Department of Primary Industries
Department of Regional NSW

NSW Stock Status Summary – 2023/24

Ghost Nipper (*Trypaea australiensis*)

Assessment Authors and Year

Chick, R.C. 2024. Stock assessment report 2023/24 – Estuary General Fishery (Hand Gathering) – Ghost Nipper (*Trypaea austaliensis*). NSW Department of Primary Industries. Fisheries NSW, Port Stephens Fisheries Institute. 48 pp.

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 supports an understanding that the biomass of nippers 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 small decline in the abundance of nippers from historically important areas.

Stock structure & distribution

Stock size and structure of NSW 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 nippers 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, nippers in NSW are assumed to constitute a single management unit.

Despite the inference of panmixia derived from Kirby et al. (2024) local-scale biological processes are likely impacted by human activities, including fishing, resulting in changes to local populations. It is also possible that dominant oceanographic processes, influencing Nipper dispersal, would necessitate considerate management of primary sources of nippers acting as a source or sources of future recruitment.

Scope of this assessment

This stock status summary presents information and results from 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 Nippers; 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 the current understanding of stock structure and available data do not support a reliable model-based stock assessment.

Biology

Nippers 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, with more southern populations maturing at smaller sizes and becoming ovigerous

earlier than those further north (Rotherham 2004). Although this is in contrast with findings of McPhee and Skilleter 2002, at Morten Bay, Qld, where females were ovigerous at 3 mm CL. 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 year^{-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} have been estimated, although with high levels of uncertainty (Rotherham 2004). Nonetheless, the estimates of M are consistent with those for other burrowing mud prawn species (*Upogebia pusilla* M = 0.9, Conides et al. 2012; *Lepidophthalmus siriboia* lower M = 1.7, Filho et al. 2013), and with M = 1.1 estimated using 'Hoenigs method' for a maximum age of 4 years (Hewitt and Hoenig 2005).

Fishery statistics

Catch information

Commercial

State-wide fishery catch increased to ~2 t from 1984/85 to 1994/95 and ranged between 2 t and 4 t from 1995/96 and 2008/09. Since 2009/10, annual reported commercial catches have generally continued to increase, with ~5 t being harvested in 3 out of the last 7 years, with 4.5 t harvested in 2022/23. Since 2009/10, annual catches have consistently been dominated with catch from one estuary, Port Hacking (average 92% total catch.yr^{-1}). Since 2013/14, relatively small (~100 kg) but consistent catches have been reported from the Shoalhaven/Crookhaven River and sporadic catches (<~400 kg.yr^{-1}) from the Myall and Hawkesbury Rivers and within the last 3 years annual catches <160 kg.yr^{-1} have been harvested from the Karuah River. The relatively low catch in 2010/11 can mostly be explained by the unusually low catch of a regular, dominant (by catch) fisher who reported an annual harvest in that year <50% of their average annual catch. Since 2019/20, with the introduction of the TAC (5.6 t), annual catch has been ≥4.5 t and at or among the highest levels reported in the fishery (Figure 1). Importantly, patterns of change in annual catch for the State-wide fishery (since 2009/10) are not necessarily consistent with patterns of catch at finer spatial scales.

Since 2009/10, annual catches of nippers from Port Hacking have contributed an average of 92% (range 86% – 99%) to the total State-wide annual catch. Port Hacking and the Shoalhaven/Crookhaven River are the only two estuaries that have supported relatively consistent levels of commercial catch since 2009/10 and 2013/14, respectively.

