NSW Stock Status Summary – 2023/24

Sand Whiting (*Sillago ciliata*)

Assessment Authors and Year

Helidoniotis, F., and Schilling, H., 2024. Stock assessment report 2024/25 – Sand Whiting (*Sillago ciliata*). NSW Department of Primary Industries - Fisheries: 35 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Sand Whiting are currently assessed as **sustainable**

Stock structure & distribution

Sand Whiting is distributed from Papua New Guinea to Tasmania and commonly occurs along the east coast of Australia (McKay 1985). It is most abundant in southern Queensland and northern New South Wales (McKay 1985). In NSW, Sand Whiting is found in estuaries and inshore waters off beaches (Hall, 2015). Within estuaries, the favoured habitat is bare sandy substrate. The diet consists of benthic dwelling invertebrates, particularly polychaete worms, crustaceans and molluscs taken by fossicking though the sand. Tagging studies indicate movement of adult fish between estuaries, but information on stock structure and biological stock boundaries is unknown (Hall, 2015).

Scope of this assessment

Sand Whiting are predominantly caught in two commercial fisheries within NSW; the Estuary General Fishery (EGF) and the Ocean Hauling Fishery (OHF). This report is focused on the whole of New South Wales.

The most recent stock assessment for Sand Whiting was in 2024 (Helidoniotis and Schilling 2024). The assessment was conducted to inform the population status of Sand Whiting in New South Wales.

The scope of the current report is to conduct a stock status informed by trends in length frequency data, age composition data, catch-rate (with catch and effort data up to July 2023) and catch curve analysis. This formed that basis for weight-of-evidence determination of Sand Whiting status for Financial Year (FY) 2024.

Biology

Sand Whiting grows to a maximum length of approximately 45-50 cm Total Length (TL) and juveniles grow quite rapidly taking 2 years to reach the legal minimum length of 27 cm (TL, New South Wales 2023) which converts to approx. 25 Fork Length (FL; McKay 1985, Hall 2015). Growth rates differ between females and male. Females grew slightly faster and attained a greater maximum size ($L\infty$ = 33.79 cm LF, k = 0.50 year-1 and t_0 = -0.57 years) than males ($L\infty$ = 29.73 cm LF, k = 0.49 ….year-1 and t_0 = -0.67 years) (Ochwada-Doyle et. al., 2013). Females also matured at a significantly larger size and older age (19.13 cm FL, 1.63 year) compared to males (at 17.07 cm FL and 1.1 years). The maximum reported age was 11 years (Ochwada-Doyle et. al., 2008), however most fish in commercial landings in Queensland and NSW are aged 2-5 years (Hall, 2015). Mortality rates were similar

between females and males; the estimated total population, natural and fishing mortality rates were Z = 0.64, M = 0.42 and F = 0.22, respectively (Ochwada-Doyle et. al., 2013).

Fishery statistics

Information presented in figures and tables below is summarised by fiscal year (July to June) unless otherwise indicated. Reference to 'year' refers to the last year of a fiscal year unless otherwise stated. For example, 2010 refers to the fiscal year 2009/10. Likely misreported catch and effort data were removed prior to analysis.

Catch information

Commercial

Sand Whiting are predominantly caught in two commercial fisheries within NSW; the Estuary General Fishery (EGF) and the Ocean Hauling Fishery (OHF). The majority of the catch (inter-annual range: 50 – 100%) is from the EGF (Figure 1). Landings in the EGF have gradually declined, from 125 t in 1998 to just over 50 t in 2022. There was a marked decrease between 2008 and 2009, (from >150 t to 100 t) and the catch remained below 100 t since 2009. The most frequently used fishing methods in the (EGF) are mesh netting (inter-annual range is predominantly 50-90% of the catch) and haul netting (inter-annual range is predominantly 30 – 50% of the catch, (Figure 2). Historically commercial catches gradually increased from approximately 50 t in 1956 to approximately 150 t in 1980 and remained above 150 t until 2008 before decreasing and remaining below <100 t (Figure 3).

