

Assessment Authors and Year

Stewart, J. 2023. NSW Stock Status Summary 2021/22 – Balmain Bugs – (*Ibacus peronii*, *Ibacus brucei*, *Ibacus chacei*, *Ibacus alticrenatus*). NSW Department of Primary Industries. Fisheries NSW. 13 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Balmain Bugs are currently assessed as Sustainable for the NSW component of the stock.
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Stock structure & distribution

The common name 'Balmain Bug' refers to four similar species of fan lobster: *Ibacus alticrenatus*, *I. brucei*, *I. chacei* and *I. peronii* (Haddy et al., 2007). These species partially overlap in their distributions on the east coast of Australia. Trawlers off NSW catch all four species. The most commonly caught species are the Eastern Balmain Bug (*Ibacus peronii*) and the Smooth Bug (*I. chacei*) which both grow in size to 8-9 cm carapace length (CL) and weigh between 300-400 g (Haddy et al., 2007). The Eastern Balmain Bug occurs mainly on inshore grounds (<80 m deep) and is distributed around southern Australia from about the NSW-Queensland border to southern WA including the east coast of Tasmania and Bass Strait. The Smooth Bug is mostly caught on deeper grounds (40-120 m) and is found off eastern Australia north from about Sydney to central Queensland. A less commonly caught species is the smaller (< 7.5 cm CL) Honey Bug (*I. brucei*) that mainly inhabits outer continental shelf and upper slope depths (120-300 m) off northern NSW and Queensland. A second small species (< 6.5 cm CL) is the Deepwater Bug (*I. alticrenatus*) which occurs mainly at depths of 200-400 m around southern Australia; it is also found in New Zealand waters. Honey Bugs are occasionally targeted by prawn trawlers off the NSW north coast and small quantities of Deepwater Bugs are caught by trawlers targeting fish or prawns on the upper continental slope.

Tagging studies have shown that Smooth Bugs have a northward movement pattern, but that Eastern Balmain Bugs do not (Stewart and Kennelly, 1998). Studies of their reproductive biology showed that maturing Smooth Bugs moved northwards to spawn in waters off Queensland, whereas Eastern Balmain Bugs spawned throughout their range along the NSW coast. Smooth Bug larvae (phyllosomata) disperse south on the East Australian Current and settle as juveniles on the NSW continental shelf. Given the prevailing influence of the East Australian Current along the east coast out to 150 m depth, a protracted pelagic larval phase and a northerly migration of older stages, Eastern Balmain Bugs, Smooth Bugs and Honey Bugs are thought to each constitute single biological stocks across Queensland and New South Wales (Haddy et al., 2007). However given the commercial catch and effort data cannot be differentiated to a species level due to their similarity in appearance and marketing names, for the purposes of SAFS the stock status of the Balmain Bugs species group is presented at a combined biological stock level — the East Coast biological stock

The data presented in this summary relate only to the NSW part of the stock.

Biology

Eastern Balmain Bugs are generally resident and quite long-lived, attaining at least 18 years of age (Stewart and Kennelly, 1998; Stewart and Kennelly, 2000; Stewart, 2003). Smooth Bugs in NSW are at the southern end of their distribution and are captured as immature individuals prior to or during their migration into Queensland waters to breed (Stewart et al., 1997). Smooth Bugs attain slightly smaller sizes than Balmain Bugs and only live for 5 to 7 years (Haddy et al., 2005).

Maturity is attained at roughly 50 mm carapace length and two years of age for Eastern Balmain Bugs, and 55 mm carapace length and two years for Smooth Bugs (Haddy et al., 2007). Sex ratio's within all four species are approximately equal.

Females have been observed carrying eggs through much of the year, with some female *I. peronii* carrying eggs in all months. Despite this, eggs tend to be seen during the colder months (late autumn to early spring; May to September) with hatching occurring during the spring/summer period (Haddy et al., 2007). *Ibacus spp.* produce phyllosoma larvae that have an extended pelagic phase, generally two to four months, before metamorphosing into a postlarval stage called a nisto.

FISHERY STATISTICS

Catch information

Commercial

NSW commercial landings peaked at approximately 120 tonnes in 1996/97 (Fig. 1). Since that time landings have fluctuated, but declined to average roughly 30 t p.a. between 2007/08 and 2017/18. Reported landings have increased substantially during the past four years. The vast majority of the catch is reported by ocean prawn trawling (Fig. 2).