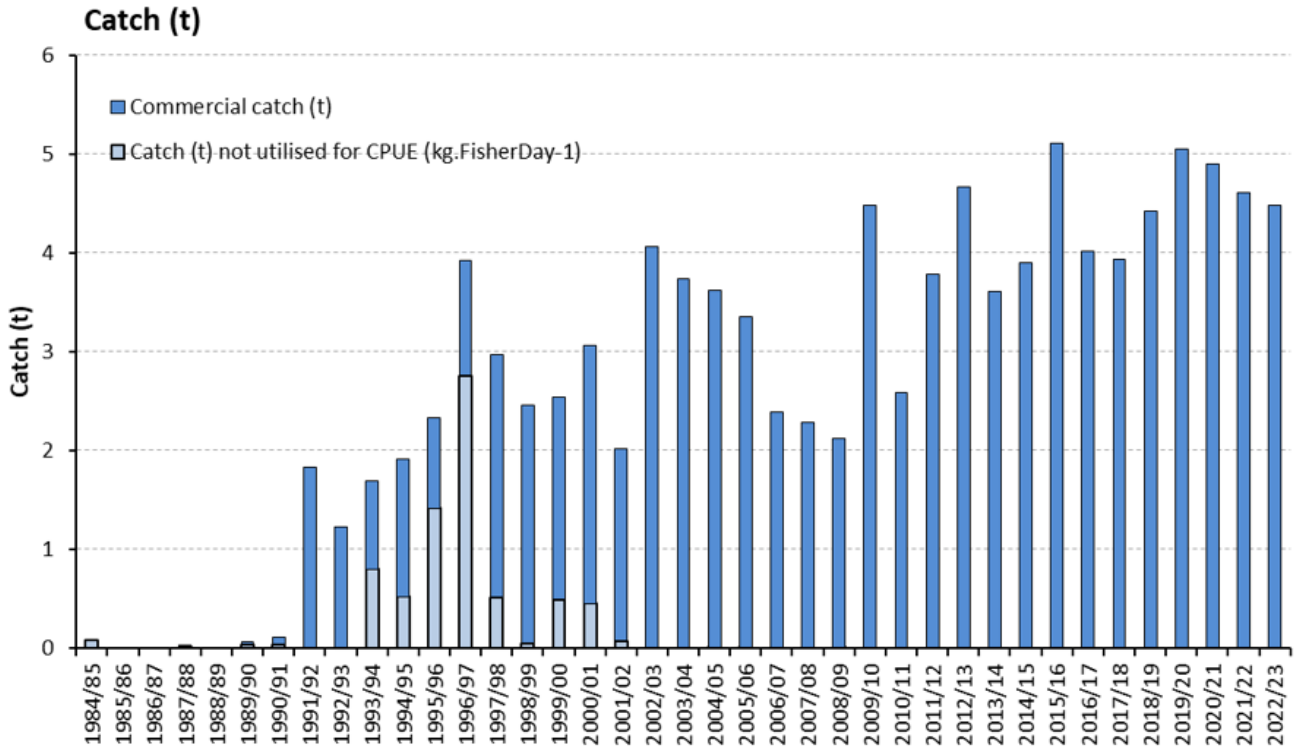

Figure 1. Annual commercial catch (t) of Ghost Nippers, from 1984/85 to 2022/23.

Recreational & Charter boat

Recreational fishers either catch nippers or purchase commercially caught nippers for bait. In NSW, recreational fishers require a recreational fishing licence (unless exempt) to fish, including the harvest of nippers. Each recreational fisher is limited to a bag limit of 100 nippers. Estimates of recreational catch (total number retained) are available from the National Recreational and Indigenous Fishing Survey (2000/01; Henry and Lyle 2003) and NSW State-wide surveys (2013/14, West et al. 2015; 2017/18, 2019/20 and 2020/21, Murphy et al. 2020, 2022 and 2023, respectively).

In 2000/01, the recreational harvest (kept numbers) of nippers in NSW was estimated to be 3.03 million (±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 State-wide survey estimated the retained recreational catch of Nippers 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). Although, calibrations made to the 2013/14 survey outcomes, to account for differences in survey design in 2017/18, indicate there was relatively little difference in recreational catch between the two times (2013/14: 2.4 t ± 0.7 t; Murphy et al. 2020). Estimates of recreational catch from the raw survey outputs represent 297%, 108%, 50%, 44% and 44% of the reported commercial catch for each survey year, respectively.

