hours, Figure 2), which suggests that there may be some reporting inaccuracy within the timeseries.

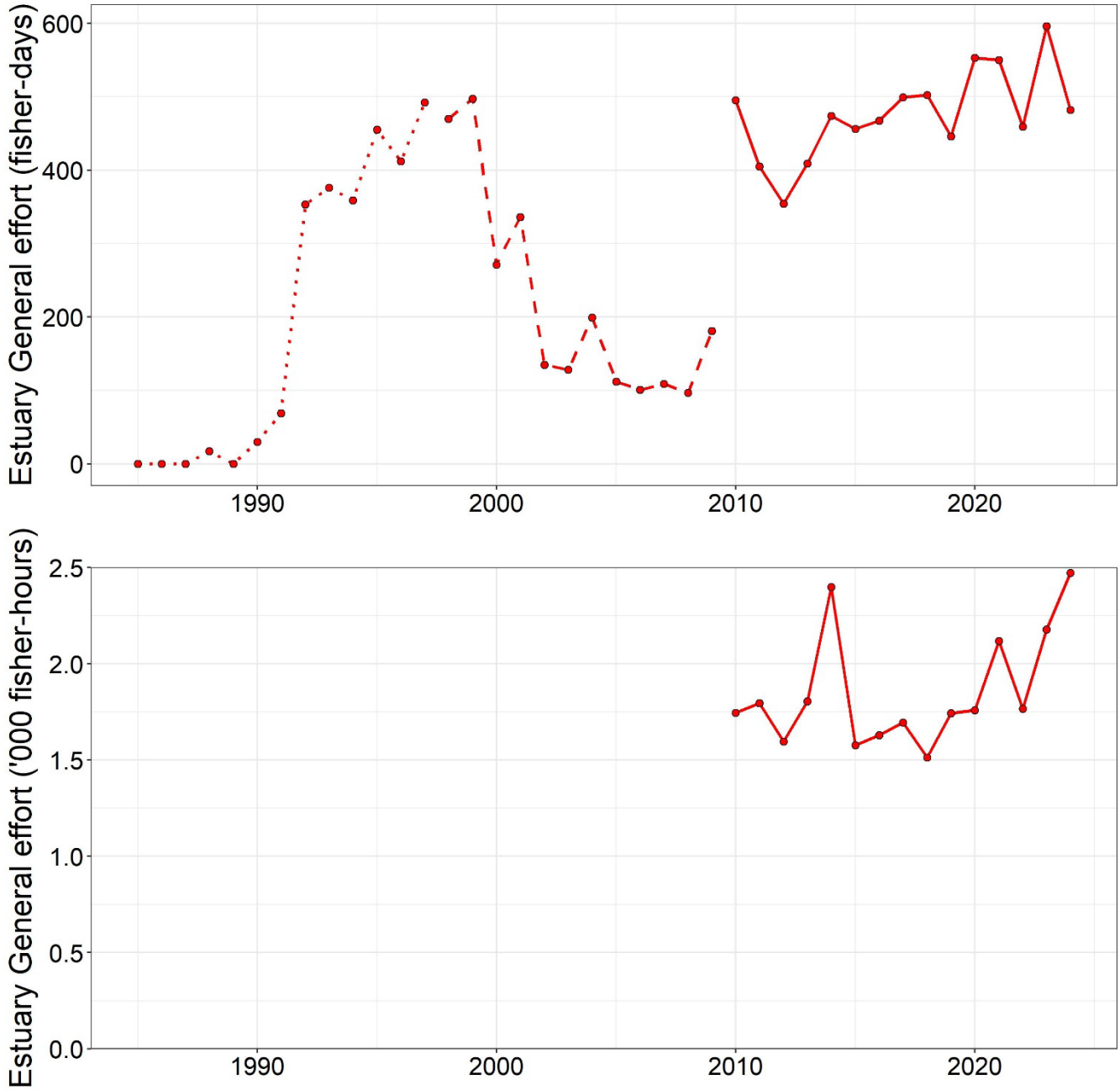

Figure 2 Annual hand-gathering effort associated with EGF Ghost Nipper harvest within NSW from FY1985 – FY2024, reported as fisher-days (upper panel) and fisher-hours (lower panel). Effort associated with harvest of Ghost Nipper for the early ComCatch timeseries is presented as a dotted line, whereas effort associated with the later ComCatch and FishOnline timeseries is presented as a dashed line and solid line respectively. Note these values exclude effort reported in the NSW Charter Fishery, and no fisher-hour data is available prior to FY2010.