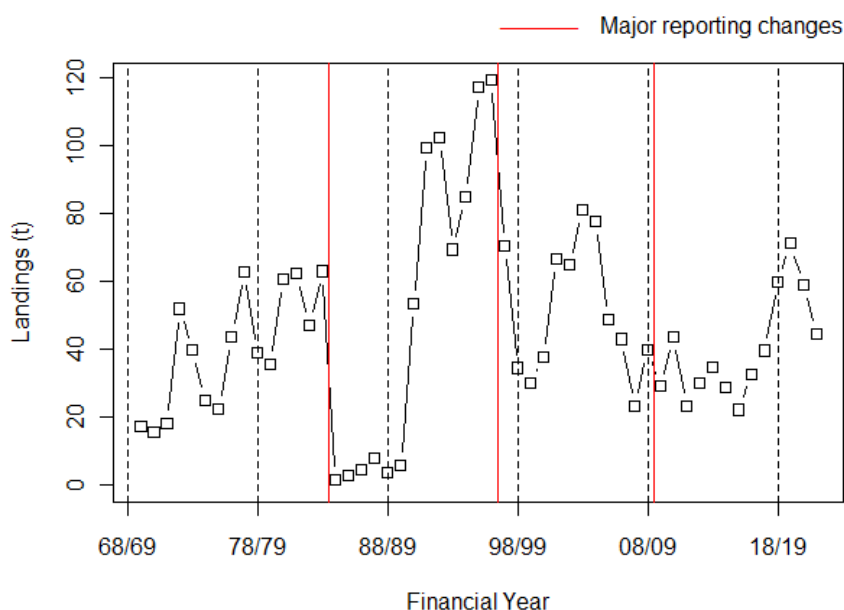


Figure 1 Commercial landings of Balmain Bugs for NSW from 1969/70 to 2021/229 for all fishing methods. Records from the mid to late 1980s are incomplete and should be ignored

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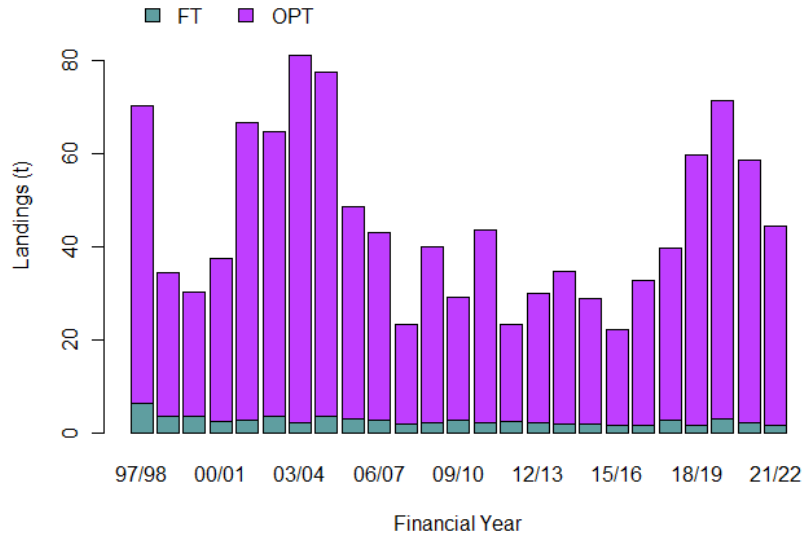


Figure 2 Landings by Fishery of Balmain Bugs in NSW for years 1997/98 to 2021/22. FT = Fish Trawl; OPT = Ocean Prawn Trawl.

Despite both Eastern Balmain and Smooth bugs being listed on fisher’s logbooks, almost the entire catch is reported as being Eastern Balmain Bugs (> 99%, Stewart et al., 2022). This is mis-reporting likely due to the similarity in appearance of the two species as well as fisher naming convention and a lack of training on how to identify the species correctly. Given the differing, but overlapping, latitudinal and depth ranges of the two species, the ratio within the Balmain Bug species complex landed in NSW will therefore depend on the latitude of fishing and depth. Port monitoring between 2005/06 and 2020/21 estimated that the catch is now dominated by Smooth Bugs that comprised roughly 85% of the catch during 2020/21 (Stewart et al., 2022). The proportion of the catch that were Eastern Balmain Bugs has fluctuated annually but has declined substantially since 2012/13 (Fig. 3).