Information collected as part of the 2013/14 survey indicates about half of that catch (0.61 ± 0.24 million SE) was harvested in the summer months (December–February), and ~0.75 million harvested from areas on the northern coast of NSW (Port Stephens to Tweed Heads). The 2019/20 State-wide survey data supports estimates of the spatial distribution of the estimated recreational catch into three Bioregions i.e. a scale larger than coastal zones available for the 2017/18 survey, as reported in Chick et al. (2021). Recreational catch (retained) of nippers from the 2017/18, 2019/20 and 2021/22 recreational surveys are presented at the scale of Bioregions in Table 1. In 2017/18, 95% of the recreational catch was harvested from Bioregions 1 and 3, with each accounting for 54% and 41%, respectively (Table 1). This contrasts with the distribution of recreational catch in 2019/20 but is similar to those distributions in 2021/22, where 46% and 31% of the estimated recreational catch was harvested from Bioregions 1 (Northern) and 3 (Southern), respectively (Table 1). Notably, Bioregion 2 (Central) includes the estuary Port Hacking, with consecutive recreational fishing surveys showing an increasing percentage of the recreational harvest of nippers from this bioregion, from 5% in 2017/19 to 23% in 2021/22.

Estimates of retained catch across all survey periods, from 2000/01 indicate a marked decline in the recreational catch of nippers 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 the time period). From 2017/18, estimates of the State-wide recreational catch of nippers has remained stable at ~2 t.yr-1 and ~46% of the annual commercial harvest.

Table 1 Annual commercial catch (t) of Ghost Nippers, from 1984/85 to 2022/23.

Year	Bioregion	Zone name	Retained catch (t)	Retained SE (t)	Percent Rec. catch	Percent Comm. Catch
2017/18	1	Northern	1.07	0.32	54%	
	2	Central	0.10	0.05	5%	
	3	Southern	0.82	0.37	41%	
	Total		**2.0**	**0.7***	**100%**	**50%**
2019/20	1	Northern	1.68	0.43	75%	
	2	Central	0.29	0.13	13%	
	3	Southern	0.25	0.14	11%	
	Total		**2.2**	**0.7***	**100%**	**44%**
2021/22	1	Northern	0.93	0.29	46%	
	2	Central	0.45	0.23	23%	
	3	Southern	0.63	0.34	31%	
	Total		**2.0**	**1.1***	**100%**	**44%**

* estimate from survey total not sum of zonal standard error

Indigenous

The benefits (and costs) of fishing generally and professional fishing to the cultural, broader social, health, wellbeing and economic value to Indigenous people and communities are substantial (Voyer et al. 2016). Schnierer and Egan (2012) described a case study in NSW of the impact of management changes on the viability of Indigenous commercial fisher businesses and the contribution 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 catch. The contribution made to Indigenous communities by Indigenous commercial fishers was, on average, 9.8% of annual catch and the contribution from broader Indigenous commercial fishers was greater than that made by fishers in the EGHG fishery, 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 2012). Moreover, Schnierer and Egan (2012) report substantial harvests of hand gathered species (principally Pipi) by Aboriginal fishers that were either not reported in commercial catch records or reported as 'other' species and went unrecorded as species specific catches, and were utilised for personal and community use.

Synthesis of catch composition from Indigenous cultural fishing in NSW indicated that there are at least 18 species in the Estuary General Fishery that overlap with Indigenous fisheries (Schnierer and Egan 2016). In a survey based in the Tweed region, annual catch of nippers by Indigenous fishers was estimated at between 1,774 and 4,166 (Schnierer 2011). Based on an average weight of 3 g, the catch from Aboriginal fishers in the Tweed region in NSW is estimated at <15 kg.year-1. Schnierer (2011) described nippers as among the top 10 culturally most important species and consisted of between 11% and 5% of the total cultural catch of invertebrates and total numbers of all species, respectively. Total effort estimated from this area for the Aboriginal fishery was 542 hours or 92 days (Schnierer 2011). Cultural catch of bait including nippers was also seen to be important in delivering economic benefits to the community (Schnierer 2011).

