Western Australian Marine Stewardship Council Report Series

West Coast Estuarine Managed Fishery (Area 2: Peel-Harvey Estuary) & Peel-Harvey Estuary Blue Swimmer Crab Recreational Fishery

Addendum 4

November 2020

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Background

The West Coast Estuarine Managed Fishery (WCEMF) Area 2 (Peel-Harvey Estuary) uses haul and gillnets to target predominantly sea mullet (*Mugil cephalus*), and crab traps to target blue swimmer crabs (*Portunus armatus*). The recreational crab fishers in the Peel-Harvey Estuary primarily use drop and scoop nets for catching blue swimmer crabs.

The fisheries achieved Marine Stewardship Council (MSC) certification in 2016 and the assessment was based on information presented in Johnston et al. (2015):

http://www.fish.wa.gov.au/Documents/wamsc_reports/wamsc_report_no_3.pdf

This report is the fourth addendum to Johnston et al. (2015) and provides catch and catch rate information for the 2019 (finfish) and 2018/19 (crab) fishing seasons in the Peel-Harvey Estuary (PHE). It also provides brief updates on work undertaken to address outstanding MSC conditions on these fisheries.

MSC Principle 1

1. Stock Status & Harvest Strategies

The sea mullet and blue swimmer crab stocks targeted by fishers in the PHE are assessed annually using a weight-of-evidence approach that considers all available information. This approach has been based primarily on evaluating standardised commercial catch rates (primary performance indicator) and catches (secondary performance indicator) of both species in the WCEMF Area 2, relative to reference points calculated based on a reference period in which these indicators have been stable (see Department of Fisheries 2015a, b). Overall weight-of-evidence assessments also consider any additional fishery-independent and fishery-dependent information where available.

The first harvest strategies developed for the finfish and blue swimmer crab resources of the PHE have recently been reviewed and updated (DPIRD 2020a, b). Key changes include a broadening scope of these documents (recognising that the stocks of both sea mullet and blue swimmer crabs extend outside the estuary), as well as updating the indicators used to assess the status of the sea mullet stock in WA (see below for more information). To address conditions on the harvest control rules for sea mullet and blue swimmer crabs, these have also been revised to ensure they now more explicitly describe the actions required to be taken if a threshold or limit reference level for the target stocks is breached (see DPIRD 2020a, b).

1.1 Sea mullet

Prior to the development of a higher-level stock assessment for sea mullet in WA, two alternative time series of standardised catch rates for sea mullet in the PHE (based on "100 m netting hours" or "fishing days" as the measure of fishing effort) have been simultaneously monitored against associated reference levels based on the catch rates observed during a 2000-2011 reference period (Table 1.1). The two alternative catch rates in 2019 (4.8 kg/ 100 m netting hour and 91.7 kg/day) were lower than in the previous year but remained above their respective lower threshold reference levels, indicating that abundance in the PHE has been maintained at a sustainable level (Figure 1.1 and Figure 1.2). The commercial catch of sea mullet in the PHE in 2019 (81.5 t) was also above the (catch-based) lower threshold level of 70 t, but was slightly lower than the 103 t retained in 2018.

Table 1.1. Catch rate reference points for sea mullet in the PHE based on original catch rate standardisation (kg/100 m netting hour, see Department of Fisheries 2015a) and an updated standardised catch rate (kg/fishing day).

Reference point	Original catch rate	Updated catch rate
Target	3.4 kg/100 m netting hour	103 kg/day
Upper Threshold	4.6 kg/100 m netting hour	136 kg/day
Lower Threshold	2.2 kg/100 m netting hour	69 kg/day
Limit	1.6 kg/100 m netting hour	49 kg/day