Catch rate information

Catch rate in terms of harvest per fisher-day (catch-per-unit-effort, $CPUE_d$) is a problematic index to estimate and interpret prior to FY2010, due to the reporting issues for the effort time series outlined above. Using daily effort calculated as explained above, three distinct time periods, with different trends, can be distinguished (Figure 3). $CPUE_d$ increased from <10 kg d^{-1} (FY1985–FY2001) to a maximum of 33 kg d^{-1} in FY2006 — this was most likely due to fewer multispecies catches being reported per month and substantial under-allocation of effort to Ghost Nipper catch in the

ComCatch reporting series, as opposed to any underlying population changes. Between FY2006 and FY2009, $CPUE_d$ declined substantially, reflecting substantially lower catches and sustained levels of comparatively low effort, again, more likely a function of the challenges in allocating effort to species-specific catches during this period than population changes. Since FY2010 (and the commencement of the FishOnline reporting system), $CPUE_d$ has been comparatively stable (but with substantial within year variation), averaging ~8.4 kg d^{-1} (range 6.4 – 11.4 kg d^{-1}) and remained around the decadal average for the past 5 years (Figure 3).

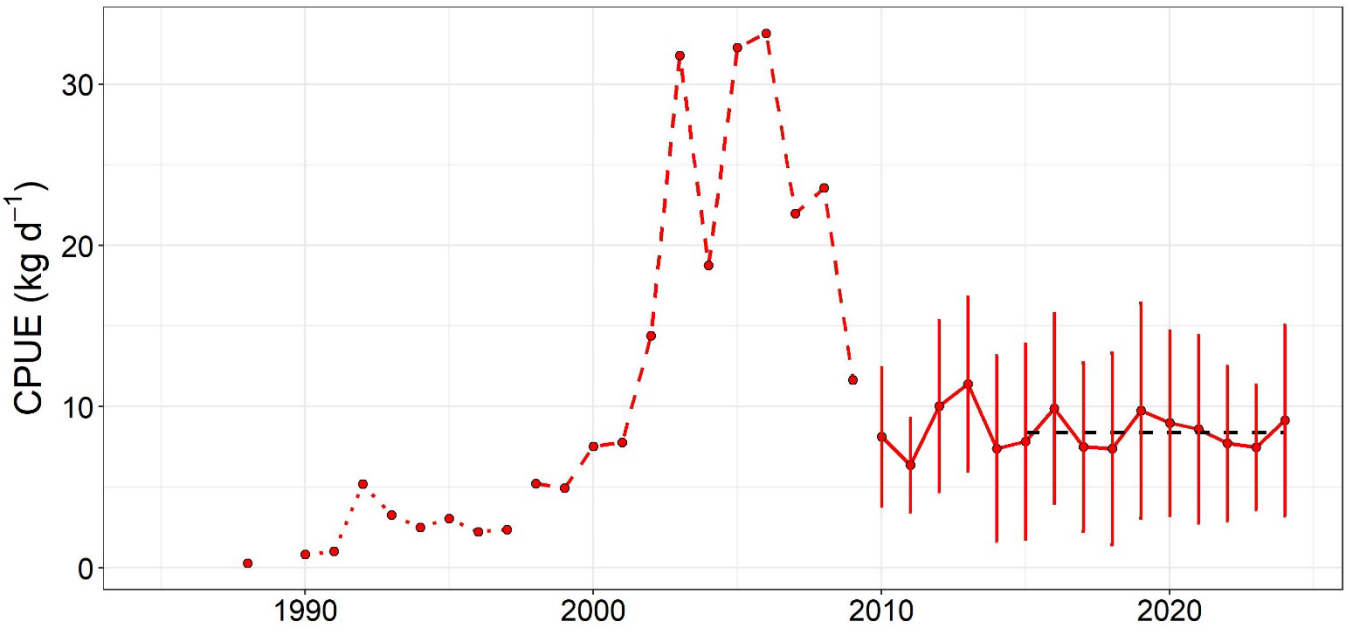

Figure 1. Average annual nominal Ghost Nipper catch-per-unit-effort ($CPUE_d$) within NSW from FY1985 – FY2024, aggregated and calculated at the statewide level. Calculations for the early ComCatch timeseries are presented as a dotted line, whereas the later ComCatch and FishOnline timeseries are presented as a dashed line and solid line respectively. Error bars reflecting one standard deviation are included for the FishOnline data series. The horizontal black dashed line indicates the most recent 10-year average.