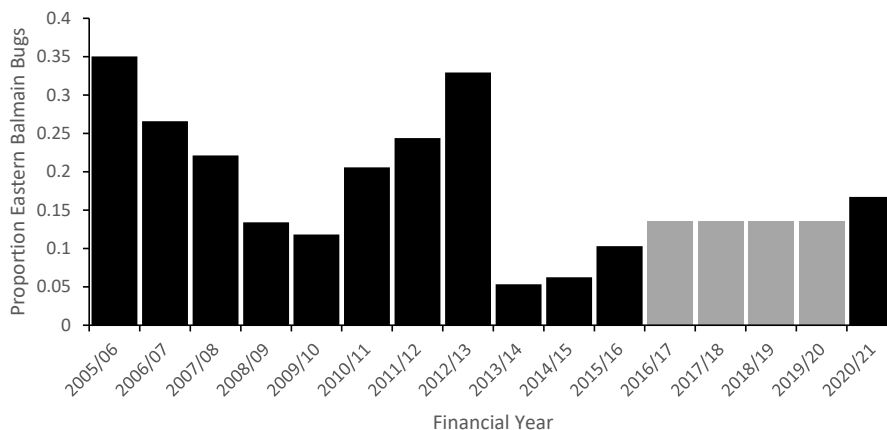


Figure 3 The proportion of Eastern Balmain Bugs in the landed catch of ‘Balmain Bugs’ observed in port monitoring 2005/06 to 2020/21. The years in grey were not sampled and show an average of 2015/16 and 2020/21.

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Recreational & Charter boat

The annual recreational harvest of Balmain Bugs in NSW is considered to be minor.

Aboriginal cultural fishery

There are no data on aboriginal harvest.

Illegal, Unregulated and Unreported

There are no data on Illegal, Unregulated and Unreported harvest; however it is considered minor in NSW waters.

Fishing effort information

Effort in the ocean prawn fishery has declined substantially since the early 2000s, from approximately 16,000 days to an average of 4,348 days during the previous 5 years, with the most recent years having the lowest reported days since 1991/92 (Fig. 4).

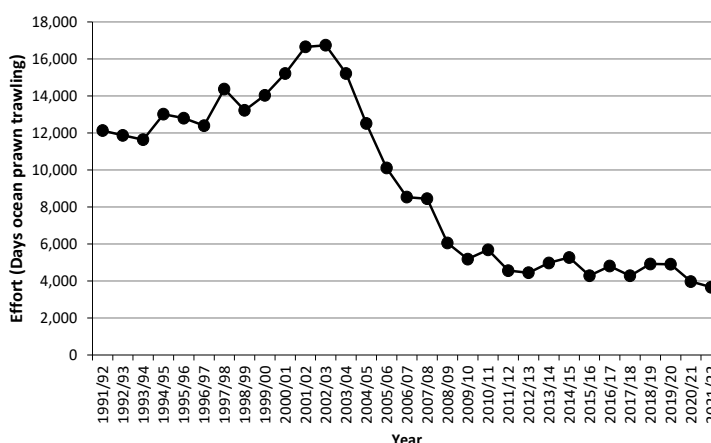


Figure 4 Annual reported days fished Ocean Prawn Trawling in months when fishers reported landing Balmain Bugs 1991/92 to 2021/22.

More accurate effort data are available for the ocean prawn trawl fishery since 2009/10 in terms of trips when Balmain Bugs were landed. There are two main endorsements that harvest Balmain Bugs: the Ocean Trawl Inshore Prawn (OTISP) and the Ocean Trawl Offshore Prawn (OTOSP) fisheries. The OTISP fishery operates out to 3 nm; whereas the OTOSP operates from 3 nm offshore to the 150 fathom (~280 m) depth contour.

Days (trips) when Balmain Bugs have been reported in these fisheries have averaged around 3,000 p.a., but increased during 2018/19 and 2019/20 to nearly 4,000 days p.a. (Fig. 5). Effort in the OTOSP fishery has been increasing, whereas effort in the OTISP has been declining steadily (Fig. 5). The increases in effort in the OTOSP have mainly occurred in the most northern ocean zones.