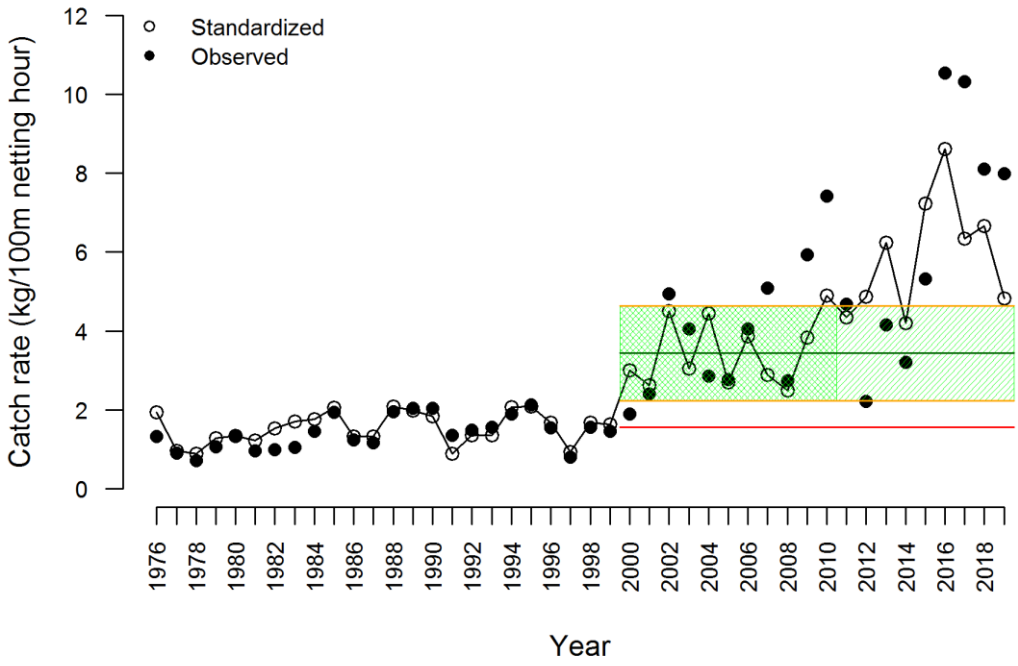

Figure 1.1. Time series of annual standardised commercial catch rate (kg/100 m netting hour) for sea mullet in the PHE net fishery, based on original catch rate standardisation, relative to the original target (green range), threshold (orange line) and limit (red line) reference levels outlined in the Finfish Resources of the PHE Harvest Strategy 2015-2020 (see Table 1.1).

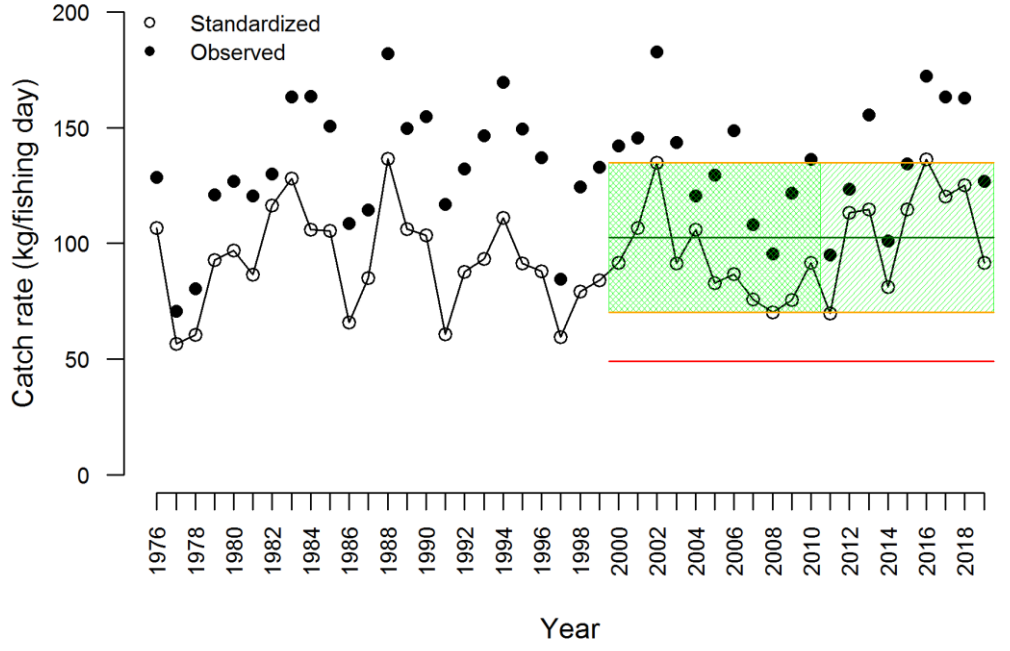

Figure 1.2. Time series of annual standardised commercial catch rate (kg/day) for sea mullet in the PHE net fishery, based on an updated catch rate standardisation, relative to the associated target (green range), threshold (orange line) and limit (red line) reference levels (see Table 1.1).