Estuary-specific catch rates calculated using hourly effort data ($CPUE_h$) in Port Hacking were standardised using a general linear model that included variables *Year*, *Month* and *Fisher*. Nominal (nCPUE) and standardised catch rates (sCPUE) did not show any substantial divergence, with changes through time consistent in both series of data (Figure 4). Catch rates generally increased in the early part of the time series from FY2010 to a peak in FY2016, with above-average catch rates consistently observed from FY2015 to FY2020. Within the last three years, however, catch rates in Port Hacking have declined from recent historical highs to below the long-term average (Figure 4).

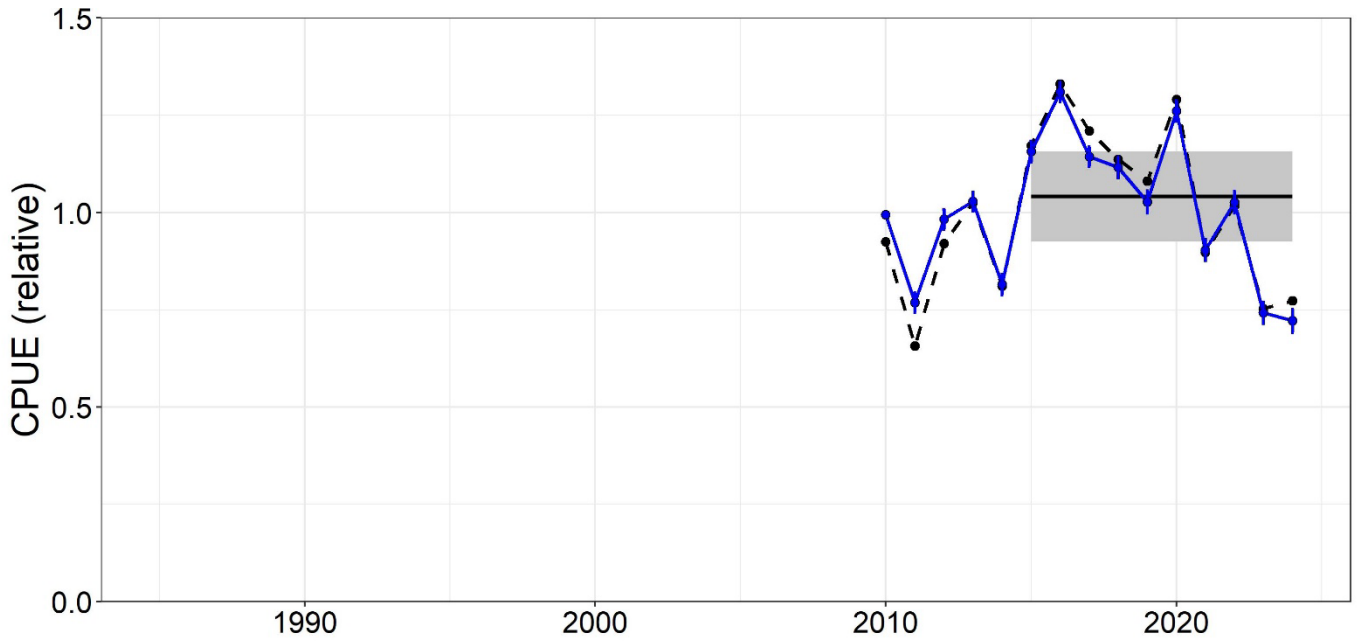

Figure 2 Ghost Nipper catch-per-unit-effort ($CPUE_h$) within for Port Hacking NSW, calculated for the FishOnline timeseries (FY2010-FY2024). Standardised (sCPUE, blue line, with standard errors indicated) and nominal (nCPUE, black line, representing the geometric mean catch-per-unit-effort [CPUE] for each fiscal year) CPUE series are presented. The solid black line indicates the most recent 10-year average, and the grey shaded area indicates the 95% confidence intervals surrounding this mean.

Stock Assessment

Stock Assessment Methodology

Year of most recent assessment:

2024 (using data to the end June 2024)

Assessment method:

Assessment of the NSW Ghost Nipper stock is based on a weight-of-evidence approach. This is done as the available data do not support a model-based stock assessment.