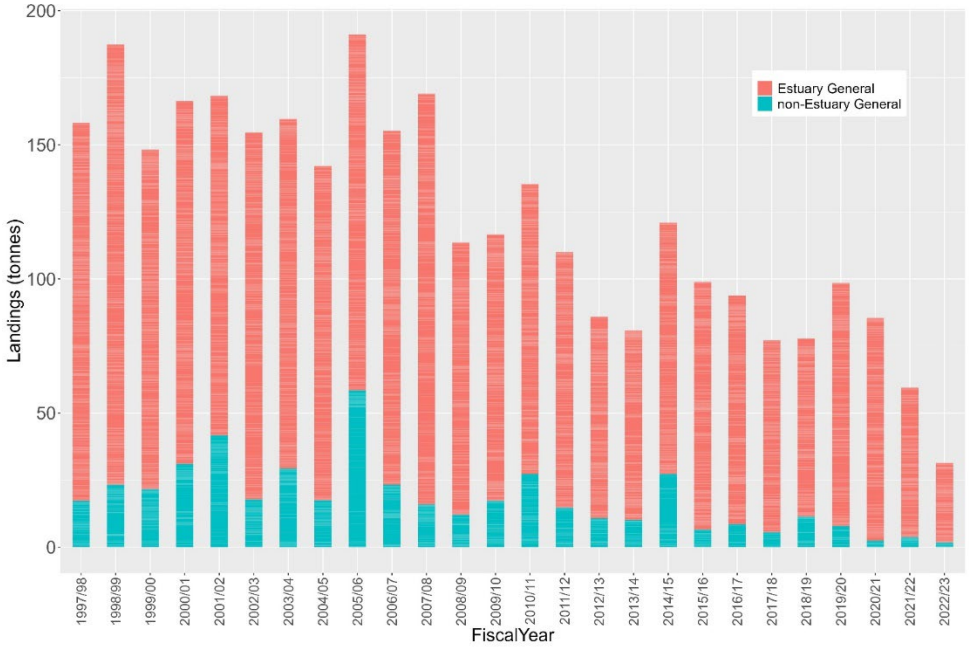

Figure 1 Annual reported commercial landings (t) of Sand Whiting in New South Wales from 1998 to 2023.

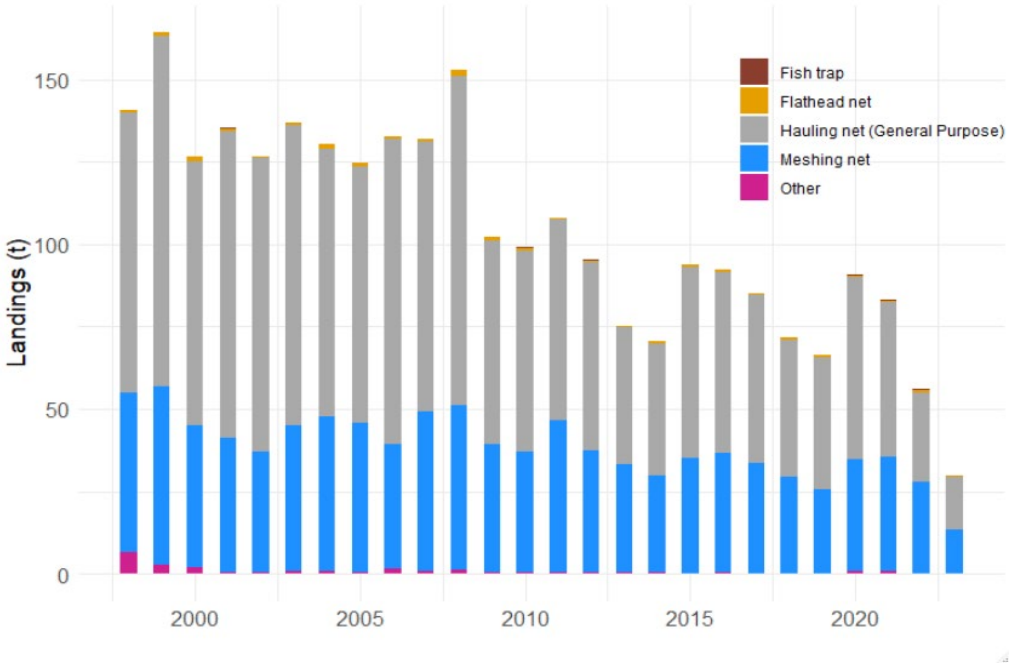

Figure 2 Annual reported commercial landings (t) of Sand Whiting from NSW from 1998 to 2023 in the Estuary General Fishery in NSW using different fishing methods.