Over the past 12 months, the performance indicators used to monitor the status of sea mullet have been reviewed as part of a broader review of the assessment and harvest strategy for this stock. While the first sea mullet harvest strategy (2015-2020) focused on the PHE, age composition data collected in 2016/17 and 2017/18 from estuarine and coastal waters of south-west WA (Figure 1.3) indicate that this component of the fishery retains mostly juvenile (two-year old) fish, which are part of a larger biological stock extending to waters outside the estuary. The age compositions of commercial catches taken from oceanic waters of the mid-West Coast Bioregion (WCB) and from Shark Bay show an increasing representation of older fish with a decreasing latitude (Figure 1.3). This is supported by observations along both the western and eastern coasts of Australia that sea mullet undertakes a northward migration to spawn (Thomson 1951; Smith and Deguara 2002; Smith 2003). Catch rates from the mid-west and Shark Bay regions are thus likely to better describe the abundance of the spawning population of sea mullet than those in the PHE, which rather provide a measure of recruitment to the stock.

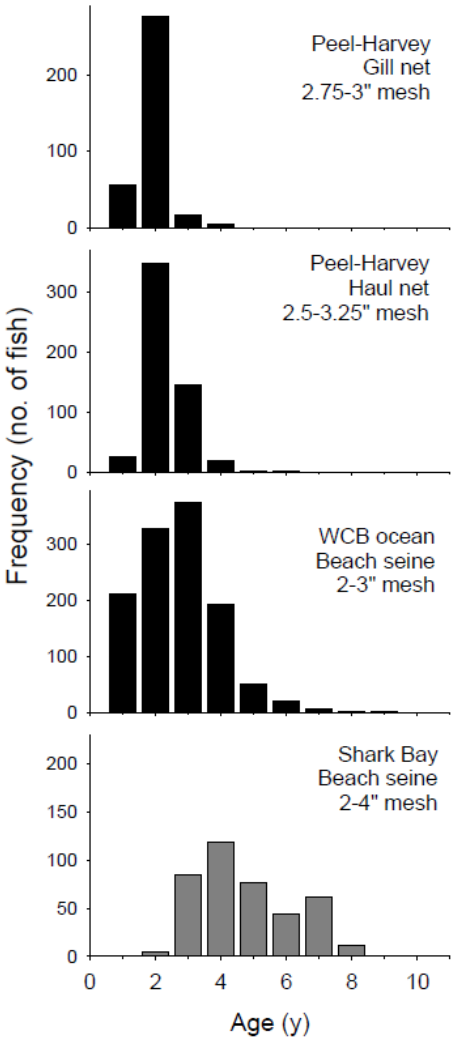

Figure 1.3. Sea mullet age composition samples collected from commercial catches in the PHE, oceanic waters off the mid-West Coast Bioregion (WCB), and from Shark Bay in 2016/17 and 2017/18. Note that the Shark Bay sample has since been completed with a further year of data (results not shown here).

To assess the status of the broader sea mullet stock in WA (assuming this extends across from the South Coast Bioregion [SCB] to the Gascoyne Coast Bioregion [GCB]), a Schaefer biomass dynamic model has been fitted using commercial catch data from the SCB, WCB and GCB between 1941 and 2018, and catch rates from the commercial fishery in Shark Bay from 1956-2018 (Figure 1.4). Note that the catch rate time series was adjusted to account for an increase in fishing efficiency when fishers began using jet-powered boats in 1980 (Figure 1.4).