Main data inputs:

- Commercial harvest by NSW EGF for the period FY1985 to FY2024
- Nominal Ghost Nipper statewide commercial catch rate ($CPUE_d$) in the NSW EGF for the period FY1985 to FY2024
- Standardised Ghost Nipper commercial catch rate ($CPUE_h$) in the NSW EGF in Port Hacking for the period FY2010 to FY2024
- Harvest by the NSW Recreational Fishery in the periods 2000/01, 2013/14, 2017/18, 2019/20, 2021/22
- Fishery-independent survey-based estimates of biomass (2015/16 and 2016/17)

Data interpreted at statewide, regional and estuary scales.

Key model structure & assumptions:

Standardised catch rates calculated using the rforcpue package (https://github.com/haddonm/rforcpue) as a relative index of abundance, noting the assumption that these are not unduly influenced by factors other than those accounted for through standardisation.

Sources of uncertainty:

General data limitations and uncertainty were considered in the weight-of-evidence approach.

There is some uncertainty in the assessment and determination of stock status, these are detailed in Chick (2024) and summarised here to include: i) knowledge gaps regarding the dynamics of Ghost Nipper populations, their response to fishing and non-fishing pressures and connectivity within and among estuaries; ii) commercial fishery-dependent data, derived from relatively few locations and assumed to be representative of the broader stock; iii) recreational fishery data from moderately different sampling frames through time and with limited spatial resolution (not estuary level); iv) the influence of management arrangements (past and recent), on the utility and reliability of commercial fishery data — in particular, recent changes have allowed unlicensed (unendorsed) 'crew' to harvest Beachworms with an endorsement holder, and it is not clear whether additional effort has been systematically captured (e.g., if an unendorsed person contributed to the fishing activity) through logbook reporting; and v) unknown or unaccounted for factors influencing the available data and unrelated to abundance (e.g., economic/market and social factors), or directly influencing population abundance and productivity (e.g., environmental variables) and that are generally unaccounted for in the assessment.

Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	None specified This assessment used a weight-of-evidence approach, with data including: • Nominal (commercial) $CPUE_d$ (statewide) • Standardised $CPUE_h$ (Port Hacking) • Fishery independent survey estimates of *B* (2015/16, 2016/17)
Biomass Limit Reference Point	None specified
Biomass Target Reference Point	None specified
Fishing mortality indicator or proxy	None specified This assessment used a weight-of-evidence approach, with data including:

	• Harvest (commercial and recreational; statewide, regional and estuary, where available)
Fishing mortality Limit Reference Point	None specified
Fishing Mortality Target Reference Point	None specified

Stock Assessment Results

The NSW stock status of Ghost Nipper is classified as **sustainable**. This classification is consistent with definitions within the Status of Australian Fish Stocks (SAFS) national reporting framework (www.fish.gov.au/). The weight-of-evidence provided supports an understanding that the biomass of Ghost Nipper is at a level sufficient to ensure that on average, future levels of recruitment are adequate and fishing mortality is at a level to avoid the stock being recruitment impaired. However, recent trends in fishery-dependent data provide a reduced level of confidence in the status determination to previous assessments and indicate a potential decline in the abundance of Ghost Nipper from historically important areas. This statewide classification is determined as an aggregate of the information available and interpreted at the statewide and finer spatial scales, with the later generally assumed representative of other parts of the population throughout NSW, for which there are no data.

A weight-of-evidence approach has been taken for this assessment and supports a stock status determination of 'sustainable' for the NSW Ghost Nipper stock. This classification is supported by:

i) knowledge of Ghost Nipper stock structure and species biology indicating a panmictic stock is likely, and that animals at a local (estuary) scale are generally resilient to processes affecting abundance (i.e., highly fecund, relatively short lived and small size-at-maturity);

ii) statewide levels of catch that have generally continued to increase since FY2010, with nominal catch rates that have been relatively stable, at or above long-term average levels for most years since FY2016;

iii) statewide nominal $CPUE_d$ has been stable with little variation over the past 10 years;

iv) catches and standardised $CPUE_h$ from Port Hacking (that has consistently contributed >90% to statewide annual catch). Catch rates have generally been at or above long-term average levels in 6 of the last 10 years. However, catch rates over the last 4-years (FY2021 – FY2024) have been below average, potentially due to exceptionally high rainfall for the majority of this period (e.g., Rotherham and West, 2007). Nonetheless, catch rates were stable between FY2023 and FY2024, and high catch levels were maintained in this estuary over both of these years

v) reduced uncertainty regarding levels of recreational catch and its spatial distribution; and

vi) historical independent surveys of nipper population structure and density from Port Hacking and Shoalhaven River (in 2015/6 and 2016/17) that indicated biomass levels capable of sustaining known catches with high confidence (importantly noting that

confidence in these data to support a current stock status of sustainable is low and declines as time between the survey and current assessment increases).

