Department of Primary Industries
and Regional Development

NSW Stock Status Summary – 2024/25

Blue Swimmer Crab (*Portunus armatus*)

Assessment Authors and Year

Johnson, D.D. 2025. NSW Stock Assessment Report 2024/25 – Blue Swimmer Crab (*Portunus armatus*). NSW Department of Primary Industries and Regional Development. 62 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Blue Swimmer Crab are currently assessed as sustainable.

Stock structure & distribution

Blue Swimmer Crabs occur in coastal and estuarine waters along the length of the New South Wales (NSW) coastline. The stock structure on the east coast of Australia is uncertain, involving overlapping stocks or a semi-continuous stock (Chaplin *et al*., 2001). Using a high-resolution oceanographic model coupled with a Lagrangian particle tracking framework to simulate larval dispersal, Hewitt *et al*. (2022) suggest populations of Blue Swimmer Crab in NSW and Queensland (Qld) appear to constitute demographically separate stocks, supporting the current assessment and management at the state level.

Scope of this assessment

This stock assessment report provides a determination of stock status of the New South Wales (NSW) component of the East Coast Blue Swimmer Crab biological stock.

Biology

New South Wales Blue Swimmer Crab populations are at the southern end of the species distribution along the east coast and have a limited spawning period rather than the year-round spawning that occurs in more northern latitudes (Johnson *et al*., 2010). The duration of the spawning period (>5% of mature females carrying eggs), proportion of mature crabs carrying eggs, and the size-structure of recorded catches of egg bearing females from fishery-independent surveys varied between Wallis Lake, Port Stephens, and Lake Macquarie (Taylor *et al*., 2023).Estimates of mean size sexual maturity (L_{50}) for Wallis Lake (50.9–52.5 mm) and Port Stephens (50.7-51.9 mm) from fishery-independent surveys (Taylor *et al*., 2023) exceed previous estimates for Wallis Lake (~46 mm Johnson *et al*., 2010). The size of the smallest functionally mature female (i.e., egg bearing) recorded from fishery-independent survey trap catches (2018-2021) in Wallis Lake (47 mm) and Port Stephens (50 mm) was below the lower estimates of L_{50} from each estuary. Increasing the minimum legal length (MLL) for Blue Swimmer Crab in NSW from 60 to 65 mm (applied to commercial sector in 2017 and recreational in 2020) reduced fishing pressure on the spawning stock (Taylor *et al*., 2023).

Fishery statistics

Catch information

Commercial

Commercial catches of this species from the NSW Estuary General Fishery (EGF) tended to fluctuate around a long-term average of about 132 t over the period 2000/01 to 2016/17 (Fig. 1). However, in 2020/21, 2021/22 and 2022/23 reported commercial landings declined to 83.4, 51.2, and 22.8 t, respectively. In 2023/24 reported landings increased to 93.8 t (~44% of total allowable catch [TAC]), but were 15.8 t (~14.0 %) lower than reported quota usage of 108.8 t (~ 42.0% of TAC). Reported quota usage in 2020/21 (103.0 t), 2021/22 (57.0 t) and 2022/23 (26.3 t) was 9.2 to 27.9% higher than reported landings (Fig. S1).

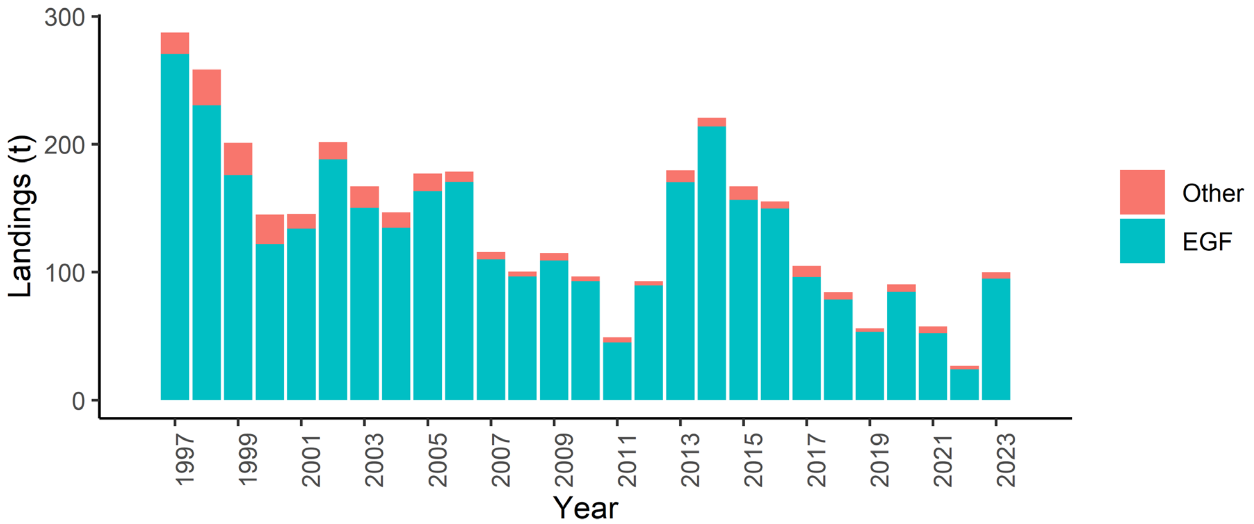

Figure 1. Annual reported commercial landings (t) from the Estuary General Fishery (EGF) and other fisheries for 1997/98 to 2023/24. Years on x-axis refer to first year of fiscal year.

From 2012/13 to 2023/24 reported landings from the estuary general fishery (EGF) accounted for ~ 95% (range 91 – 98%) of total landings. Reported landings from Region-4 of the EGF account for approximately 75 per cent (range 61 - 83%) of commercial Blue Swimmer Crab landings in New South Wales (Fig. S2). Within Region 4, the most important estuary is Wallis Lake accounting for approximately 80 per cent of reported landings (Fig. S3). Most of the catch from the EGF is reported for the method of fish and crab trapping. From 2012/13 to 2022/23 reported landings from fish and crab trapping accounted for approximately 65 and 10% of estuary landings, respectively (Fig.S4) The annual catch composition by sex is biased towards males with reported landings of females accounting for approximately 33% of total landings from 2009/10 to 2023/24 (Fig. S5).

Recreational & Charter boat

From an estimated state-wide harvest of ~413, 000 individuals weighing ~155 t in 2000/01 (Henry & Lyle 2003), harvest declined by ~85% to 50, 637 (± 14, 220) individuals weighing ~27 t in 2013/14 (West *et al*., 2015). Annual estimates of recreational harvest for 2017/18 (63, 034 individuals, ~ 33 t), 2019/20 (42, 325 individuals, ~ 22 t) and 2021/22 (13, 124 individuals, ~ 6.9 t) applies only to 1-3 year recreational licence holders, and non-license holders residing in households selected within the sampling frame (Murphy *et al*., 2020, 2022, 2024).

Estimated harvest by recreational anglers in Lake Macquarie derived from boat ramp/ creel surveys in 2003/04 (61, 000 individuals, ~ 38 t), 18 months after it was designated as a recreational fishing haven were ~45% lower by number and 27% lower by weight than 1999/2000 (111, 000 individuals, ~ 51 t). Although estimated harvest of Blue Swimmer Crab had decreased from 1999/2000 to 2003/04, the difference was not statistically significant (Steffe *et al*., 2005). Like the 1999/2000 and 2003/04 surveys, Blue Swimmer Crabs were one of the most-harvested species by boat-based anglers in Lake Macquarie in 2011 (Ochwada-Doyle *et al*., 2014). From March to May 2011 an estimated 24, 435 and 814 Blue Swimmer Crabs were harvested by boat-based and shore-based anglers, respectively.

Indigenous

Although Indigenous fishers harvest Blue Swimmer Crabs throughout New South Wales, there are no state-wide estimates of harvest. It is however, acknowledged and understood that fishing practices have been undertaken by Aboriginal people of many groups throughout NSW for many thousands of years and that fishing and related practices are valued by Aboriginal people for a wide range of reasons including subsistence (Smyth *et al*., 2018).

Illegal, Unregulated and Unreported

The level of Illegal, Unregulated and Unreported (IUU) fishing is unknown. NSW DPIRD Compliance provide annual summaries of seizures of fish and invertebrates due to non-compliance. These reports indicate regular seizures of crabs and crab traps from 2014/15 to 2022/23 (most recent report). (https://www.dpi.nsw.gov.au/fishing/compliance/fisheries-compliance-enforcement).

Fishing effort information

Reported effort (days) crab trapping for Blue Swimmer Crab estimated from monthly catch and effort records slowly decreased from ~10, 900 days in 1997/98 to ~6, 900 days in 2003/04 then declined by ~50% in 2004/05 (3, 460 days). Following the introduction of daily catch and effort reporting in 2009/10, reported effort has remained below 3, 000 days per year (Fig. 2). In contrast reported effort fish trapping increased from 2004/05 and exceeded 2, 000 days per year from 2004/05 to 2008/09. After the initial decline in reported effort following the change from monthly to daily reporting (2009/10), effort increased and peaked at 4, 400 days in 2014/15. From 2015/16 reported effort fish trapping has continually declined with 2, 290 days reported in 2021/22 (~50% of 2014/15). The trends in reported effort suggest a large proportion of the catch of Blue Swimmer Crabs reported from crab trapping (pre 2004/05) was reported from the method of fish trapping from 2005/06 to 2018/19. However, reported days effort crab trapping has increased in recent years, with > 2, 000 days effort reported in 2018. In 2022/23, 2, 204 and 1, 634 days effort were reported from the method of fish trapping and crab trapping, respectively. Reported effort fish trapping (3, 758 days) and crab trapping crab trapping (3, 035 days) in 2023/24 was ~70% and 85% higher than 2022/23, respectively (Fig. 2).