Illegal, Unregulated and Unreported

The level of 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 nippers in many of the years from 2010/11 to 2021/22 (no public report is available for 2022/23). Annual seizures have ranged between 1363 and 8900 individual nippers (the equivalent to ~4 kg – 27 kg in any year).

Fishing effort information

Estimated effort in FisherDays ($effort_{dy}$) increased from less than 100 days (1984/85–1990/91) to >450 days during the late 1990s (Figure 2). Noting that during this period 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 linked to species catch within a gear type. Therefore, prior to 1997/98 total $effort_{dy}$ reported within the EGHGF cannot be allocated to a species catch and is the total $effort_{dy}$ reported by the EGHG fisher for each month where one method was reported and the species of interest was also reported in that month. In 1998/99, 497 days were reported, a historical maximum. $Effort_{dy}$, declined substantially over the following 3 years, to 135 days in 2001/02. From 2001/02 to 2008/09, $effort_{dy}$ remained below 200 days (Figure 2). The decline in days fished coincided with changes to commercial fishery reporting requirements and the difficulty in allocating effort to catch, as effort was linked to fishing method, irrespective of the catch reported. The substantial decline in $effort_{dy}$ is likely a function of an increased targeting of other species (e.g. Pipis) and fewer monthly catches of multiple species (including Nippers). In 2009/10, reported $effort_{dy}$ was 495 days, coinciding with the introduction of changes in commercial reporting, with fishers required to report hours spent hand gathering for each species and per fishing day, reported at finer spatial scales. The change in $effort_{dy}$ from 2009/10 to 2010/11 is principally due to a reduction in effort from one regular dominant (by catch) fisher (as described above for catch). Since 2013/14, the number of days fished per year has generally increased, with ≥500 $effort_{dy}$ reported in 2019/20, 2020/21 and 2022/23, to the highest levels of $effort_{dy}$ reported in the fishery (596 days).

Effort in reported hours fished ($effort_{hr}$) was relatively stable from 2009/10 to 2019/20, averaging ~1750 hr (range 1514–2398 hr), with the exception of a spike in 2013/14, of 2398 hours, coinciding with new entrants to the fishery and their fishing previously unfished estuaries (e.g. Shoalhaven/Crookhaven). Recent spikes in $effort_{hr}$, in 2020/21 and 2022/23, of 2185 hr and 2177 hours, respectively, coincide 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 presented in this report. In 2022/23, $effort_{hr}$ was 2177 hours, and very similar to total hours in 2020/21 (Figure 2).