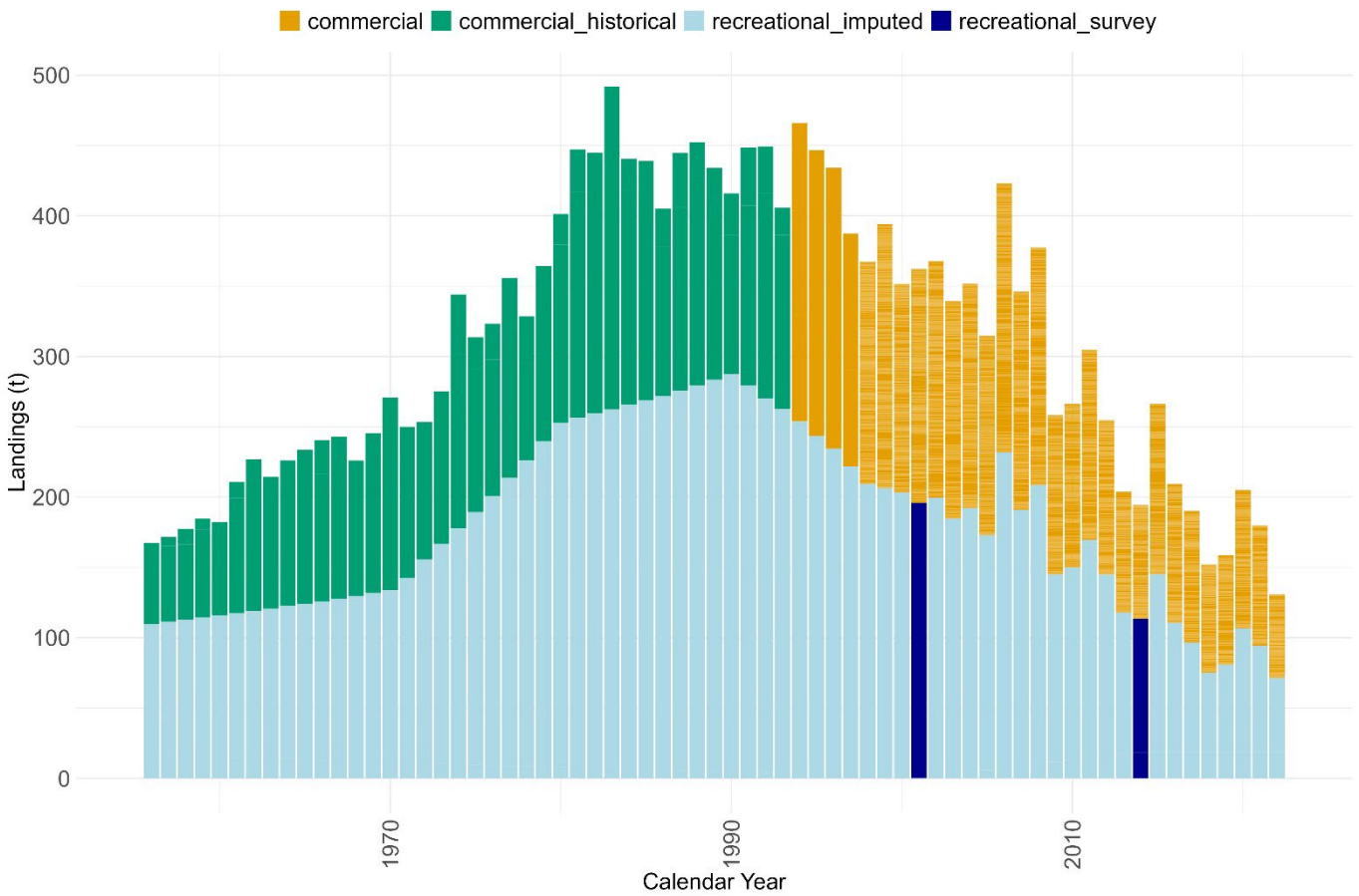

Figure 3 Total landings (t) of Sand Whiting, including historical commercial landings, logbook commercial landings and reconstructed recreational landings.

Recreational & Charter boat

This species is primarily harvested by the recreational sector in New South Wales. The proportion of recreational catch to total catch is 54% – 58% in 2001 and 2014 respectively. Details about the sampling frame of the recreational survey are reported in Helidoniotis & Schilling (2024) and Murphy, et al. (2020, 2022).

Indigenous

A survey of Aboriginal cultural fishing in the Tweed River catchment identified Sand Whiting as one of the top 10 most important species numerically in catches, which was estimated to account for 14.2% of the total finfish catch (Schnierer and Egan 2016). Total catches in the region were estimated to range between 2,085–4,940 Sand Whiting per annum (Schnierer 2011). Statewide estimates of the annual Aboriginal harvest of Sand Whiting in NSW waters are unknown but are assumed to be significant.

Illegal, Unregulated and Unreported

There is no information available on the Illegal, unregulated and unreported take of Sand Whiting in New South Wales.

Fishing effort information

Fishing effort (days) in the EGF was variable during 2010-2023, with a gradual decline to 2580 days in 2023 (Figure 4). The trend in number of days fished between 2010 and 2022, was derived from summing the number of fishing events for the target species. In the logbook records prior to 2010, effort was recorded as days fished per month however following reporting changes implemented in 2009, effort was also reported in terms of gear used. For Sand Whiting the unit of effort since 2010 was 'number of shots' for the hauling endorsement and 'length of net' for meshing endorsement.