The annual total number of traps lifts reported for the method of fish trapping increased from a minimum of ~31, 400 in 2011/12 to ~92, 600 in 2018/19, before declining to ~62, 400 in 2021/22 and ~38, 200 in 2022/23 (Fig. 3). In contrast, report effort (TrapLifts) crab trapping increased from ~13, 200 in 2017 to 24, 100 in 2018 and reached a historical peak of ~28, 200 trap lifts in 2021/22, before declining to 18, 950 in 2022/23 (Fig. 3). In 2023/24, 89, 271 and 43, 039 trap lifts were reported from the method of fish trapping and crab trapping, respectively.

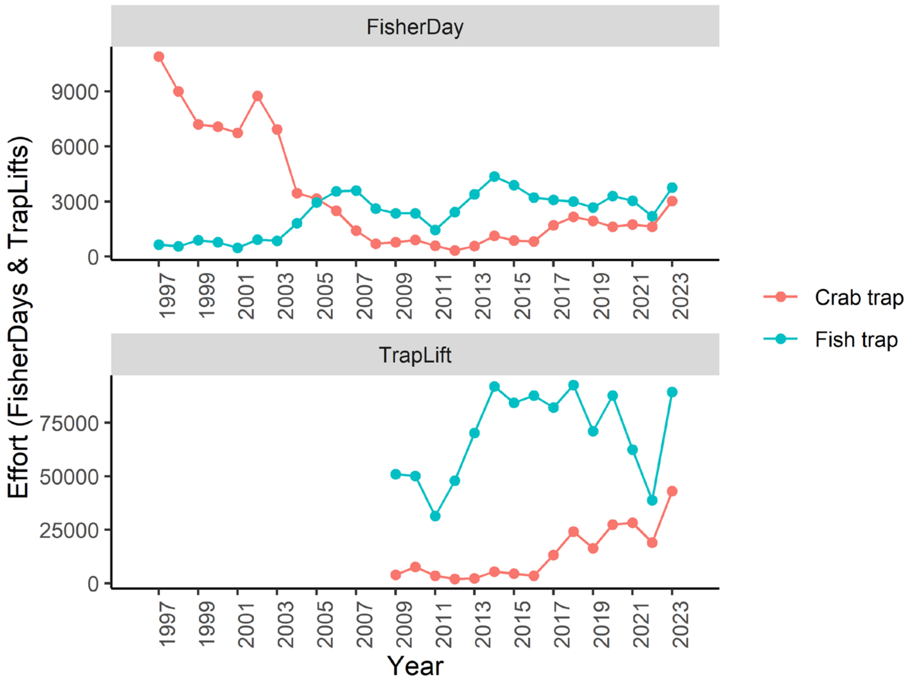

Figure 2 Reported days effort (top plot) and trap lifts (bottom plot) for the methods of fish and crab trapping from all NSW estuaries.

Catch rate information

Nominal catch rates (kg.FisherDay^{-1}) for fish trapping averaged ~20 kg.day^{-1} before increasing to > 30 kg.day^{-1} from 2013/14 to 2016/17 (Fig. 3). Under revised management arrangement (i.e., MLL increase and quota management) catch rates declined from ~18 kg.Day^{-1} (2017/18) to < 10 kg.Day^{-1} in 2022/23 before increasing to ~18 kg,day^{-1} in 2023/24. Catch rates crab trapping steadily declined from 2002/03 to 2011/12 and remained low (<9 kg.day^{-1}) until 2019/20 before increasing to ~13 kg.Day^{-1} in 2020/21 (Fig. 3). Catch rates crab trapping declined to ~4 kg.Day^{-1} in 2022/23, but increased to ~7 kg.Day^{-1} in 2023/24.

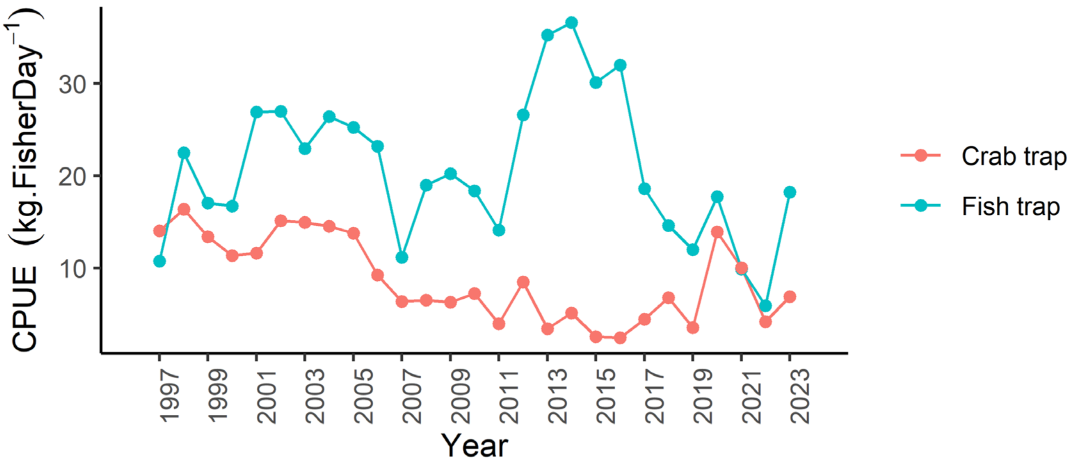

Figure 3. Nominal commercial catch rates from crab and fish trapping in the EGF for all NSW estuaries from 1997/98 to 2023/24.

Stock Assessment

Stock Assessment Methodology

Year of most recent assessment:

2025

Assessment method:

Weight of evidence approach, including standardised commercial catch rates, Fishery-independent survey catch rates of legal and undersize crabs in Wallis Lake, size-structure of observed catches and predictions of CPUE and harvest.

Main data inputs:

- Reported commercial landings from 1950/51 to 2023/24;
- Commercial catch rates in kg.day^{-1} for the methods of crab and fish trapping derived from fisher-reported monthly records by fiscal year (1997/98 -2008/09);

- Commercial catch rates in kg.trap^{-1} for the methods of crab and fish trapping derived from fisher-reported daily records by fiscal year (2009/10 -2023/24);
- Estimates of recreational harvest from state-wide surveys completed in 2000, 2012/13, 2017/18, 2019/20 and 2021/22;
- Catch rates and size-structure of catches from fishery independent surveys (FIS) in Walls Lake from 2018/19 to 2023/24 (see Taylor *et al*., 2023 for a full description); and

Key model structure & assumptions:

Standardised catch rates

Annual catch rates were standardised using Generalised Additive Mixed Model (GAMM) using daily catch data from 2009/10 to 2016/17 and 2017/18 to 2023/24 to account for changes in reporting and management arrangements (described in full in Johnson 2024). Catch rates were standardised for the methods of fish and crab trapping for Wallis Lake and other main estuaries separately.

For the GAMM, the variables considered as part of the standardisation process were, Estuary, Authorised Fisher ID (as a random effect), Month, Lunar Phase, Mean freshwater inflow to the estuary in the previous month and Effort (Trap lifts).

Lunar phase was included to incorporate differences in height between high and low tides as the moon waxes and wanes from new to full. Lunar phase was calculated from illumination (as a fraction of visible surface) using the 'lunar' package in R based on the date (Lazaridis, 2022).

Daily freshwater inflow was extracted from the Water NSW online portal (https://realtimedata.waternsw.com.au/water.stm) for main estuaries that accounted for >95% of total landings from 2018/19 to 2023/24 (i.e., Wallis Lake, Port Stephens, and Lake Illawarra). Mean monthly flow values were calculated and scaled by Estuary for use in standardisation.

The Null model (other estuaries) included an estuary by fiscal year interaction, to allow the CPUE trends in each estuary to differ, and a random effect of Authorised Fisher to account for differences between fishers. To account for the cyclical nature of Month and Lunar Phase, GAMMs included cyclical splines of Month and Lunar Phase. Factor smooth interactions were included for Mean Flow and Estuary to model estuary specific deviations from an overall smooth. To ensure CPUE relationships identified were not driven by more records in individual estuaries or years, all data points were weighted to provide equal weighting between Year and Estuary combinations (Campbell 2015). All GAMMs were fit using the 'mgcv' R package (Wood, 2011).

Predicted CPUE indices for the main estuaries were aggregated to generate a single index of abundance by calculating the weighted average for the time series for each estuary and weighting these by the area of the estuary (see Hoyle *et al*., 2024 for justification).

A model selection process using a manual backwards selection process, whereby each variable was removed one at a time and the Akaike information criterion values (AIC) compared between competing models was completed to determine the optimum model. Model fits were assessed visually with residual and partial effects plots generated by the 'appraise' and 'draw' functions of the 'gratia' package in r (Simpson, 2023).

Assumptions: that annual catch rates are a relative index of abundance and not unduly influenced by other factors that are not accounted for through standardisation.