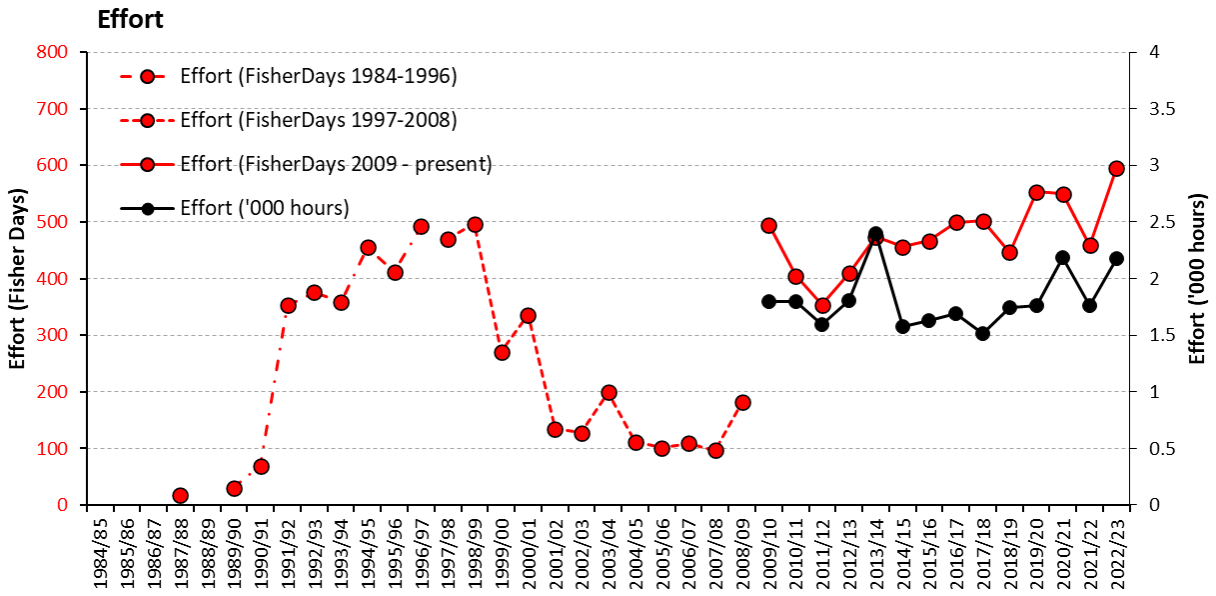

Figure 2. Total annual commercial effort (days and hours) fishing for Ghost Nippers from 1984/85 to 2022/23.

Catch rate information

Catch per FisherDay ($CPUE_{dy}$) is a problematic index to estimate and interpret prior to 2009/10, for reasons outlined for the $effort_{dy}$ time series (above). Using daily effort calculated as explained above, three distinct time periods, with different trends, can be distinguished (Figure 3). $CPUE_{dy}$ increased from less than 10 $kg.day^{-1}$ (1984/85–2000/01) to a maximum of 33 $kg.day^{-1}$ in 2005/06, likely due to fewer multispecies catches per month and substantially less allocated daily effort than any underlying population changes. Between 2005/06 and 2008/09, daily catch rate declined substantially, reflecting substantially lower catches and sustained levels of relatively low effort, again, more likely a function of the challenges in allocating effort to species specific catches during this period than population changes. Since 2009/10 (the first year of current commercial fisher reporting requirements), daily catch rate has been relatively stable (with substantial within year variation), reflecting similar increases in levels of catch and effort through the years, has averaged ~9 $kg.day^{-1}$ (range 6.4 – 11.4 $kg.day^{-1}$) and been at or above long-term average levels in 4 of the last 5 years. In 2022/23, the average daily catch rate was 7.5 $kg.day^{-1}$, below the long-term average and the second lowest level since 2009/10 (Figure 3).

Since 2009/10, annual estimates of catch (kg) per hour ($CPUE_{hr}$) have averaged 2.4 $kg.hr^{-1}$ (range 1.5–3.3 $kg.hr^{-1}$), with substantial within year variation, and has remained relatively stable, despite exceptions in 2010/11 and 2013/14 when $CPUE_{hr}$ was 1.4 and 1.5 $kg.hr^{-1}$, respectively (Figure 3). More recently, $CPUE_{hr}$ has declined from a historical peak of 3.3 $kg.hr^{-1}$ (in 2015/16) to its lowest level since then, of 2.1 $kg.hr^{-1}$ (in 2022/23). And, while 7 of the last 9 years of State-wide levels of $CPUE_{hr}$ have been at or above long-term average levels, those 2 years below the long-term average have been within the last 3 years (Figure 3). As described for the substantial changes in the hourly effort and catch series, the anomalous $CPUE_{hr}$ levels in 2010/11 and 2013/14, coincide with and partially reflect changes in the composition of fishers between years, the spatial distribution of catch and effort among estuaries and reductions in effort and catch within these years by a dominant individual fisher. Importantly, and as similarly described for fishery-wide levels of catch, change in levels of fishery-wide effort and $CPUE_{hr}$ are not necessarily consistent with patterns at smaller spatial scales.