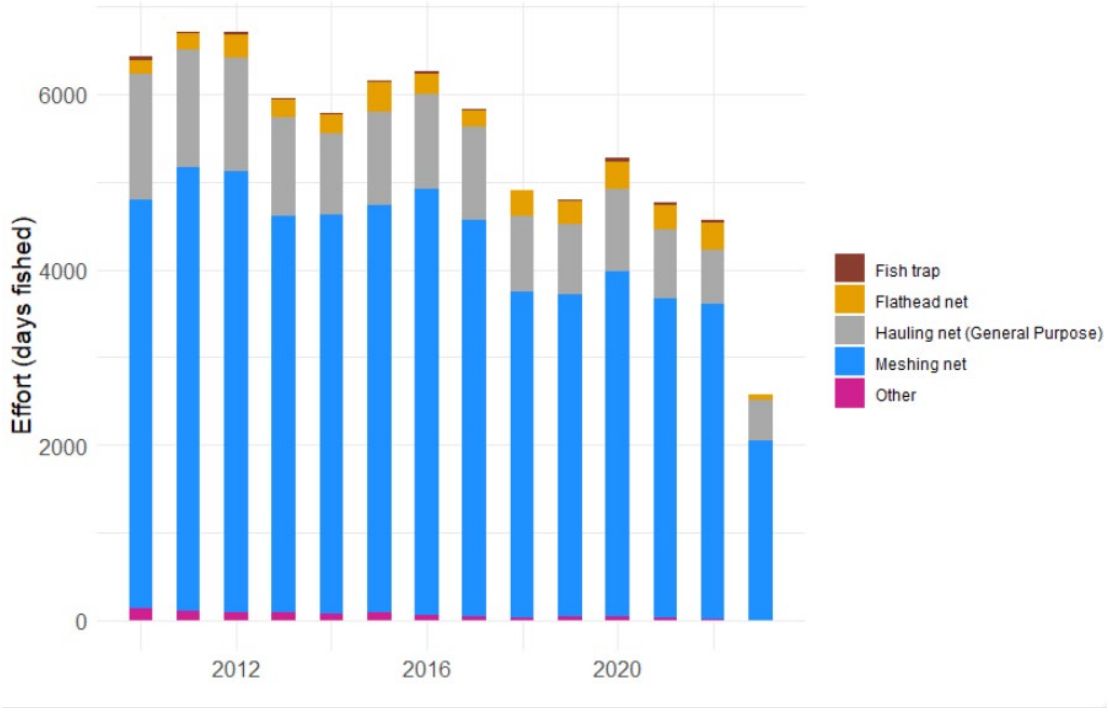

Figure 4 Annual effort (days fished) between different fishing methods of Sand Whiting from NSW from 2010 to 2023.

Catch rate information

The data was separated into the two main fishing methods: meshing and haul. Standardised catch rates were prepared for each fishing method separately (Figure 5, Figure 6). Overall, the catch rate standardization indicated that catch rates decreased in since 2021 in haul however this decrease was within the interannual variation observed throughout the timeseries. The standardised catch rates for meshing remained relatively stable.

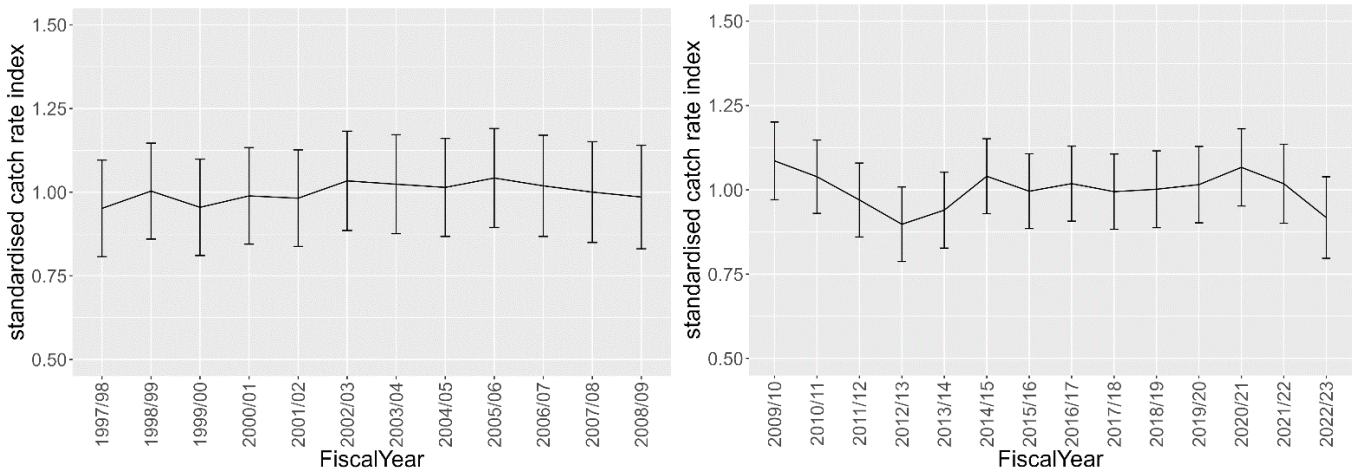

Figure 5 Catch rate standardisation (scaled to 1) for Sand Whiting in the Estuary General Fishery for haul. Left plot is CommCatch logbook data (monthly records) and right plot is FishOnline logbook data daily records)