CPUE and catch prediction for Wallis Lake (Schilling *et al.*, 2023)

Predictions of summer (January – April) CPUE for Wallis Lake from a liner model fitted to the previous year's summer CPUE (kg scaled fisher day-1), the total catch taken the previous winter (June – November; kg), and the mean Pacific Decadal Oscillation (PDO) index from November – January leading into the fishing season (see Schilling *et al*., 2023 for a full description).

Quadratic discrimination analysis using the previous summer (January – April) CPUE and the winter (June – November) catch to classify years as above or below average (see Schilling *et al*., 2023 for a full description).

Sources of uncertainty evaluated:

Two different model scenarios were tested:

- Daily data GAMM with lognormal distribution,
- Daily data GAMM with Tweedie distribution.

The effect of data selection on standardisations of daily data (kg.Day^{-1}) from 2009/10 to 2016/17 and 2017/18 to 2023/24 was investigated using the following criteria:

- Minimum number of years in the fishery (2, 4 & 6)
- Minimum average catch per fisher (0.5, 1 & 2 t);
- Minimum catch per record (1, 3 & 5 kg); and
- Maximum catch per record (50, 100 & 150 kg).

Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	None specified in a formal harvest strategy. This assessment used a weight-of-evidence approach, which included: trend in annual standardised catch rates from Wallis Lake and other main estuaries (combined) for the methods of fish and crab trapping; catch rates from fishery-independent surveys in Wallis Lake (legal and undersize crabs); and predictions of summer (January – April) CPUE and catches from Wallis Lake.
Biomass Limit Reference Point	None specified in a formal harvest strategy. In the interim, the current catch rates were compared to the long-term averages of each time series.

Biomass Target Reference Point	None specified in a formal harvest strategy. Current catch rates are compared to the long-term averages of each time series.
Fishing mortality indicator or proxy	None specified in a formal harvest strategy. In the interim, trends in the total fishing effort of the fish and crab trapping sector of the EGF was used as an indicator of relative fishing pressure.
Fishing mortality Limit Reference Point	None specified in a formal harvest strategy. In the interim, current effort levels were compared against historic levels.
Fishing Mortality Target Reference Point	None specified in a formal harvest strategy.

Stock Assessment Results

Standardised commercial catch rates

Standardised catch rates (sCPUE in mean CPUE kg-trap^{-1}) for fish and crab trapping in Wallis Lake increased from 2011/12 and were ≥ mean catch rate from 2012/13 to 2014/15 and in 2016/17 (Fig. 5). For other main estuaries, sCPUE for fish trapping exceeded mean catch rate from 2009/10 to 2011/12 and in 2015/16 (Fig. 6). Standardised catch rates for crab trapping in other main estuaries are not shown due to insufficient records. Reported total catches for the method of crab trapping in Port Stephens and Lake Macquarie accounted for <7% and <1% of total landings from 2009/10 to 2016/17, respectively.

Under revised management arrangements from 2017/18 (i.e., TAC and size limit increase), sCPUE for fish trapping (~60% of average landings) generally declined from 2017/18 to 2022/23. However, sCPUE fish trapping in Wallis Lake slightly increased in 2020/21, but declined in 2021/22. In 2022/23, sCPUE fish trapping in Wallis Lake declined to the lowest levels in the available time series (Fig. 5). Similarly, crab trap catch rates in Wallis (~15% of average landings) declined from 2019/20 to reach a minimum in 2021/22 and remained below mean catch rate in 2022/23 When compared to 2017/18, sCPUE fish trapping in Wallis Lake in 2022/23 was ~64% lower and However, sCPUE in 2023/24 for fish and crab trapping in Wallis exceeded mean catch rate and was 61% and 27%greater than 2022/23, respectively (Fig. 5). For other main estuaries, fish trap and crab trap sCPUE fluctuated around the mean catch rate from 2019/20 to 2021/22, before declining to ~10% below mean catch rate in 2022/23. However, in 2023/24, fish trap sCPUE in other estuaries increased by 22% and exceeded mean catch rate by 12%. Additionally, crab trap SCPUE for other estuaries in 2023/24 was 13% greater than 2022/23 and exceed mean catch rate.

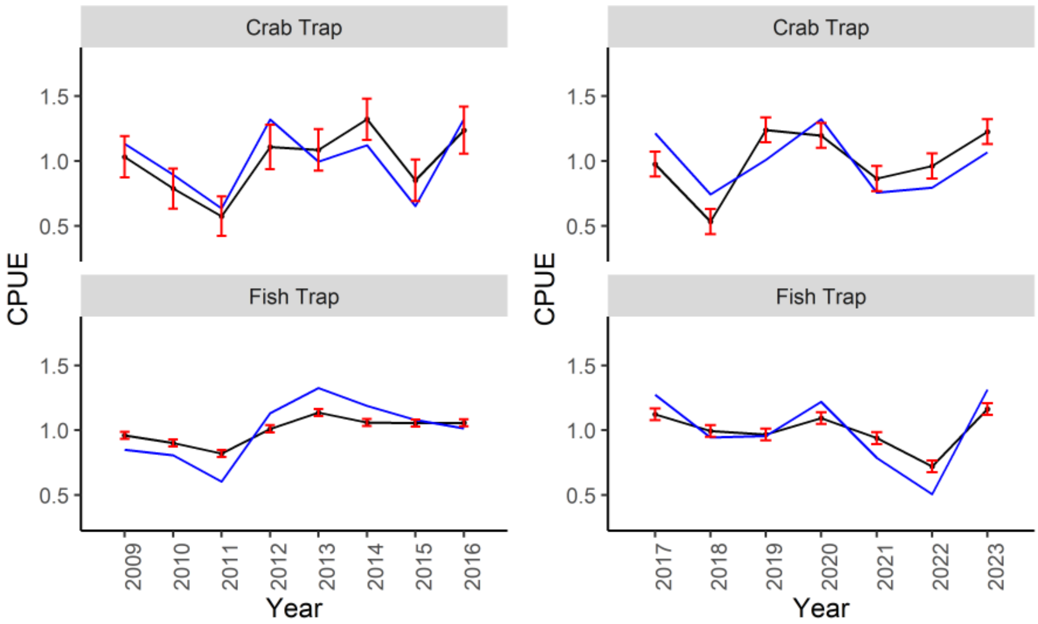

Figure 4. Standardised CPUE (± SE) and nominal catch rates (blue line) in kg.trap^{-1} for Wallis Lake from the Tweedie GAMM for daily data from 2009/10 to 2016/17 (left) and 2017/18 to 2023/24 (right).

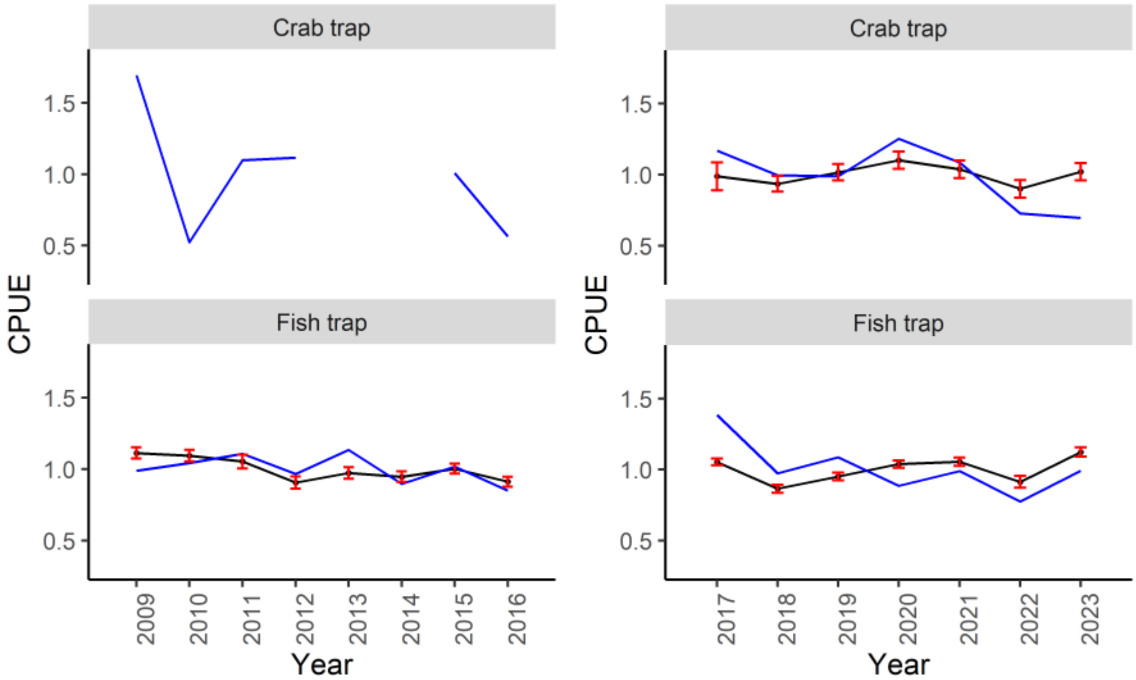

Figure 5. Standardised CPUE (± SE) and nominal catch rates (blue line) in kg.trap^{-1} for main estuaries from the Tweedie GAMM from 2009/10 to 2016/17 (left) and 2017/18 to 2023/24 (right).