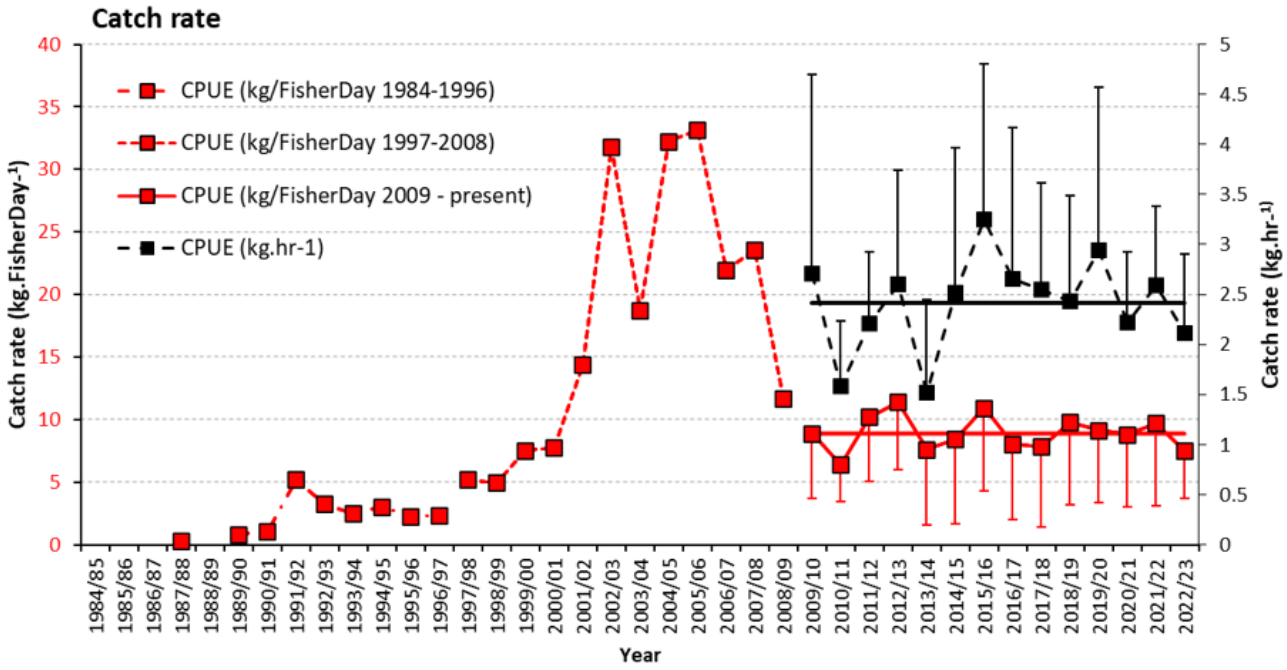

Figure 3. Average annual catch rate ($kg.hr^{-1}$ and $kg.FisherDay^{-1}$, plus or minus one standard deviation from 2009/10) from 1984/85 to 2022/23. Horizontal black and red lines represent average annual catch rate ($kg.hr^{-1}$ and $kg.day^{-1}$, respectively) from 2009/10.

In Port Hacking, patterns of nominal ($CPUE_{hr}$) and standardised catch rate ($sCPUE_{hr}$) do not show any substantial divergence, with changes through time consistent in both series of data (Figure 4). Catch rates generally increased since the early part of the time series from 2009/10, with those from 2014/15 to levels at or above the long-term average to 2019/20. However, within the last three years, catch rates in Port Hacking have declined from recent historical highs, including that in 2019/20 ($CPUE_{hr}$ 3.5 $kg.hr^{-1}$), to levels at and, in 2022/23, below, the long-term average (Figure 4).