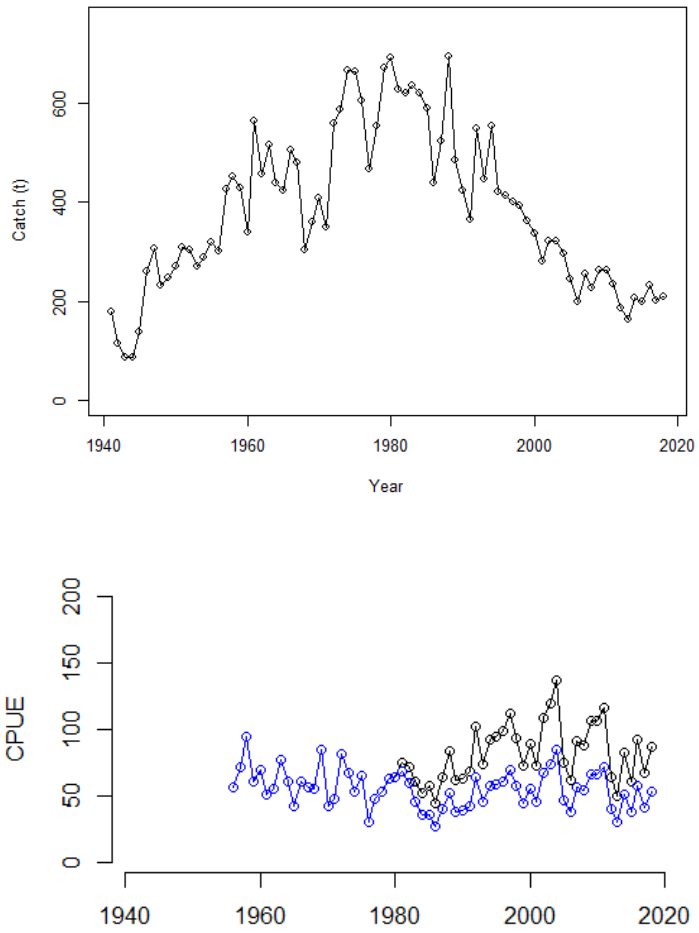

Figure 1.4. (Top plot) Total sea mullet catch (tonnes, t) and (Bottom plot) unadjusted (black line) and adjusted (blue line) catch per unit effort (CPUE; kg/day) in the Shark Bay commercial fishery.

The visual fit to the Schaefer production model to the nominal, adjusted catch rates of sea mullet in Shark Bay was relatively good except for the most recent period, when the model estimated values were larger than the observed values (Figure 1.5). This is possibly due to the relatively low effort in the fishery in recent years, which is likely to increase variability around the catch rates. Given that the Shark Bay catch rates used in the model had been compiled from different sources and not been standardised, the assessment will be re-visited using an updated catch rate time series generated using the same GLM approach applied to the PHE data.

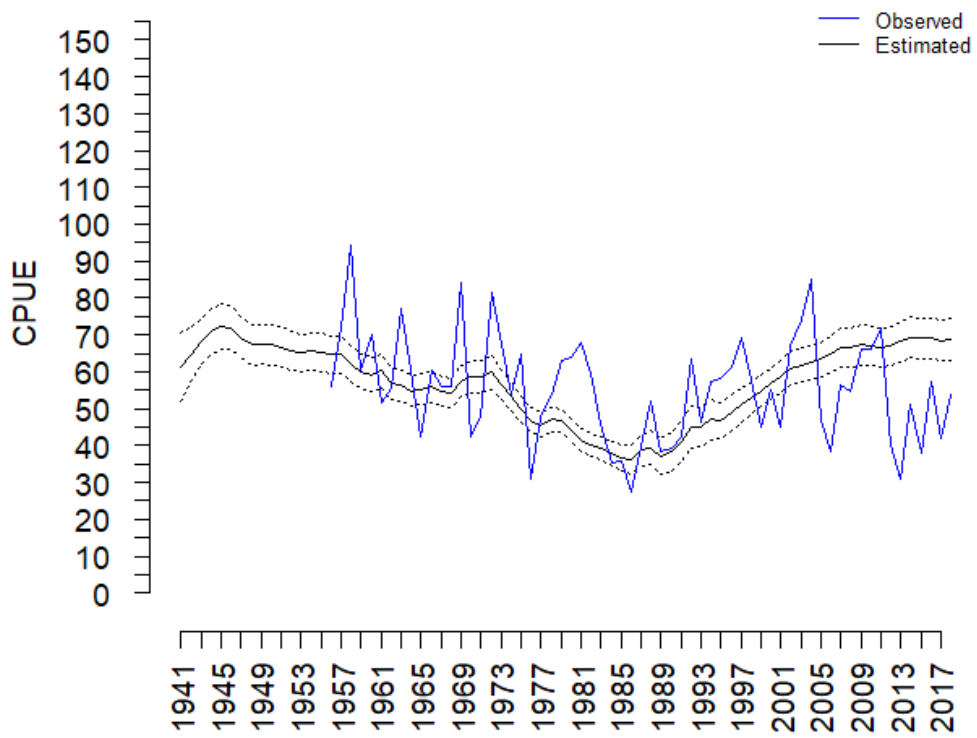

Figure 1.5. Fit of Schaefer ADMB model to nominal, adjusted (for changes in fishing efficiency) catch rate data for sea mullet in Shark Bay. The dashed lines around the estimated catch rates (black) represent the 95% CLs.