Fishery-independent surveys (FIS)

Totals of 18, 845 undersize and 5, 1746 legal Blue Swimmer Crabs have been caught from ~4, 880 trap lifts from November 2018 to May 2024. There was substantial temporal variability in catch rates (number.crabs.trap^{-1}) of undersize and legal sized crabs throughout the survey period (Fig. 6). Catches of undersize crabs in 2018/19, 2019/20 and 2020/21 peaked in mid-late summer (January or

February). Catch rates of undersized crabs in January 2024 (9.61 ± 0.71 crabs.trap^{-1}), 2023 (0.76 ± 0.11 crabs.trap^{-1}) and 2022 (5.00 ± 0.46 crabs.trap^{-1})) were lower than 2019 (17.18 ± 1.44 crabs.trap^{-1}) and 2021 (13.60 ± crabs.trap^{-1}). Catches of legal sized crabs were less variable but generally declined throughout the fishing season reaching a minimum from July to September. Monthly catch rates of legal sized crabs for 2022 (July to June) and 2023 (July to January) were below mean long-term average (1.11 crabs.trap^{-1}) and mean catch rate calculated for the first three years (November 2018/19 to June 2021/22) surveyed (1.27 crabs.trap^{-1}). Catch rates declined from 1.73 (± 0.08) crabs.Trap.lift^{-1} in 2018/19 to 0.85 (± 0.04) and 0.69 (± 0.03) crabs per trap lift for the main fishing period and all months in 2022/23 (Fig. 7). Similarly, annual catch rates of undersize crabs from November to March (Main) have declined from 9.50 (± 0.49) crabs.Trap.Lift^{-1} in 2018 to 3.37 (± 0.16) and 1.10 (± 0.06) crabs.Trap.Lift^{-1} in 2021/22 and 2022/23, respectively (Fig. 7). Catch rates of undersize crabs in 2023/24 (Main; 5.73 ± 0.24) were ~6x higher than 2022/23 (0.85 ± 0.04), but were 40%, 19% and 36% below catch rates in 2020/21, 2019/20 and 2018/19, respectively (Fig. 6). Similarly, catch rates of legal crabs in 2023/24 (Main; 1.18 ± 0.05) were 38% above 2022/23 (0.85 ± 0,04), and were 68% of peak catch rates recorded in 2018/19 (Fig. 7).

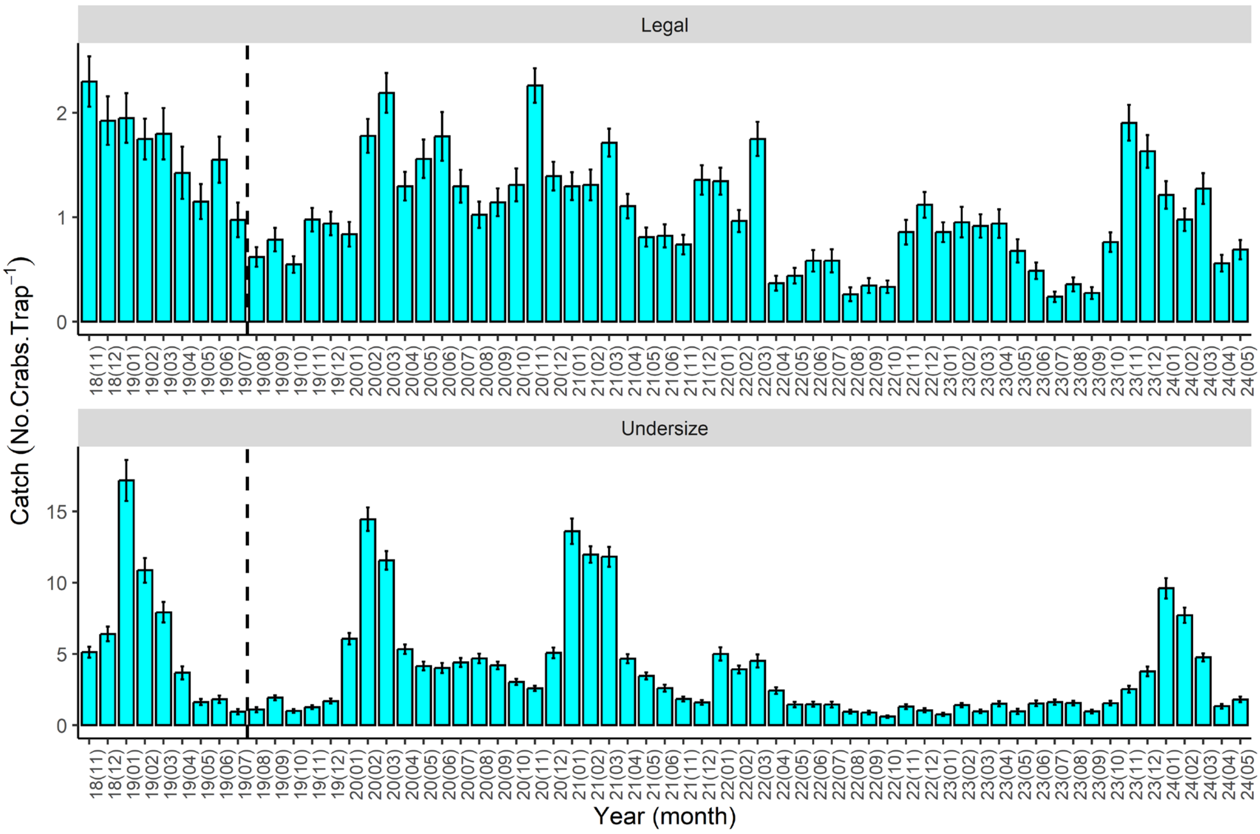

Figure 6. Mean (± SE) monthly catch rate (number.crabs.trap^{-1}) of legal (top plot) and undersize crabs (bottom plot). Dashed vertical line indicates change in sampling design (See Taylor *et al*., 2023).

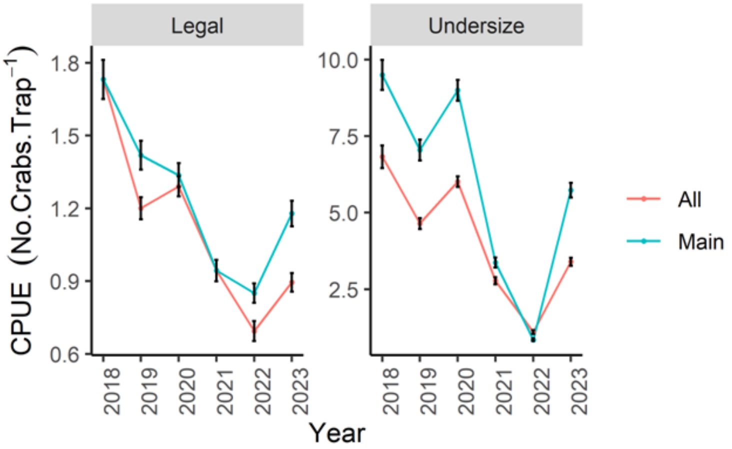

Figure 7. Mean catch rate (± SE) of legal crabs and undersize crabs for all months and November to June for legal crabs and November to March for undersize (Main).

2025 FIS (December 2024 – February 2025)

Catch rates of undersize crabs in January 2025 (14.9 crabs.trap^{-1}) were the second highest in the available time series (Fig. 8). Mean catch rate of undersize crabs calculated from December 2024 to February 2025 (10.1 crabs.trap^{-1}) was greater than mean annual catch rate (7.1 crabs.trap^{-1}) calculated from surveys completed in Summer (December to February, Fig. 8). However, catch rate of legal crabs calculated from Summer 2025 (1.0 crabs.trap^{-1}) was less than mean annual summer catch rate (1.3 crabs.trap^{-1}, (Fig. 8).

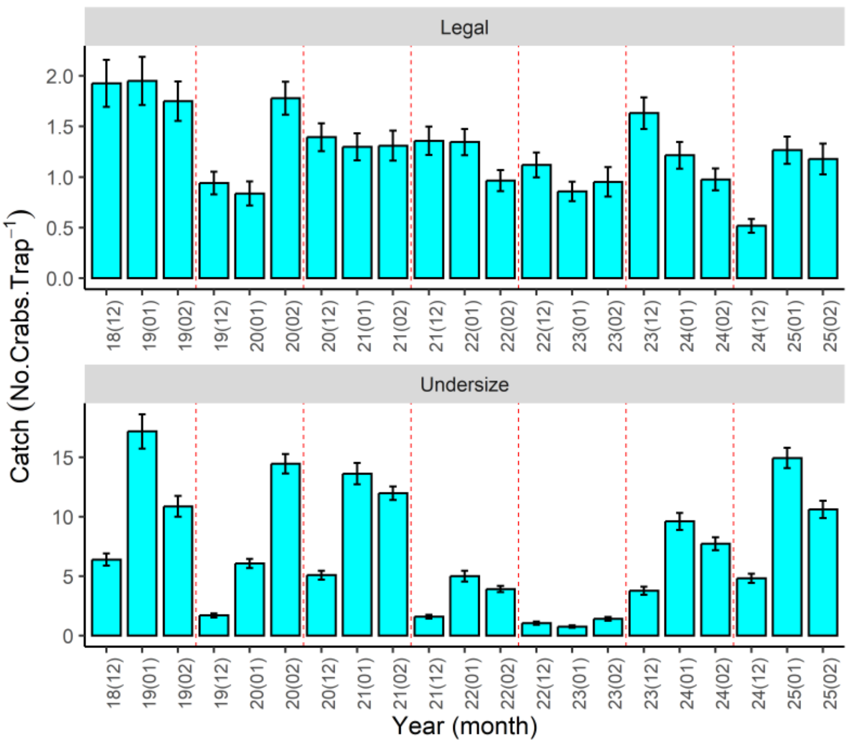

Figure 8. Mean (± SE) monthly catch rate (number.crabs.trap-1) of legal and undersize crabs (pooled across sites) for December to February from 2018/19 to 2024/25. Sampling years separated by vertical red dashed lines.