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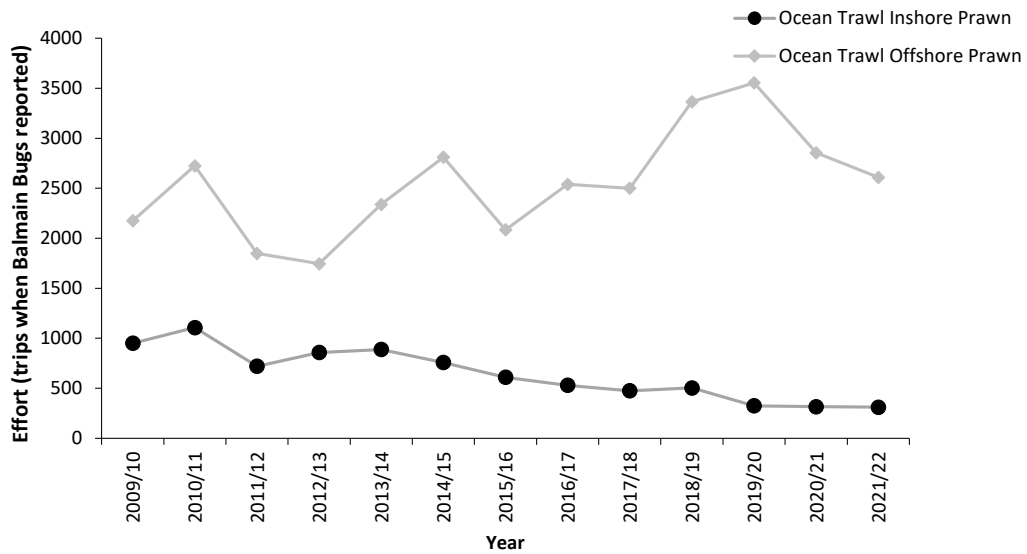


Figure 5 Annual reported trips fished Ocean Prawn Trawling by inshore and offshore endorsements when fishers reported landing Balmain Bugs 2009/10 to 2021/22.

Catch Rate information

Nominal catch rates of Balmain Bugs (kg per day ocean prawn trawling) have fluctuated since the early 1990s, but show an increasing trend in recent years (Fig. 6).

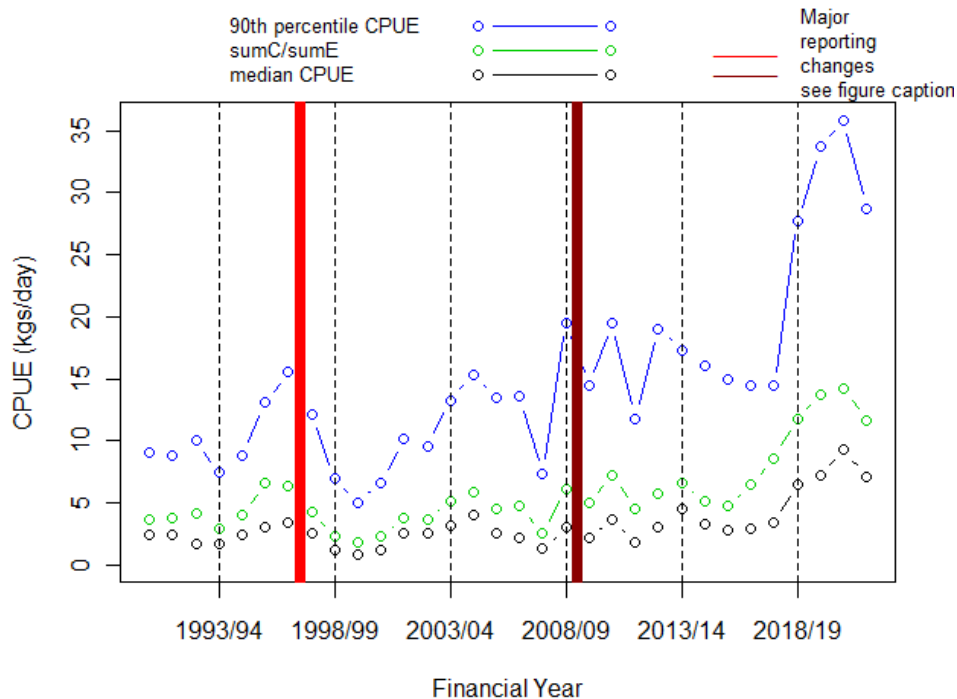


Figure 6 Nominal commercial catch rates (kg/day) of Balmain Bugs using Ocean Prawn Trawling for years 1990/91 to 2021/22 in NSW.