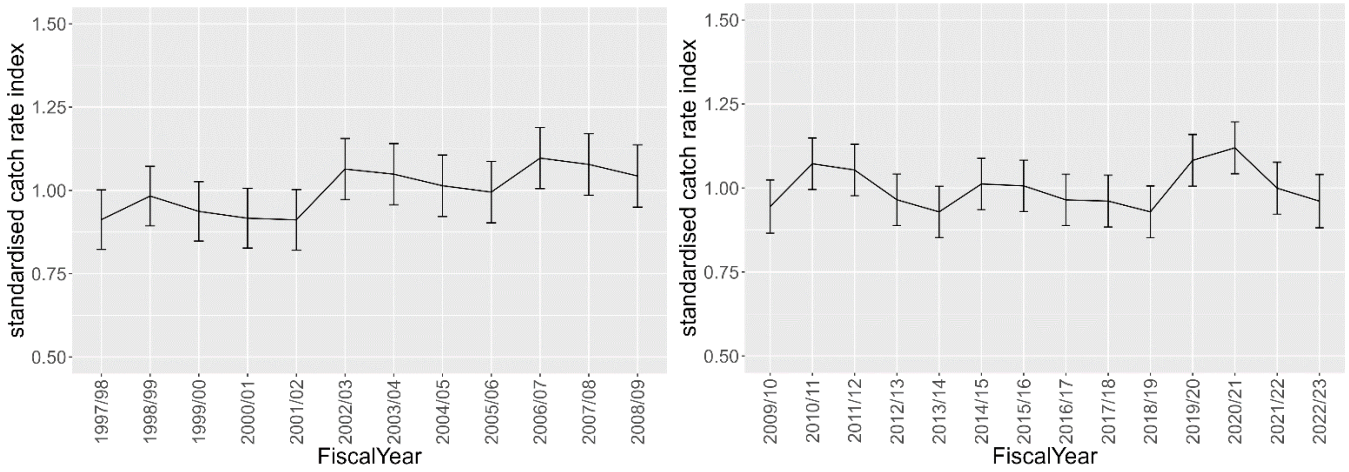

Figure 6 Catch rate standardisation (scaled to 1) for Sand Whiting in the Estuary General Fishery for meshing. Left plot is CommCatch logbook data (monthly records) and right plot is FishOnline logbook data daily records)

STOCK ASSESSMENT

Stock Assessment Methodology

Year of most recent assessment:

2024 (using data to June 23)

Assessment method:

A weight-of-evidence approach has been used to classify the biological status of the New South Wales Sand Whiting stock. It relies on analyses for the two main commercial fishing sectors, mesh netting and hauling in the EGF, pooled across all estuaries. Then weight of evidence was based on:

1) standardised catch rates: Modelling of a standardised catch rate time series for two different fishing methods used; meshnet and haulnet;
2) length composition data;
3) Age composition data;
4) catch curve analysis.

Main data inputs:

The data sources used in the status determination included log-book data, and fishery dependant age and length data. The logbook data was used to determine catch rates, and to create total annual harvests. The time series of data varied between different data sources. Harvest data had the longest time series of 73 years from 1950 to current year and the catch and effort data spanned 35 years.

The data for the catch rate analysis included records in the ComCatch database for FY1985 – FY2009, and FishOnline database from FY2010 – FY2023 (Table 1). Standardised catch rate was calculated for two time periods 1985 – 2010 based on ComCatch database and 2010 – 2023 based on FishOnline database. The ComCatch database were monthly aggregates of catch and effort (in days) for specific fishing methods following 1997/98, with previous data not specific to a particular method. The FishOnline database were daily records consisting of daily catch and effort data.

Table 1. Summary of the commercial fishery log book records and changes to fisher reporting requirements through time

Time period	Data source	Reporting requirements
Pre-1984	HCatch	Catch unit – kg per month No fisher, vessel or effort information available Spatial scale – 3 broad ocean zones and smaller scale Regions
July 1984 – June 1997	ComCatch	Catch unit – kg per month Effort unit – days fished per month Catch data not linked to individual methods, therefore, effort only assigned to catches when a single method was used in a given month
July 1997 – June 2009	ComCatch	Catch unit – kg per month Effort unit – days fished per month Catch data provided for each method used
July 2009 – present	FishOnline	Catch unit – kg per fishing event (daily records) Effort unit – various, one per method; hours fished, net length or number of shots, hooks, lures or traps; hours trawled per day Catch data provided for each method used Spatial scale – individual estuaries, 7 broad regions; 0.1° x 0.1° C-square grid Voluntary E-reporting of catch records since 2011 Compulsory E-reporting for quota reconciliation since 2019