Size-structure of observed catches

Increasing the minimum legal length (MLL) from 60 to 65 mm in 2017 increased protection of the spawning stock. The size-structure of observed catches from Wallis Lake trap fishery indicate that ~60% of the total catch of both egg bearing and female Blue Swimmer Crabs were below the current MLL (Fig. 8). Approximately 55 and 64% of the total observed catch of male Blue Swimmer Crabs from 2018/19 and 2019/20 were undersized, respectively (Fig. 9). The proportion of the observed annual catch of undersized Blue Swimmer Crabs ≥ 60 < 65 mm ranged from 59.6% for males to 65.9% for females (Fig. 8, Fig. 9). Within individual months, the proportion of female and male crabs ≥ 60 < 65 mm ranged from 17.3 to 49.3% and 12.2 to 46.6%, respectively (Fig. S6).

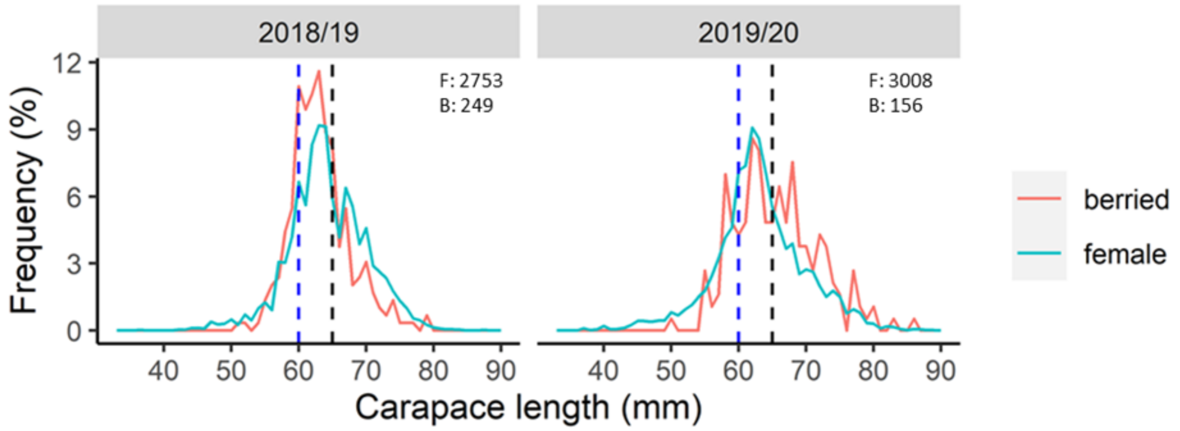

Figure 8. Size-frequency distribution of egg bearingfemale and female Blue Swimmer Crabs recorded from observer-based survey of Wallis Lake from 2018/19 to 2019/20. The number of female (F) and egg bearing female (B) crabs measured is shown. Dashed line represents historic (blue - pre December 2017) and current (black) MLL.

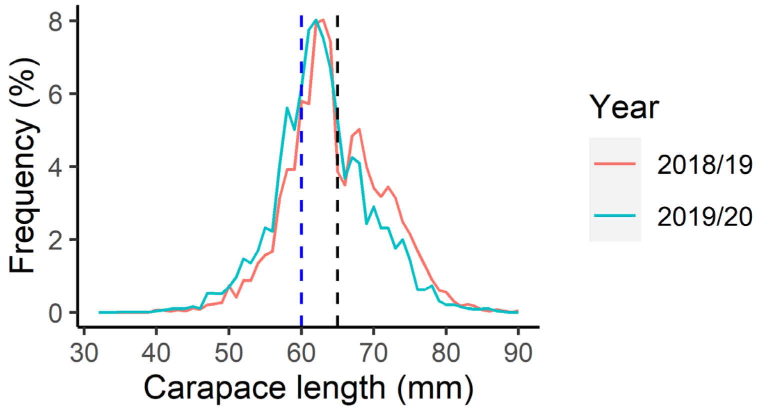

Figure 9. Size-frequency distribution of male Blue Swimmer Crabs recorded from observer-based survey of Wallis Lake for 2018/19 (n = 6, 673) and 2019/20 (n = 8, 153). Dashed line represents historic (blue - pre December 2017) and current (black) MLL.

CPUE and catch prediction for Wallis Lake (see Schilling *et al.*, 2023)

Following integrative analysis drawing together information to test specific hypotheses of a variety of factors that could influence Blue Swimmer Crab commercial fisheries harvest in Wallis Lake, Schilling *et al.*, 2023 used a single ecologically relevant regression model to predict the summer

(January – April) CPUE (the period when most of the blue swimmer crabs are harvested). The model predicted CPUE (January in April) in 2023/24 (22.7 kg day^{-1}to be greater than 2022/23 but below long-term average (Fig. 10, 24.7± 2.0 kg day^{-1}).

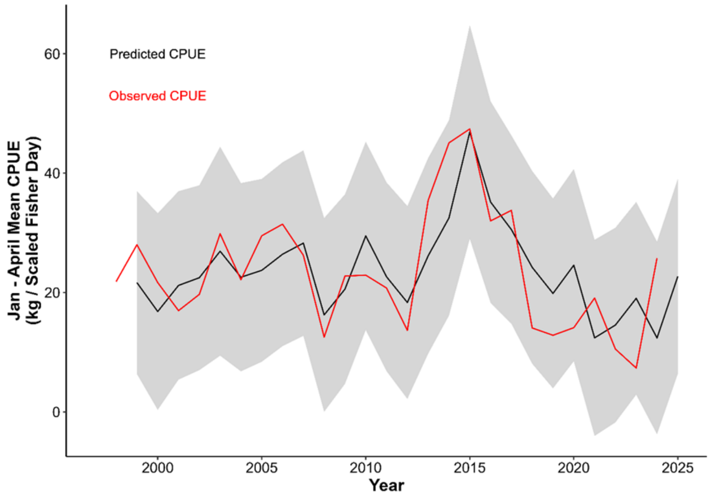

Figure 10. Hindcast predictions of summer (January – April) CPUE (kg scaled Fisher Day^{-1}) for Blue Swimmer Crab in Wallis Lake. The red line shows observed CPUE while the black line shows the predicted CPUE. The grey ribbon shows the 95% prediction interval using the linear model (see Schilling *et al*., 2023).

Quadratic discrimination analysis was successful (72.0% accuracy) at using the previous summer (January – April) CPUE and the winter (June – November) catch to classify most years as above or below mean total harvest (78.7 t) calculated from reported landings for Wallis Lake from 1998 – 2021 (Fig. 11, Schilling *et al*., 2023). The classification analysis showed that when the previous summer harvest was high, the forecast season was likely to be above average but if the winter harvest was too large then there was a risk of a below average harvest (Schilling *et al*., 2023). The magnitude of winter harvest declined from 2017/18 to 2022/23, but increased in 2023/24 (~10.0 t) and 2024/25 (~7.8 t). The analysis correctly predicted below average total catch in 2023/24 (Fig. 11), and predicted with a 78% likelihood that total catch in 2025 will also be below average.

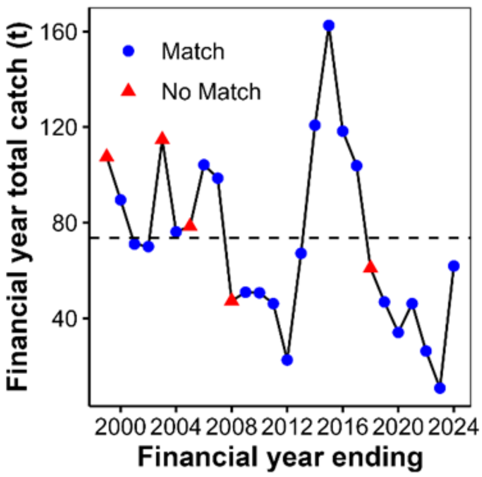

Figure 11. The performance of the predictions over time relative to the observed financial year catch (year ending June 30th). The dashed line represents the mean total catch (source Schilling *et al*., 2023).