In addition, catch rates of Balmain Bugs ($\text{kg}\cdot\text{day}^{-1}$) were standardised using general linear models in the R package ‘cede’ (Haddon et al., 2018). Data were available from 2009/10 to 2021/22. Variables used included year, latitude, fisher, month and depth of capture. For these standardisations a trip was considered to be a single day of fishing as fewer than 0.9% of trips were reported as being greater than 24 hours. The standardised catch rates showed a substantial increase from 2018/19 onwards (Fig. 7).

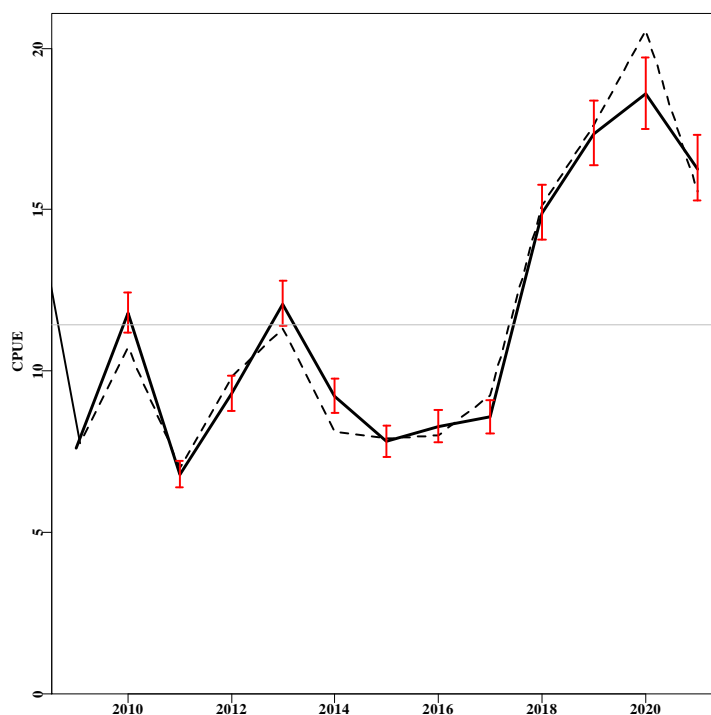


Figure 7 Standardised catch rate (solid line) of Balmain Bugs by offshore prawn trawling. The dashed black line indicates the geometric mean catch rate. Red bars indicate 95% confidence intervals.

STOCK ASSESSMENT

Stock Assessment Methodology

Year of most recent assessment:

2023 on data up to and including 2021/22.

Assessment method:

Weight of Evidence incorporating:

- Landed catch 1991/92 to 2021/22.
- Nominal median catch rates 1991/92 to 2021/22.
- Standardised catch rates 2009/10 to 2021/22
- Fishing effort 1991/92 to 2021/22.
- Size composition in landed catch 1994 to 2021/22.

Main data inputs:

- Reported landed catch from logbooks 1991/92 to 2021/22.

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- NSW Commercial Maximum Sustainable Yield (MSY) estimated by Smith et al. (2021).
- Reported landed catch and effort from logbooks 1991/92 to 2021/22.
- Days of effort Ocean Prawn Trawling when Balmain Bugs were landed from logbooks.
- Size composition in landed catch 1994 to 2020/21 obtained through a Port Monitoring program.

Key model structure & assumptions:

- Reported logbook records are accurate.
- Nominal and standardised catch rates can be used to infer the relative abundance of exploitable Balmain Bugs.
- The sampling program produced estimates of size compositions that were representative of landings.
- There have been no major changes in the species composition in the landed catch of the species complex.

Sources of uncertainty evaluated:

Logbook data were examined for obvious spurious records which were removed for analytical purposes.

Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	Catch rates. Size composition in landings for the two main species Eastern Balmain and Smooth bugs.
Biomass Limit Reference Point	No formal reference level for catch rates; however, trends are assessed to estimate trends in exploitable biomass. No formal reference level for size compositions; however, trends are assessed.
Biomass Target Reference Point	No Target Reference Point
Fishing mortality indicator or proxy	Landed catch. Fishing effort. Size composition in landed catch for the 2 main species Eastern Balmain and Smooth bugs.
Fishing mortality Limit Reference Point	Landed catch relative to NSW commercial MSY. Trends in indicators through time are used to estimate trends in fishing mortality
Fishing Mortality Target Reference Point	No Target Reference Point

Stock Assessment Results

Nominal median catch rates since 1990/91 show variability but overall an increasing trend and in particular during the previous four years (Fig. 6). Recent trends are supported by the standardised catch rates (Fig. 7).