Key model structure & assumptions:

The assumption in the standardised catch rate is that there is a linear relationship between catch rate and exploitable biomass. However, this might not be valid. For example, hyperstability may be occurring (catch rate remain stable while the stock size changes) or hyper-depletion (catch rates decline much faster than stock size changes) may occur. The purpose of standardization is to account for variation in the data that is not attributable to changes in abundance (Maunder and Punt 2004). However, the standardisation might not successfully account for all of this variation. The availability of the fish to the gear is another source of uncertainty that may influence the catch rate. Availability can be the result of aggregating behaviour; increasing catchability or efficiency of a fishing method through time. Another source of uncertainty is the model structure used in the linear regression. Some jurisdictions use effort as an offset (where the response variable is catch /effort) while other jurisdiction use effort as a term (where catch is the response term). Future work is recommended to the explore the difference in trends due to the model structure and different linear regression models (i.e between REML and glm).

Sources of uncertainty evaluated:

Results from catch rate standardisation must be interpreted with caution, given limited information used to derive population parameters and stock status. An important consideration is the variability and inconsistency in effort reporting, particularly for the meshnet fishery. For example, in the meshnet fishery, the unit of effort in a given fishing event may have been reported as 750 m (net mesh length). However, if the net was deployed multiple times in that single fishing event, the total units should be reported as the mesh length (750 m) multiplied by the number of times it was deployed, however it still may have been reported as 750 m. Another

source of uncertainty is that New South Wales catch and effort logbook data for Sand Whiting consists of other species that were caught simultaneously. The change in targeting behaviour of commercial fishers may affect the catch rate time series. Daily changes in targeting behaviour are market driven and may influence the proportion of Sand Whiting caught in each unit of effort. Further work is required to determine if and how this can be addressed in the catch rate standardisation or whether there are other methods that can be used as an index of abundance such as fishery independent surveys.

Factors other than fishing, including environmental factors, may affect abundance and biological functioning of fish stocks through time. Temporal and spatial variations in estuarine conditions may influence available trophic resources, growth, population connectivity and ultimately recruitment. Knowledge of the interaction of these factors with fishing activity will be important for isolating the role of fishing on changes in the biomass of Sand Whiting.

Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this assessment the trend in commercial catch rates of the hauling and mesh netting sectors of the EGF were selected as indices of relative abundance.
Biomass Limit Reference Point	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment current catch rates were assessed relative to long-term averages of each time series.
Biomass Target Reference Point	NA
Fishing mortality indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment, estimates of fishing mortality (F) relative to natural mortality (M) were made from catch curve analyses.
Fishing mortality Limit Reference Point	NA
Fishing Mortality Target Reference Point	None specified in a formal harvest strategy. For the purposes of this stock assessment, F = M (approx.) was assumed to represent an acceptable level of F.

Stock Assessment Results

Landings of Sand Whiting in the EGF varied considerably among estuaries during 2018-2023, with the greatest volume of catch throughout the 5 year period being taken from Shoalhaven River (Estuary Region 6) and Wallis Lake (Estuary Region 4)

The trends in catch rate standardisations for the most recent three years (FY 2021 – 2023) were within the interannual range of the timeseries (Figure 5, Figure 6).

Length frequency distributions were prepared from fishery dependant data for two different fishing method gears: mesh and haul. The length frequencies were above the size at maturity at approx. 20 cm FL (female) and 17 cm (male). There were higher proportion of larger sizes in the mesh gear than in the haul gear (Figure 7).