Stock Assessment Result Summary

Biomass status in relation to Limit	NA – no fishing mortality limit has been set. For recent data analysed as mean catch rates (kg.trap^{-1}), standardised commercial catch rates (sCPUE) for fish trapping in Wallis Lake in 2023/24 exceeded mean catch rate and was 24% and 61% greater than 2021/22 and 2022/23, respectively. Although, sCPUE declined by more than 50% from 2017/18 to 2022/23. For crab trapping in Wallis Lake sCPUE in 2023/24 exceeded mean catch rate and was 27% and 42% greater than 2021/22 and 2022/23, respectively. Although, sCPUE was below mean catch rate in 2021/22 and 2022/23. For other main estuaries, fish and crab trap sCPUE in 2023/24 exceeded mean catch rate. Although, fish and crab trap CPUE was ~10% below mean catch rate in 2022/23. Catch rates of undersize crabs from fishery-independent surveys (FIS) in Wallis Lake in January 2025 (14.9 crabs.trap^{-1}) were the second highest in the available time series. Additionally, catch rate of undersize crabs calculated from summer 2025 (10.1 crabs.trap^{-1}) exceeded mean annual catch rate (7.1 crabs.trap^{-1}) calculated for summer. Although, summer catch rates in 2022/23 (7.0 crabs.trap^{-1}) were ~7 x higher than 2021/22 (1.1 crabs.trap^{-1}), they were 40 and 30% lower than peak summer catch rates in 2018 (11.5 crabs.trap^{-1}) and 2020 (10.3 crab.trap^{-1}), respectively. Quadratic discrimination analysis correctly predicted below average catch in 2023/24, and predicts below average catch in 2024/25.
Biomass status in relation to Target	Not assessed.
Fishing mortality in relation to Limit	NA – no fishing mortality limit has been set. Weight-of-evidence provided is sufficient to support an understanding that fishing mortality is at a level to avoid the stock being recruitment impaired. The trend of decreasing catch rates from

	the fishery and main regions coincides with a reduction in total commercial landings and effort following the transition to quota management in 2017/18.
Fishing mortality in relation to Target	Not assessed.
Current SAFS stock status	Depleting (Johnston *et al*., 2023)

Fishery interactions

Of the ~51 incidental species recorded from a fishery-wide observer-based assessment of the Blue Swimmer Crab trap fishery in Wallis Lake completed over two fishing season, only one individual of two protected species: a green turtle (*Chelonia mydas*) and a pied cormorant (*Phalacrocorax varius*) (both deceased), and two alien species, including 11 *Carcinus maenas*, and one *Charybdis japonica* were caught (Barnes *et al*., 2022).

Stakeholder engagement

NSW DPI Fisheries presented the current stock assessment to stakeholders in the Estuary General Fishery on the 5th March 2024, to outline the assessment process and provide an opportunity for feedback.

Qualifying Comments

On the basis of the evidence contained within this assessment, Blue Swimmer Crabs are currently assessed as sustainable. The weight of evidence provided supports an understanding that the biomass of Blue Swimmer Crabs is at a level to ensure, on average, future levels of recruitment are adequate and fishing mortality is adequately controlled to avoid the stock becoming recruitment impaired. However the change in stock status from depleting in 2024 based on understanding that the biomass of Blue Swimmer Crabs declined from 2017/18 to 2022/23 (Johnson 2024), should be interpreted cautiously due to the short-term increases in catches and indexes of abundance from the commercial fishery and pre-recruits in the fishery-independent survey (1 to 2 years). Additionally, trends in indexes of abundance from the commercial fishery derived from short-time series (<10 years) do not allow direct comparison of the current performance of the fishery to historic levels. Furthermore, if the level of fishing mortality permitted under existing management arrangements (i.e., TAC 185 t) is combined with recreational catches estimated at 10–20% of total harvest, fishing mortality may result in declining biomass. Particularly, if unfavourable conditions (i.e., high freshwater inflows) occur over an extended temporal scale (i.e., 1-2 years).

Known or likely uncertainties in the key indicators were taken into consideration in ranking of the quality of key indicators, and in reaching a conclusion regarding stock status.

The impact of recent management changes (i.e. quota management) on catch rates has not been fully quantified. However, the results of the observer-based survey of the Wallis Lake trap fishery indicate the increased MLL has likely resulted in increased levels of discarding reducing retained catches (*Barnes et al*., 2022).

La Niña developed in the second half of 2020 causing extreme rainfall events on the east coast of Australia resulting in several major flooding events in northern NSW in 2021 and 2022. Although Schilling *et al*., 2023 found no relationship between freshwater flow and recruitment (catch) the following season in Wallis Lake, there was a negative relationship between catch rates of legal crabs in estuarine and inshore habitats suggesting that large crabs may be moving between these environments (Schilling *et al*., 2023, Taylor *et al*., 2023). From 2009/10 to 2016/17, reported landings for Wallis Lake exceeded 100 t in four years during which mean river flow was below average for 10 months (2014/15 to 2016/17) and 12 months (2013/14) annually. Only one year (2009/10) with more than 10 months of below average river flow had reported landings less than 100 t during this time-series. Post management reform (2017/18), both years with landings less than 30 t (2021/22 and 2022/23) had five months of above average river flow. In 2023/24, the number of months with below average river flow increased to 9 from 7 for years spanning 2020/21 to 2022/23, and reported landings increased to 74.1 t from 14.2 t in 2022/23, 23.5 t (2021/22) and 48.7 t in 2020/21.

The size-structure of catches from the fishery and fishery-independent surveys suggests that either crabs are rapidly removed by fishers as soon as they enter the fishery, or crabs are emigrating from the estuary with Taylor *et al*., (2023) reporting catches of large crabs (70-80 mm CL) from inshore waters adjacent to Wallis Lake from May to August. Due to reduced fishing pressure on mature female crabs following the MLL increase, and declining winter harvest the stock is unlikely to be recruitment impaired.

The increased minimum legal length and, the implementation of daily possession limit for all ocean fisheries (25 kg) has reduced fishing pressure on the spawning stock, resulting in a decline in harvest rate over the last two years. However, Schilling *et al*., (2023) found that winter harvesting in Wallis Lake disproportionally impacts large females which negatively impacts the following January to April harvest. The negative relationship between increased fishing mortality on mated pre-spawning females during winter and, a declining summer harvest aligns with previous research on Blue Swimmer Crabs in Western Australia (Johnston *et al*., 2011).

References

Barnes, T.C., Broadhurst, M.K., Johnson, D, D. (2022) Fleet-wide acceptance of escape gaps and their utility for improving selectivity in south-eastern Australian *Portunus armatus* traps. *Fisheries Management and Ecology* 2022; 00:1–10. DOI: 10.1111/fme.12586.

Campbell, R.A., 2015. Constructing stock abundance indices from catch and effort data: some nuts and bolts. Fish. Res. 161, 109–130. https://doi.org/10.1016/j. fishres.2014.07.004.

Chaplin, J., Yap, E., Sezmiş, E., and Potter, I. (2001) Genetic (microsatellite) determination of the stock structure of the blue swimmer crab in Australia. FRDC Project No. 98/118, Murdoch University, Murdoch.

Henry, G.W. and Lyle, J.M. (2003) The national recreational and Indigenous fishing survey, Fisheries Research and Development Corporation, Canberra. https://www.frdc.com.au/sites/default/files/products/1999-158-DLD.pdf

Hewitt, D.E., Schilling, H.T., Hanamseth, R., Everett, J.D., Li, J., Roughan, M., Johnson, D.D., Suthers, I.M., Taylor, M.D. (2022) Mesoscale oceanographic features drive divergent patterns in connectivity for co-occurring estuarine portunid crabs. *Fisheries Oceanography*, 2022;31:587–600. DOI: 10.1111/fog.12608

Hoyle S.D., Campbell R.A., Ducharme-Barth N.D., Grüss A., Moore B.R., Thorson J.T., *et al.* (2024). Catch per unit effort modelling for stock assessment: A summary of good practices. *Fisheries Research* 269, 106860. https://doi.org/10.1016/j.fishres.2023.106860

Johnson, D.D., Gray, C.A., Macbeth, W.G. (2010) Reproductive biology of *Portunus pelagicus* in a south-east Australian estuary, *Journal of Crustacean Biology* 30: 200–205. DOI: 10.1651/08-3076-1

Johnson, D.D., (2024) Stock assessment report 2023/24 – Estuary General Fishery – Blue Swimmer Crab (*Portunus armatus*). NSW Department of Primary Industries. Fisheries NSW, Port Stephens Fisheries Institute: 87 pp.

Johnston, D., Harris, D., Caputi, N., Thomson, A. (2011). Decline of a blue swimmer crab (*Portunus pelagicus*) fishery in Western Australia — History, contributing factors and future management strategy. *Fisheries Research* 109, 119–130. https://doi.org/10.1016/j.fishres.2011.01.027

Johnston, D., Chandrapavan, A., Walton, L., Beckmann, C., Johnson, D.D., and Garland, A. (2021) Blue Swimmer Crab (*Portunus armatus*). In Status of Australian Fish Stocks 2020. pp. https://fish.gov.au/report/299-Blue-Swimmer-Crab-2020 accessed 4 April 2022. (Fisheries Research and Development Corporation: Canberra)

Johnston, D., Harris, D, Chandrapavan A. Hanamseth, R, Johnson, D and Garland A (2023) Blue Swimmer Crab in Anthony Roelofs, Toby Piddocke, Crispian Ashby, Simon Conron, Klaas Hartmann, Alex Hesp, Patrick Hone, Ian Jacobsen, Marlee Jesson-Kerr, Stephen Mayfield, John Stewart, Michael Usher, James Woodhams and Daniel Wright (eds) 2024, Status of Australian Fish Stocks Reports 2024, Fisheries Research and Development Corporation, Canberra.