Importantly, the persistence of recent trends in standardised catch rate, even with sustained levels of catch would support a change in stock status for Ghost Nipper, and likely warrant further consideration of the spatial assessment of the stock and its management.

Stock Assessment Result Summary

Biomass status in relation to Limit	Weight-of-evidence provided suggests that the biomass of Ghost Nipper is at a level sufficient to ensure that on average, future levels of recruitment are adequate. However, there is some evidence to suggest a decline in biomass since FY2020, but the stock is not yet considered to be recruitment impaired.
Biomass status in relation to Target	Not assessed.
Fishing mortality in relation to Limit	Weight-of-evidence provided suggests that fishing mortality is at a low-enough level to avoid the stock being recruitment impaired.
Fishing mortality in relation to Target	Not assessed.
Current stock status	**Sustainable**

Fishery interactions

Fishing for Ghost Nipper is done by hand with a manual hand pump and hand collection of individuals. Ghost Nipper inhabit sandy substratum often adjoining seagrass habitat and there is anecdotal evidence of fishers (from all sectors) interacting with seagrass habitat.

There are limited, if any interactions with other fisheries and no interactions have been reported between the hand gathering in the EGF and species protected under the Environment Protection and Biodiversity Conservation *Act 1999*.

Stakeholder engagement

EGF stakeholders with hand gathering endorsements were invited to participate in online presentations of fishery assessments for Pipi, Cockles, Beachworms and Nippers on 6 March 2025. Unfortunately, no stakeholders directly involved in the harvest of Ghost Nipper attended, and there was no feedback offered from other stakeholders present at the meeting regarding Ghost Nipper.

Qualifying Comments

While this assessment is for Ghost Nipper across NSW in its entirety, there are no spatially-explicit data available for many of the estuaries where Ghost Nipper are present and harvested. Data available for the assessment, including patterns and statewide levels of catch and catch rate and limited estuary-specific data, are assumed to be representative of, or at least represent a minimum baseline of stock performance for the entire stock. Even with an understanding of a panmictic stock (noting uncertainties with this assumption being based on a study limited to 3 locations along the NSW central-southern coast), biologically functional stocks (estuary scale) are impacted by local factors such that the application of a statewide TAC, without finer spatial scale management of activities (including fishing) impacting on those populations, could result in diminished populations through time.

There is uncertainty in the interpretation of patterns of fishery-dependent and independent data, beyond those issues regarding their individual representivity of changes to the stock. This uncertainty is associated with contrasts in the interpretation of different data sets from the same area. For example, in Port Hacking between FY2016 and FY2017, despite small increases in measures of annual catch rate in FY2017, these changes do not reflect the magnitude of the change in biomass estimated from fishery-independent surveys (Chick, 2024), suggesting catch rate may not accurately reflect changes in abundance (or perhaps less so at high abundances) or surveys may somehow overestimate exploitable biomass.

NSW catch and effort logbook data vary spatially and temporally across different eras, delineated by changes in fisher reporting requirements and other management changes. As outlined above, these changes have resulted in a level of uncertainty in the measures associated with some fishery-dependent data, particularly those related to days of effort (fisher-days), and the integration of these data across different reporting ‘eras’.

The EGF is a multi-species fishery, and hand gathering endorsements allow the harvest of multiple species. Also, the commercial fishery data is sourced from few fishing businesses and authorised fishers. Variation in the composition of fishers through time can influence differences in measures of fishery-dependent data and their utility for inferring fishery performance and stock status, such that changes in these measures may not relate to biological performance of the stock. For example, factors related to economics (e.g., price of other species that can be harvested under the endorsement, operational costs) and fisher’s personal circumstances, may affect larger scale patterns of catch and effort. With the exception of including Authorised Fisher, and other variables, in the catch rate standardisation for Port Hacking, these factors have not been considered in the interpretation of the fishery-dependent data in this assessment, beyond acknowledgement.