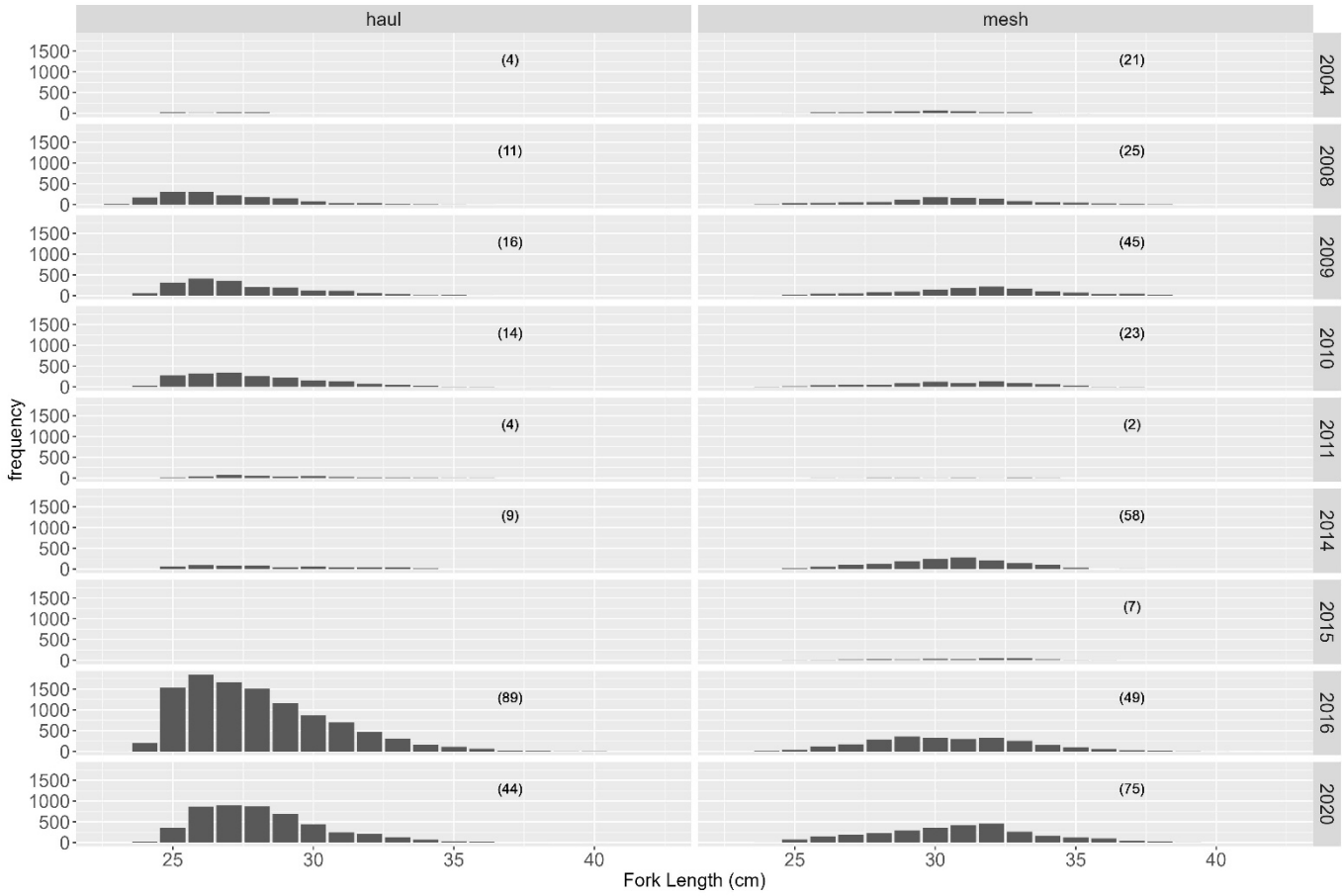

Figure 7 Length composition for Sand Whiting in the Estuary General fishery for haul (left column), mesh (right column), The numbers in parentheses are the number of fishing trips sampled.

Age composition data were prepared from fishery dependant data for three different gears: mesh, haul and all other gears combined. The age data were above the age at maturity at approx. 1.5 years. There were higher proportion of larger ages in the mesh and other gears than in the haul gear (Figure 8). The frequency plots in Figure 8 show that there were very low sample sizes for 'other' gear category and higher sample size for haul and there was stronger evidence of higher aged individuals in mesh and to a lesser extent in haul rather than 'other' gear category.