While preliminary, outputs from the sea mullet assessment suggest that current level of catch is well below the estimated Maximum Sustainable Yield (MSY) for the stock of 566 t (95% CLs: 543 – 589 t). The results from the production model indicate that the broader sea mullet stock in WA declined to a level around B_{MSY} after a period of high catches in the 1970s and early 1980s before a decrease in catch and fishing mortality has led to the stock rebuilding to near the unfished level (Figure 1.6).

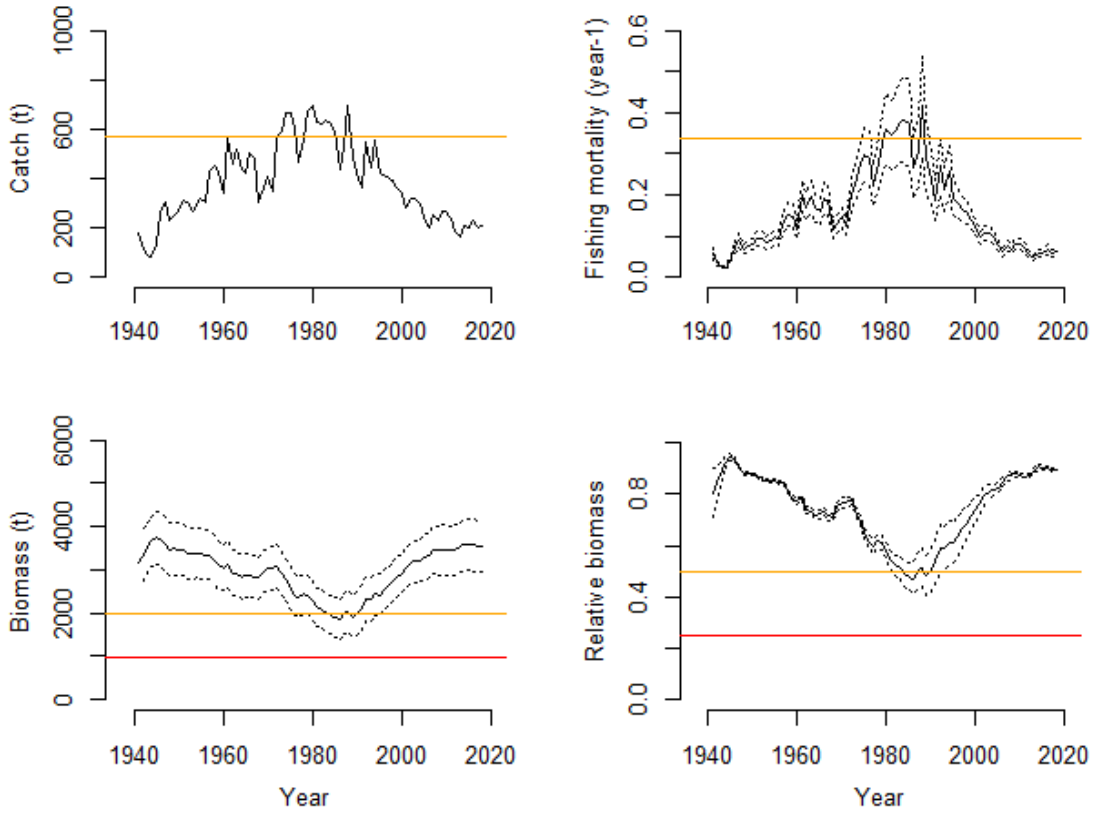

Figure 1.6. Annual time series of catch and estimates of fishing mortality, biomass and relative biomass (proportion of unfished levels) derived from a Schaefer production model fitted using sea mullet catch and catch rate data. The 95% CLs around parameter estimates are shown as dotted lines, with the orange and red horizontal lines corresponding to commonly-used threshold and limit reference levels relating to MSY and 0.5MSY, respectively.