Fishery-independent surveys carried out in a number of NSW estuaries, including Port Hacking and Shoalhaven River have demonstrated a methodology and provided outputs describing estimates of biomass, with high confidence, that levels of fishing in those estuaries, for those years, was sustainable and that nipper populations appear resilient to fishing such that current levels of fishing are sustainable. However, given the likely maximum age of Ghost Nipper (4-5 years) and the high variability of population size (seemingly arising due to recruitment variability), the likelihood that survey results from >5-6 years ago provide reliable and relevant information to current stock status is low.

Factors other than fishing, including global phenomena (e.g., COVID-19 and associated social impacts - FAO 2021; and climate change), large scale, statewide disruptions (e.g., natural disasters such as bushfires) and also, more local factors (e.g., flooding, land-use influences and environmental factors), likely influence abundance, catchability and productivity of Ghost Nipper and/or the operations of the fishery. How these factors may influence survival/life history for Ghost Nipper, and the reliability of the available data to inform fishery and stock performance and status, is not well known and are not considered in the assessment beyond their acknowledgement. Influences at local scales are likely to be spatially and temporally variable. Identifying and quantifying (where possible) the likely effect of these otherwise unaccounted for factors in influencing the potential productivity of the nipper fishery (e.g., through a risk assessment) would provide improve context for the impacts of fishing.

References

Chick R.C. (2023) Stock assessment report 2022/23 Estuary General Fishery (Hand Gathering) - Ghost Nipper (*Trypaea austaliensis*). 44 pp.

Chick R.C. (2024) Stock assessment report 2023/24 Estuary General Fishery (Hand Gathering) - Ghost Nipper (*Trypaea austaliensis*). 48 pp.

Conides A.J., Nicolaidou A., Apostolopoulou M. & Thessalou-Legaki M. (2012) Growth, mortality and yield of the mudprawn *Upogebia pusilla* (Petagna, 1792) (Crustacea: Decapoda: Gebiidea) from western Greece. *Acta Adriatica* **53,** 87-103.

Filho J.S.R., Girard T.C. & Frédou F.L. (2013) Population dynamics of the burrowing shrimp *Lepidophthalmus siriboia* Felder and Rodrigues, 1993 (Reptantia: Axiidea: Callianassidae) on the Amazonian coast. *Journal of Crustacean Biology* **33,** 503-511.

Henry G.W. & Lyle J.M. (2003) The national recreational and indigenous fishing survey. 188 pp.

Hewitt D.A. & Hoenig J.M. (2005) Comparison of two approaches for estimating natural mortality based on longevity. *Fishery Bulletin* **103,** 433.

Kirby R.L., Froehlich C.Y., Greaves S., Klanten O.S. & Wong M.Y. (2024) Lack of population structure in an important fishery species of mud shrimp, *Trypaea australiensis*. *Fisheries Management and Ecology* **31,** e12682.

McPhee D. & Skilleter G.A. (2002) Aspects of the biology of the yabby *Trypea australiensis* (Dana)(Decapoda: Thalassinidea) and the potential of burrow counts as an indirect measure of population density. *Hydrobiologia* **485,** 133-141.

Murphy J.J., Ochwada-Doyle F.A., West L.D., Stark K.E. & Hughes J.M. (2020) Survey of recreational fishing in NSW, 2017/18. 208 pp.

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. 80 pp.

Murphy J.J., Ochwada-Doyle F.A., West L.D., Stark K.E., Hughes J.M. & Taylor M.D. (2024) Survey of recreational fishing in NSW, 2021/22. 66 pp.

Rotherham D., , PhD thesis, , 2004. http://ro.uow.edu.au/theses/376 (2004) *Fisheries biology, ecology and recreational harvesting of ghost shrimp (Trypaea australiensis) in south-eastern Australia*. PhD thesis, School of Earth and Environmental Sciences: University of Wollongong, 293 pp.

Rotherham D. & West R. (2007) Spatial and temporal patterns of abundance and recruitment of ghost shrimp *Trypaea australiensis* across hierarchical scales in south-eastern Australia. *Marine Ecology Progress Series* **341,** 165-175.

Schnierer S. (2011) Aboriginal fisheries in New South Wales: determining catch, cultural significance of species and traditional fishing knowledge needs 89 pp.

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.

Voyer M., Barclay K., McIlgorm A. & Mazur N. (2016) Social and Economic Evaluation of NSW Coastal Professional Wild-Catch Fisheries: Valuing Coastal Fisheries. 208 pp.

West L.D., Stark K.E., Murphy J.J., Lyle J.M. & Ochwada-Doyle F.A. (2015) Survey of Recreational Fishing in New South Wales and the ACT, 2013/14. 150 pp.