Lazaridis E. (2022). lunar: Lunar Phase & Distance, Seasons and Other Environmental Factors (version 0.2-01)

Murphy, J.J., Ochwada-Doyle, F.A., Hughes, J.M., West, L.D., Stark, K.E. (2020) The NSW Recreational Fisheries Monitoring Program - Survey of recreational fishing, 2017/18. NSW DPI - Fisheries Final Report Series No. 158. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/1325319/NSW-Recreational-Fisheries-Monitoring-Program-Survey-of-recreational-fishing-in-NSW-201718-_-Fisheries-Final-Report-Series-No-158.https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/1325319/NSW-Recreational-Fisheries-Monitoring-Program-Survey-of-recreational-fishing-in-NSW-201718-_-Fisheries-Final-Report-Series-No-158.pdf

Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark, K.E., Hughes, J.M. and Taylor, M.D. (2022) Survey of recreational fishing in NSW, 2019/20 – Key Results. NSW DPI - Fisheries Final Report Series No.161. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/1394969/NSW-Recreational-Fisheries-Monitoring-Program-Survey-of-recreational-fishing-in-NSW-201920-~-Fisheries-Final-Report-Series-No-161.pdf

Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark, K.E., Hughes, J.M. and Taylor, M.D. (2024) Survey of recreational fishing in NSW, 2019/20 – Key Results. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/1550631/NSW-Recreational-Fisheries-Monitoring-Program-Survey-of-recreational-fishing-in-NSW-202122.pdf

Ochwada-Doyle, F., McLeod, J., Barrett, G., Clarke, G., and Gray, C. (2014) 'Assessment of recreational fishing in three recreational fishing havens in New South Wales.' (NSW Department of Primary Industries, Port Stephens). https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/545750/FFRS-139_Ochwada-Doyle-et-al-2014.pdf

R Development Core Team. (2017) R: A Language and Environment for Statistical Computing. Vienna: Foundation for Statistical Computing. http://www.R-project.org.

Schilling, H.T., Johnson, D.D., Hanamseth, R., Suthers, I.M., Taylor, M.D. 2023. Long-term drivers of catch variability in south-eastern Australia’s largest portunid fishery. *Fisheries Research* 260 https://doi.org/10.1016/j.fishres.2022.106582

Smyth, L., Egan, H. and Kennett, R., Australian Institute of Aboriginal and Torres Strait Islander Studies, 2018, Livelihood values of Indigenous customary fishing: Final report to the Fisheries Research and Development Corporation, Canberra.

Steffe, A.S., Murphy, J.J., Chapman, D.J., Barrett, G.P., Gray, C., 2005. An assessment of changes in the daytime, boat-based recreational fishery of the Tuross Lake estuary following the establishment of a 'Recreational fishing Haven'. NSW Department of Primary Industries – Fisheries final Report Series No. 81. NSW Department of Primary Industries, Cronulla, 70 pp.

Simpson G. (2023). _gratia: Graceful ggplot-Based Graphics and Other Functions for GAMs Fitted using mgcv_. R package version 0.8.1

Taylor M.D., Hewitt D., Hanamseth R., Schilling H., Nolan S., Suthers I.M., Johnson D.D. (2023) Informing adaptive management of portunid fisheries in NSW. Final Report to the Fisheries Research and Development Corporation on project 2017/006, NSW Department of Primary Industries, Port Stephens. CC BY 3.0.

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. Fisheries Final Report Series No. 149. NSW Department of Primary Industries, Wollongong. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/598628/West-et-al-Survey-of-rec-fishing-in-NSW-ACT-2013-14-2016_03_02.pdf

Wood, S. N. (2011). Fast stable restricted maximum likelihood and marginal likelihood estimation of semiparametric generalized linear models. In *Journal of the Royal Statistical Society (B)* (Vol. 73, Issue 1, pp. 3–36).

Appendices

Supplementary figures

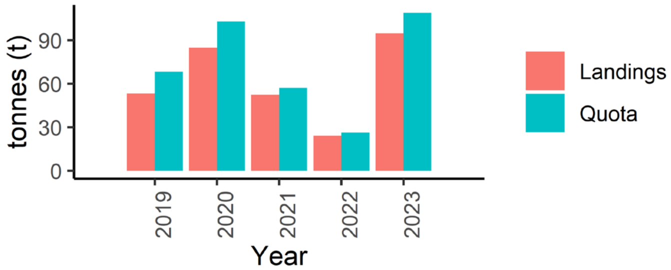

Figure S1. Reported annual landings from the Estuary General Fishery and quota usage from 2019/20 to 2023/24.

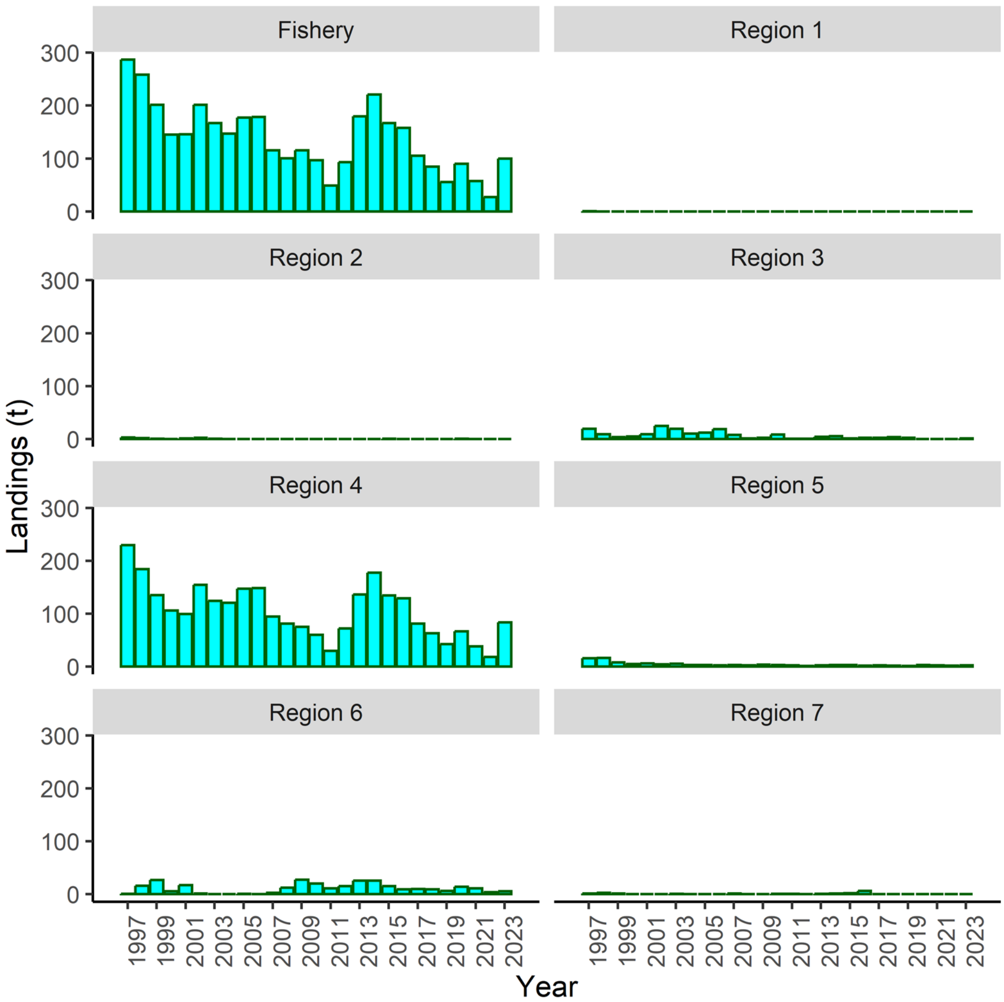

Figure S2. Reported landings (t) from NSW estuaries and estuary general management regions from 1997/98 to 2023/24.