Smith et al. (2021) estimated the NSW commercial MSY for Balmain Bugs (species complex) to be approximately 59 t p.a.. NSW reported catch in 2019/20 exceeded this estimate; however the average landed catch during the most recent 5 years has been below this at approximately 55 t p.a. Reported landings during the 1990s were at times double this estimate of MSY.

The landed sizes of Eastern Balmain Bugs since 2005/06 has shown a slight contraction in average size from approximately 6.3 to 6.1 cm carapace length (Fig. 8). Noting some smaller sample sizes in some years, the data at either end of the period are supported by large sample sizes and show the relative abundance of Eastern Balmain Bugs larger than around 6.5 cm carapace length has declined substantially. Monitoring prior to this, during 2002 and an FRDC study during 1994, showed these larger Eastern Balmain Bugs in catches. Female Eastern Balmain Bugs comprise a substantially larger mode than males (Fig. 9); however the sexes have not been separated in the length monitoring, so any changes in sex ratios are unknown.

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NSW Stock Status Summary – Balmain Bugs (*Ibacus peronii*, *Ibacus brucei*, *Ibacus chacei*, *Ibacus alticrenatus*)

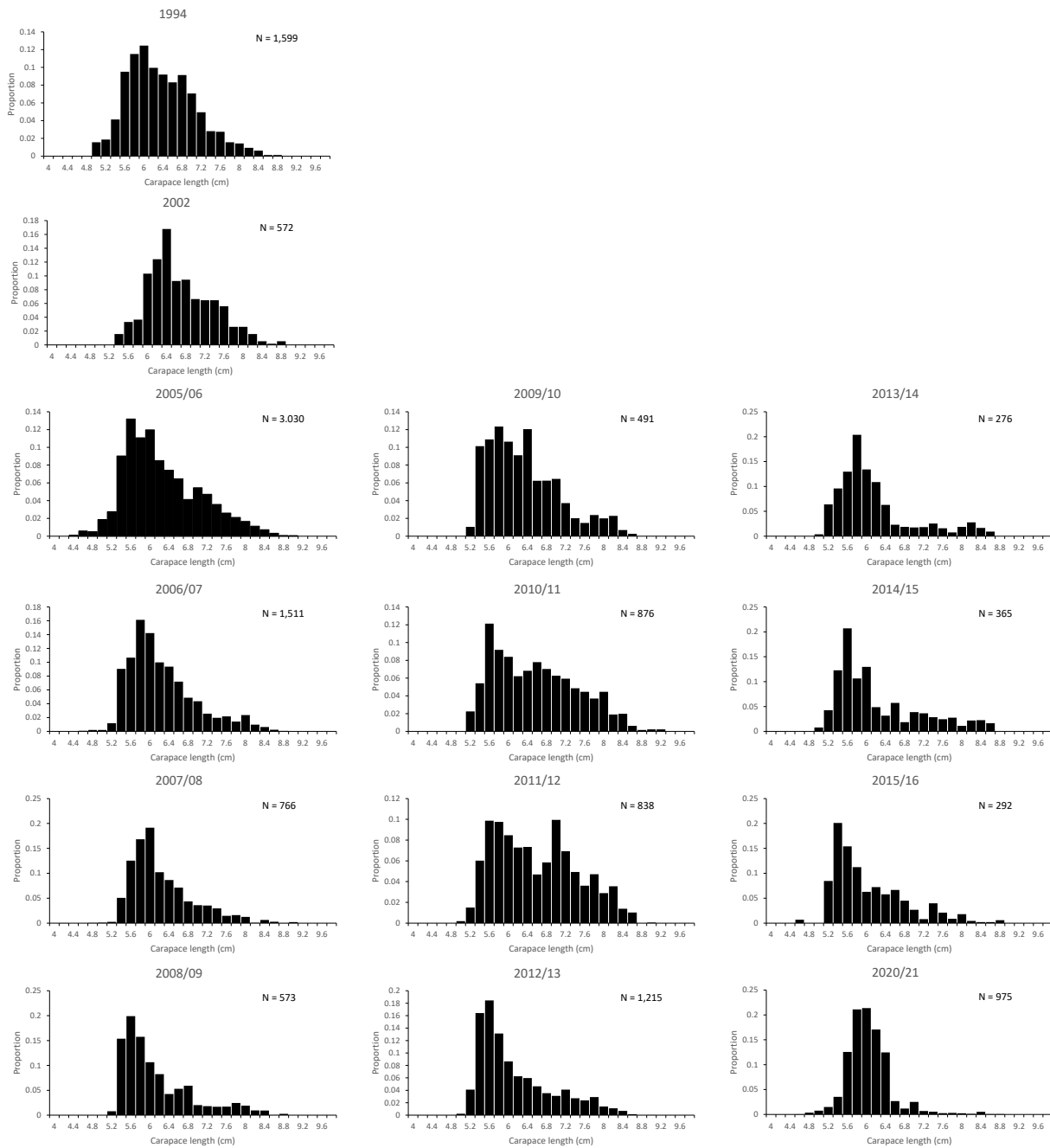


Figure 8 The length distribution of landed Eastern Balmain Bugs in NSW 1994 to 2020/21.

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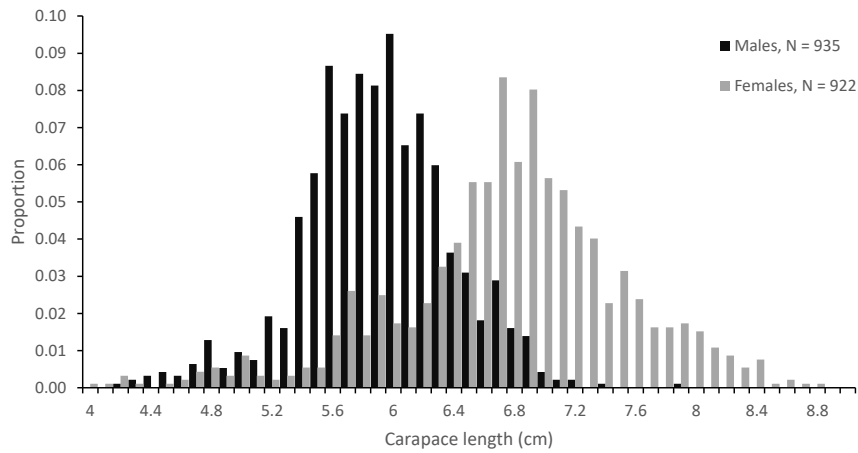


Figure 9 The length distribution of male and female Eastern Balmain Bugs monitored during 1994.

The annual size compositions of landed Smooth Bugs have been remarkably stable since 2005/06 (Fig. 10). Note large sample sizes in all years.

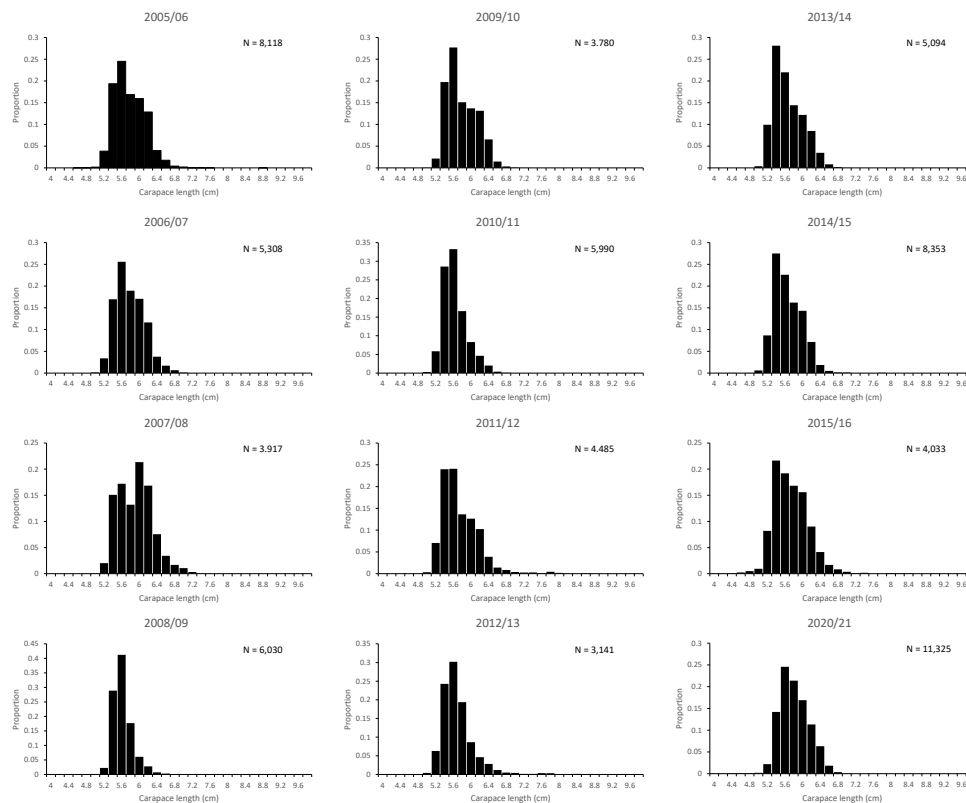


Figure 10 The length distribution of landed Smooth Bugs in NSW 2005/06 to 2020/21.