1.2 Blue swimmer crab

The standardised commercial catch rate for blue swimmer crabs in the PHE during the 2018/19 fishing season (1 November 2018 to 31 August 2019) of 0.92 kg/traplift was a significant decrease from the previous year of 1.32 kg/traplift. This is above the harvest strategy threshold of 0.7 kg/traplift (Figure 1.7a), which indicates that the stock has been fished at sustainable levels. The annual commercial crab catch decreased significantly from 96.6 t in 2017/18 to 66.5 t in 2018/19, but remained within the target range of 45-104 t (Figure 1.7b). As both performance indicators have remained within their respective target ranges, no changes to management were required for the 2019/20 season.

The estimated retained harvest of blue swimmer crab by boat-based recreational fishers in WA during 2017/18 was 61.1 t, with 90% of this catch (by numbers) taken in the WCB (Ryan et al. 2019). The estimated boat-based recreational harvest for blue swimmer crab in the WCB was relatively steady at 54 t (95% CI 45–63 t) in 2017/18, compared with 44 t (95% CI 37–51 t) in 2015/16 (Ryan et al. 2019). Recreational catch estimates for the PHE account for the majority of the total boat-based recreational catch in the WCB, although significant recreational catches are also recorded for the Swan-Canning Estuary and Geographe Bay regions (Ryan et al. 2019). Preliminary estimates of the annual boat-based recreational crab catch within the PHE have ranged between 26 and 46 t from 2011/12 to 2017/18. Based on data from the most recent (2017/18) survey, the estimated boat-based recreational harvest in the PHE was 36 t (95% CI 30–42 t), representing a 10 t (38%) increase from 2015/16.

Additional data collected by fishery-dependent and fishery-independent monitoring as well as environmental data (rainfall data from Bureau of Meteorology and *in situ* temperature loggers) in the PHE indicate that the decrease in catch rates and catch during the 2018/19 season may be due to cooler water temperatures throughout much of the season (Figure 1.8). Catches at the start of the 2018/19 season were very low, with November and December catch rates the lowest on record since 1995/96. Catch rates during January, March, July and August were also lower than the long-term average for these months resulting in reduced growth rates (Figure 1.8). This is consistent with the decline in mean size of crabs caught in commercial monitoring surveys during 2018/19 (129 mm), compared with 2017/18 (133 mm).