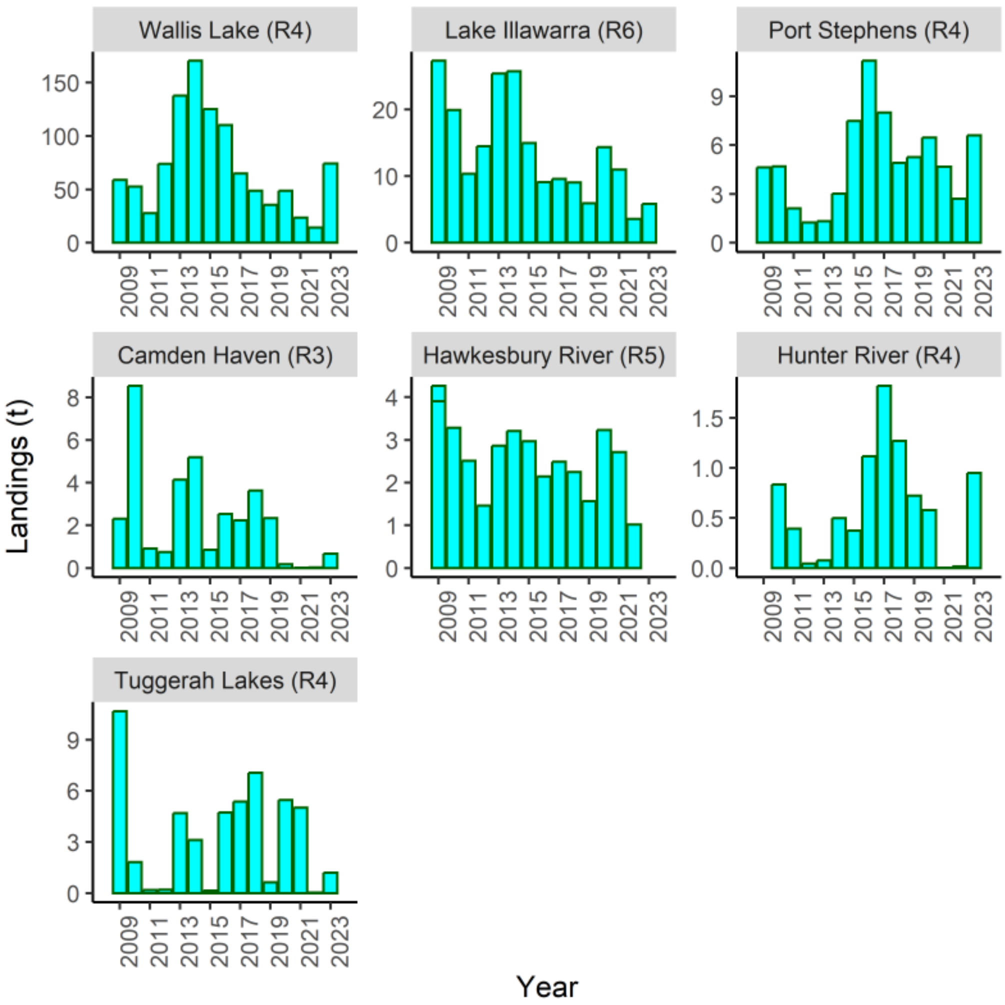

Figure S3. Reported landings (t) from main estuaries from 2009/10 to 2023/24. Estuary general regions shown in parentheses. Scales on Y axis variable.

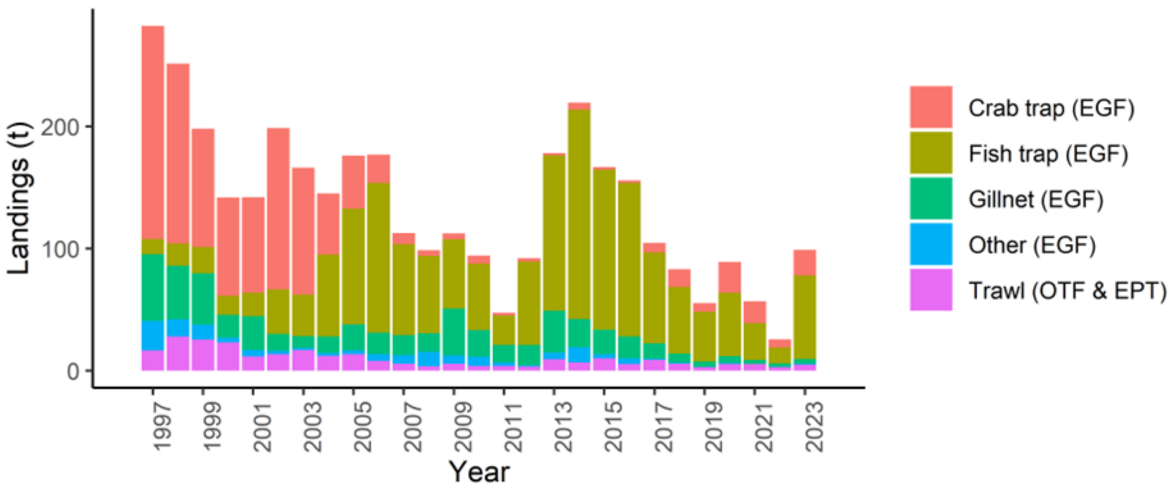

Figure S4. Annual reported commercial landings (t) from the EGF by method and Ocean Trawl Fishery (OTF) and Estuary Prawn Trawl (EPT) combined (Trawl) from 1997/98 to 2023/24.

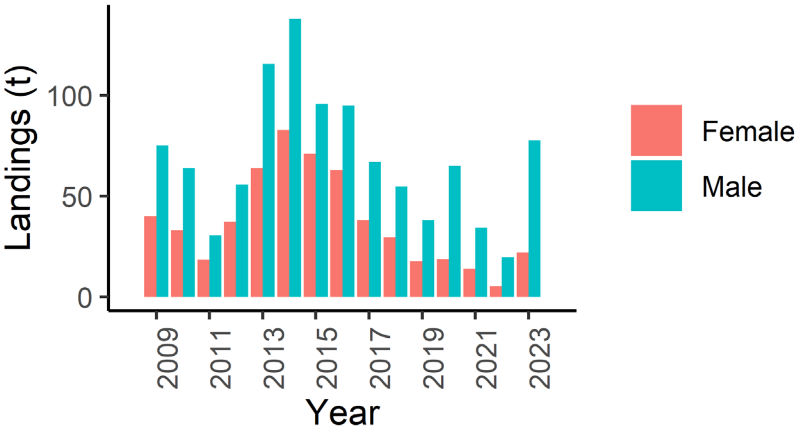

Figure S5. Reported landings of female and male Blue Swimmer Crabs from 2009/10 to 2023/24.

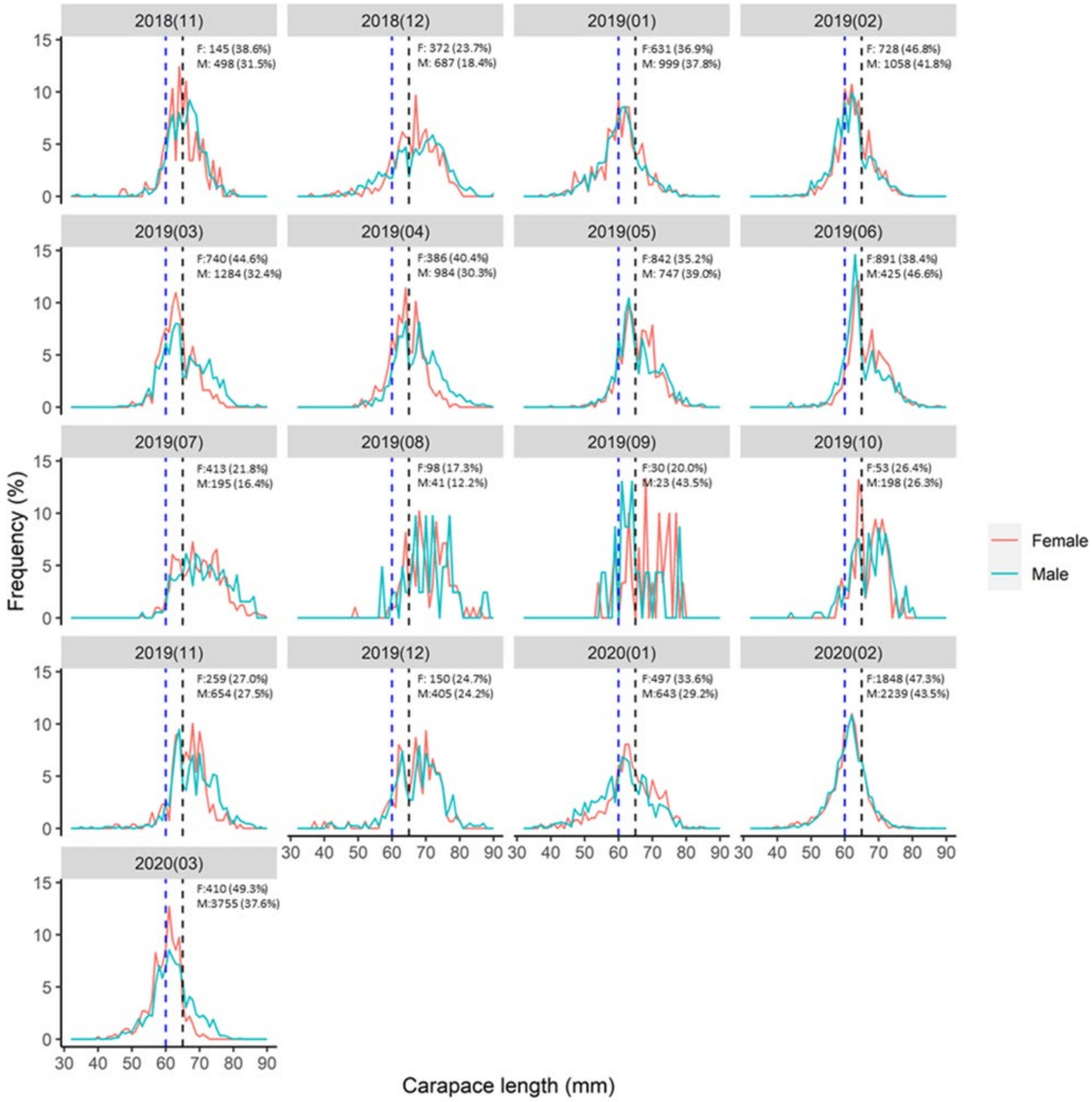

Figure S6. Monthly size-frequency distribution of female and male Blue Swimmer Crabs for observed catches from November 2018 to March 2020. The number of female (F) and Male (M) crabs measured and proportion of catch ≥ 60 < 65 mm is shown in parenthesis (%). Dashed lines indicate historic (blue 60 mm) and current (black 65 mm) MLL.