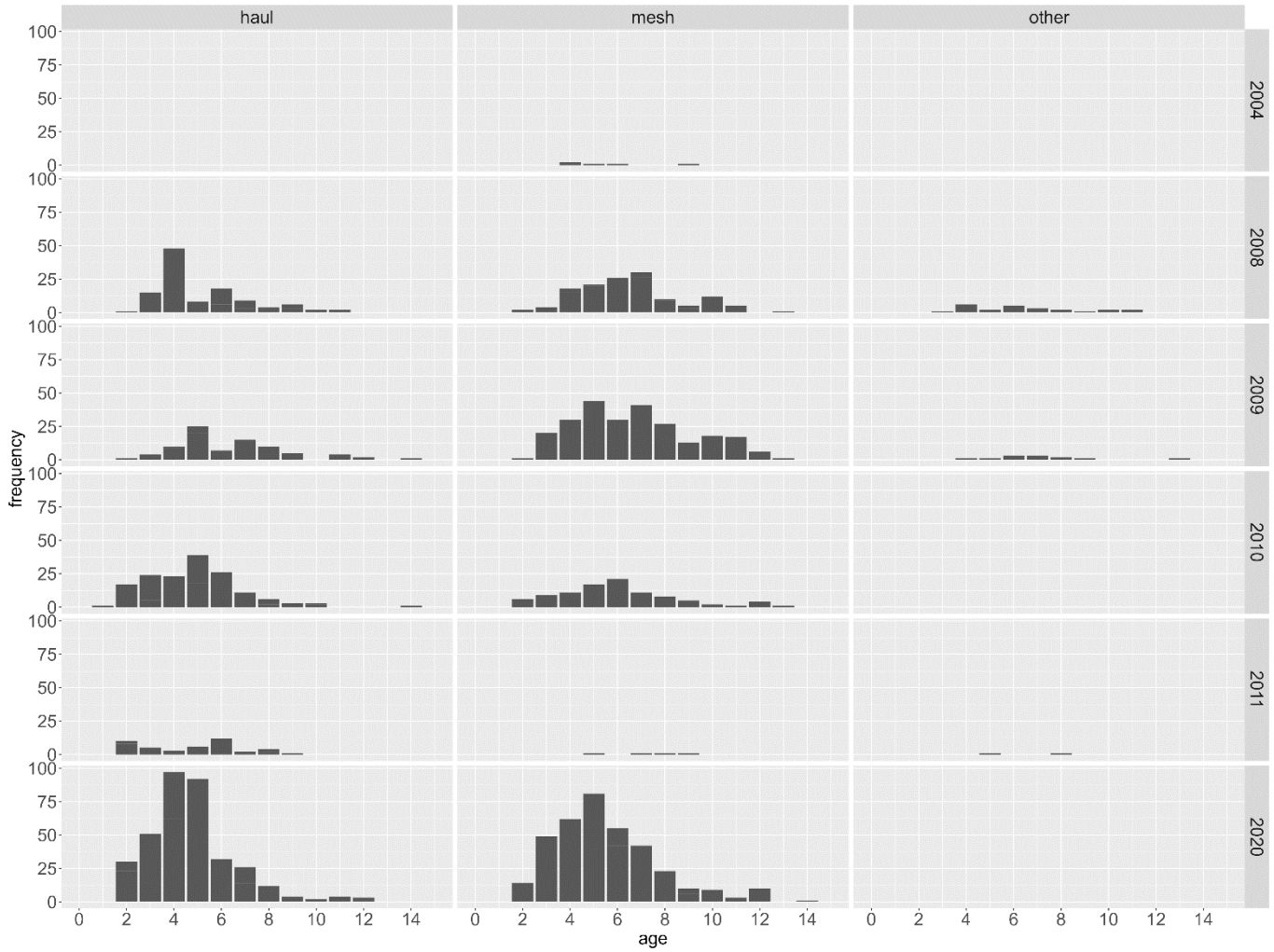

Figure 8 Age composition data (raw data) for Sand Whiting in the commercial Estuary General Fishery for the different gears (meshnet, haul and all other gears combined), in different years.

Total mortality (Z) was estimated from a catch curve analysis based on the most recent age composition data (2019/2020) for hauling net. The estimate of Z (2019/20) was 0.694 (0.086 SE). Natural mortality (M) was estimated to be 0.42, which was based on a rule of thumb approach of an M which results in 1% survival at a maximum age of 11 years old. The estimated fishing mortality (F) was therefore 0.27 (Z-M) which was lower than the estimated M of 0.42.

Stock Assessment Result Summary

Biomass status in relation to Limit	Trends in catch rates stable around long-term (1998 – 2023) averages
Biomass status in relation to Target	NA
Fishing mortality in relation to Limit	NA
Fishing mortality in relation to Target	F (0.27) < M (0.42) based on estimated Z (0.694 in 2019-20).
Current stock status	Sustainable (New South Wales)
SAFS stock status	SAFS (2020): Sustainable

Fishery interactions

The majority of Sand Whiting catch is taken within estuaries and the proportion of whiting to other species was between 5 – 30 %. Bycatch and impacts on non-target species may be likely, and diverse assemblages are often captured. interactions with threatened and protected species were believed to be low.

Stakeholder engagement

Fishery shareholders, fishers and/or their representatives were invited to participate in online presentations of the assessments of the key species in the Estuary General Fishery including Sand Whiting. The meetings were held on the 4th March for the Category 1 and Category 2 Hauling and 6th March for Estuarine General meshing. In addition, a meeting with the Total Allowable Fishing Committee was held on the 16th April 2024. The meetings provided an opportunity to exchange commentary on the assessments and raise any other relevant information. No major issues or points of discussion were raised.

Qualifying Comments

New South Wales catch and effort logbook data vary spatially and temporally across different eras, delineated by changes in fisher reporting requirements and other management changes. The change in the method of effort reporting during 2009/10 limits the certainty with which conclusions can be made regarding shifts in effort and catch rates around that time.

Results from catch rate standardisation methods must be interpreted with caution, given the limited information used to derive population parameters and stock status.

Factors other than fishing, including climate change and other environmental processes, may affect changes in the abundance and biological functioning of the Sand Whiting stock through time.

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