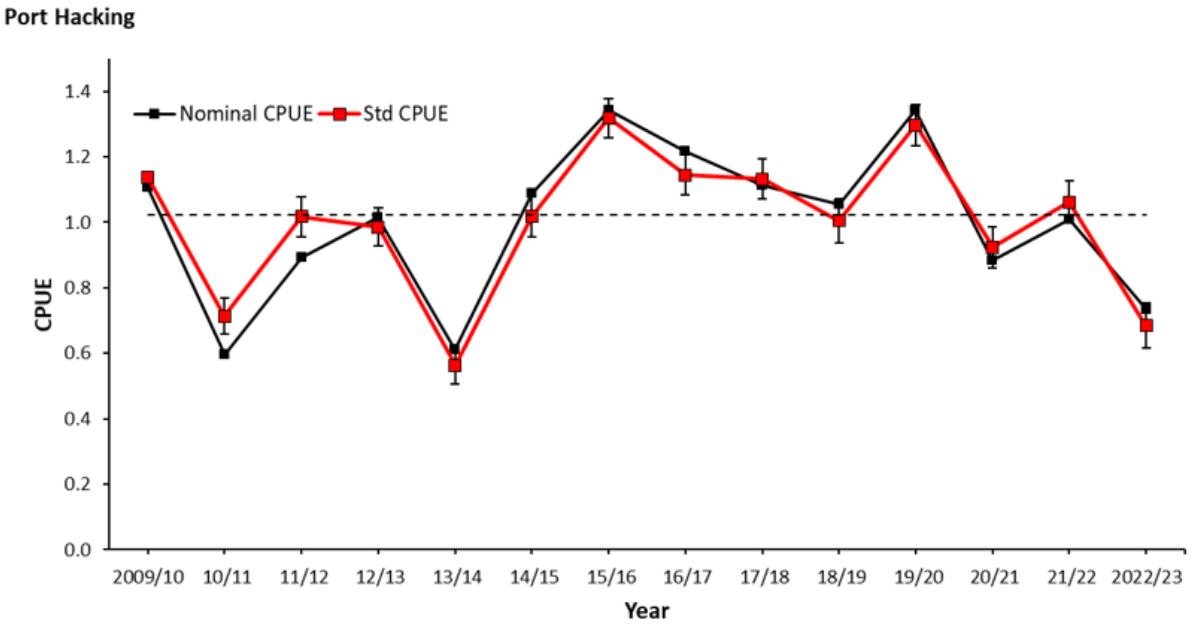

Figure 4. Port Hacking - standardised commercial catch rate (red line with 95% confidence intervals) and nominal catch rate (solid black line) scaled to the 14-year average catch rate (horizontal dashed black line).

Stock Assessment

Stock Assessment Methodology

Year of most recent assessment:

2024 (using data to the end June 2023)

Assessment method:

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

Main data inputs:

- Catch (commercial, NSW EGHG Fishery) (t) – 1984/85 to 2022/23
- Standardised and nominal commercial catch rate (NSW EGHG Fishery and Port Hacking) – 2009/10 to 2022/23
- Catch (NSW Recreational Fishery) (t) 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 state-wide, regional and estuary scales.

Key model structure & assumptions:

Standardised catch rates (using cede v. 0.04) (Haddon, 2018). Assumption: annual catch rates are a relative index of abundance not unduly influenced by factors other than those accounted for through standardisation.

Sources of uncertainty:

General data limitations and uncertainty was 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) remaining knowledge gaps regarding the dynamics of biologically functional populations, their response to fishing and non-fishing pressures and their relationship to the likely panmictic

genetic stock structure; 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 present) on the utility and reliability of commercial fishery data, including levels of fishing activity unrelated to the abundance of nippers; 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) $CPUE_{hr}$ (state-wide and estuary) • Nominal (commercial) $CPUE_{dy}$ (state-wide) • Standardised CPUE (estuary - 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: • Catch (commercial and recreational; state-wide, 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 nippers 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/; Piddocke et al 2021). The weight of evidence provided supports an understanding that the biomass of nippers 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 small decline in the abundance of nippers from historically important areas. This State-wide classification is determined as an aggregate of information available and interpreted at the State-wide and finer spatial scales, with the later generally assumed representative of other populations 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) an understanding of stock structure and species biology indicating the likelihood of a panmictic stock but populations influenced at a local (estuary) scale that are resilient to processes affecting abundance (i.e. highly fecund, relatively short lived and small size-at-maturity);