Stock Assessment Result Summary

<p>Biomass status in relation to Limit</p>	<p>Variable but overall increasing trends in catch rates suggest cyclical variability in availability, with more recent increases (Figs. 6 and 7).</p> <p>The decline in relative abundance of larger (> 6.5 cm carapace length) Eastern Balmain Bugs in landings may be an indication that the biomass has been fished down. Alternatively, it could indicate a change in the operations of the fishery. The cause of this change in size composition in the landed catch warrants further investigation.</p> <p>Stability in the landed sizes of Smooth bugs since 2005/06 infers stability in exploitable biomass of this species.</p>
<p>Biomass status in relation to Target</p>	<p>No Target Reference Point</p>
<p>Fishing mortality in relation to Limit</p>	<p>NSW reported catch in 2019/20 exceeded the estimated NSW Commercial MSY; however the average landed catch during the most recent 5 years has been below this at approximately 55 t p.a.</p> <p>Declines in landed catch and fishing effort infer declines in fishing mortality following the early 2000s; however, increases in catch and effort in the offshore fishery suggest fishing mortality may have increased during the previous few years.</p> <p>As for biomass, the observed decline in relative abundance of larger (> 6.5 cm carapace length) Eastern Balmain Bugs in landings may indicate excessive fishing mortality through time, that has resulted in a length-truncated population, or simply a change in the operations of the fishery.</p> <p>Stability in the landed sizes of Smooth Bugs since 2005/06 infers sustainability at current levels of fishing mortality.</p>
<p>Fishing mortality in relation to Target</p>	<p>No Target Reference Point</p>
<p>Current SAFS stock status</p>	<p>The stock in NSW is not considered to be recruitment impaired.</p> <p>The current level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.</p> <p>On the basis of the evidence provided above, Balmain Bugs in New South Wales is classified as a sustainable stock.</p>

Fishery interactions

Smooth Bugs are landed generally as a byproduct species in the Queensland East Coast Otter Trawl Fishery when targeting Eastern King Prawns.

Qualifying Comments

The assessment of stock status for the Balmain Bug species complex, comprising four different species, risks masking declines of any individual species. It is unlikely that the fishery has caused unseen declines in the abundance of the Honey Bug or Deepwater Bug, due to limited trawling in their habitats and resulting limited catches in recent times. There is a greater concern for masked declines around the Balmain Bug and Smooth Bug data. Given the relative minor composition of the landed catch that comprise Eastern Balmain Bugs, the observed increases in catch rates during recent years likely represent increased recruitment and resulting relative abundance of Smooth Bugs, and may not be informative for Eastern Balmain Bugs.

The substantial reduction in relative abundance of larger Eastern Balmain Bugs in landings was evident after 2011/12, and has reduced further since that time (Fig. 8). It is not known whether this reduction in larger individuals is as a result of fishing down the available biomass, or as a result of changes in fishing operations such as decreased effort from the inshore trawl sector (OTISP) (Fig. 5). Management of Balmain Bugs in NSW appears robust, with a minimum legal size of 10 cm carapace width based on protecting juveniles (Stewart et al., 1997) and a prohibition on landing egg-bearing individuals. Survival of discarded juveniles is thought to be very high (Wassenberg and Hill, 1989) and trawling effort on the inshore grounds continues to decline. Therefore, it is likely that the observed declines in the proportions of Eastern Balmain Bugs in landings of the species complex, and decline in average sizes, have resulted from changes to the operations within the fishery rather than a decline in biomass.

Previously Balmain Bugs have been assessed as:

Fully Fished in NSW assessments 2002/03 to 2014/15.

SAFS Sustainable 2012

SAFS Sustainable 2014

SAFS Sustainable 2016

SAFS Sustainable 2018

SAFS Sustainable 2020

References

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