ii) State-wide levels of catch that have generally continued to increase since 2009/10, with catch rates ($CPUE_{dy}$ and $CPUE_{hr}$) that have been relatively stable, at or above long-term average levels since 2015/16;

iii) catches and standardised catch rates ($sCPUE_{hr}$) from Port Hacking (that has consistently contributed >90% to State-wide annual catch) that have generally been at or above long-term average levels in 8 of the last 9 years, with catch maintained among historically high levels (~4 $t.yr^{-1}$) between 2018/19 and 2021/22, but whilst understanding catch and $sCPUE_{hr}$ have recently declined and are among the lowest levels for at least the last 6 years;

iv) catches from Shoalhaven/Crookhaven River have been consistent and relatively stable since 2013/14 (albeit relatively low, ~100 $kg.yr^{-1}$) and harvested at increasing catch rates, above the long-term average;

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).

Stock Assessment Result Summary

Biomass status in relation to Limit	No biomass limits has been set. Weight of evidence provided supports an understanding that the biomass of nippers is at a level sufficient to ensure that on average, future levels of recruitment are adequate. However, for the period 2018/19 to 2022/23, evidence suggests the biomass declined, but the stock is not yet considered to be recruitment impaired.
Biomass status in relation to Target	No biomass target has been set.
Fishing mortality in relation to Limit	No fishing mortality limit has been set. Weight of evidence provided supports an understanding that fishing mortality is at a level to avoid the stock being recruitment impaired.
Fishing mortality in relation to Target	No fishing mortality target has been set.
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 Nippers 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 EGHG Fishery and species protected under the Environment Protection and Biodiversity Conservation *Act 1999*.

Stakeholder engagement

EGHG Fishery stakeholders were invited to participate in online presentations of EGHG Fishery assessments for Pipi, Cockles, Beachworms and Nippers. Unfortunately, no stakeholders directly involved in the harvest of Nippers attended. Issues raised, relevant to the assessment of EGHG Fishery species generally, included those related to: catch and catch reporting, biological issues and observations, fisheries management and IUU fishing and extraneous factors, including environmental (direct and indirect impacts). Detailed descriptions of these issues are outlined in the assessment report (Chick 2024).

Qualifying Comments

The assessment is for the State-wide population(s) of nippers, for the majority of which there are no data. Data available for the assessment, including patterns and levels of catch and catch rate for the State and among key estuaries are assumed to be representative of, or at least represent a minimum baseline of stock performance for all populations, given the relatively high levels of fishing pressure these stocks are exposed to. 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 State-wide 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 2015/16 and 2016/17, despite small increases in measures of annual catch rate in 2016/17, these changes do not reflect the magnitude of the change in biomass estimated from fishery-independent surveys, 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 (see ***Error! Reference source n ot found.*** - ***Error! Reference source not found.***), these changes have resulted in a level of uncertainty in the measures associated some fishery-dependent data, particularly those related to days of effort (FisherDays) and the integration of these data across different eras.

The EGHG fishery is a multi-species fishery with commercial fishery data sourced from relatively 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 use 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. beach price of other species, 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 standardisation of $CPUE_{hr}$ for Port Hacking, these factors have not been considered in 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 nippers (4-5 years) and the high variability of population size, seemingly reliant on recruitment, 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, State-wide disruptions (e.g. natural disasters - bushfires e.g. those in 2019/20) and also, more local factors (e.g. flooding, land-use influences and environmental factors), likely influence abundance, catchability and productivity of nippers and/or the operations of the fishery. How these factors may influence 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 limiting the potential of the nipper fishery (e.g. through a risk assessment) would help inform the relative effects of fishing.

References

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