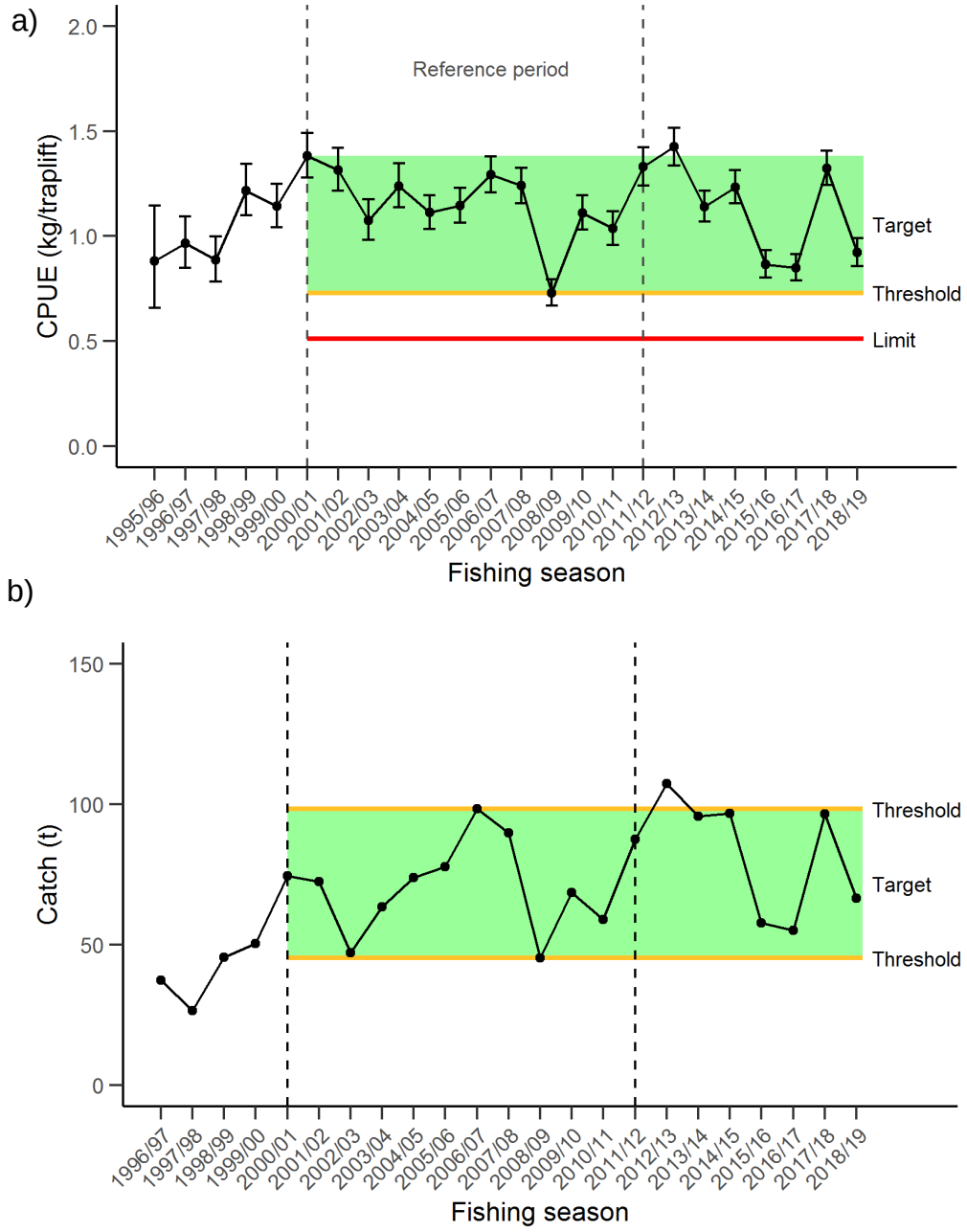

Figure 1.7. Annual (a) standardised commercial trap catch rate (kg/traplift, ±95% CIs) and (b) commercial trap catch (t) of blue swimmer crabs in the PHE fishery relative to target (green range), threshold (orange line) and limit (red line) reference levels. The reference period from 2000/01 to 2011/12 is defined as the period where the fishery was operating with traps only and for which the fishery was operating normally following the transition from gillnets in the late 1990s. Years 1996/97 to 2000/01 include only trap data.

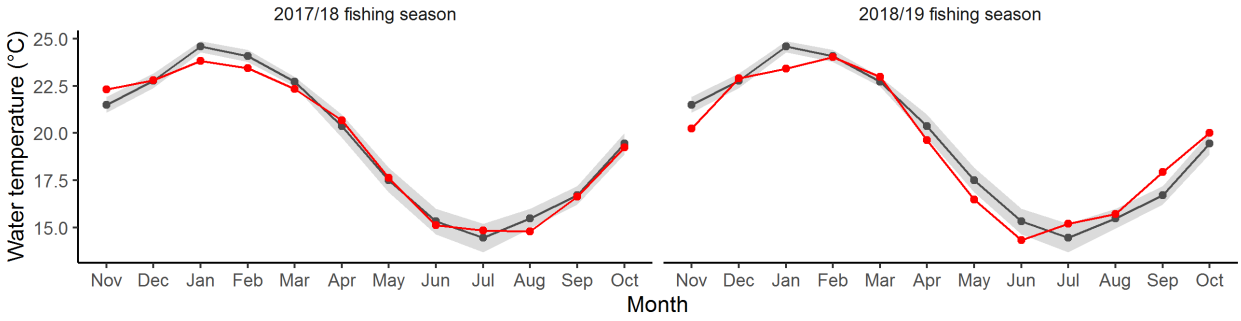

Figure 1.8. Patterns of water temperature in the PHE in 2017/18 and 2018/19 (red line) relative to the long-term 10-year average (2007-2017) (black line with 95% confidence limits in grey). Data sourced from Tidbit temperature loggers.

Monthly commercial trap monitoring of blue swimmer crab length frequencies in 2018/19 shows that males dominate the catch between November and March with higher numbers of large females between April and August (Figure 1.9). Fishery-independent surveys using research traps (without the escape gaps used in commercial trap to minimise captures of undersize crabs) show a dominance of male sub-legal crabs between June and November the majority between 90 and 120 mm carapace width (Figure 1.10). The large proportion of sub-legal crabs in the PHE is also evident from trawl surveys undertaken in 2019, although smaller juvenile and sub-adult crabs were evident with much higher numbers of females overall, with females dominating the catch in July-December. A significant number of crabs (pulse) were caught in July-September, the majority being between 60 and 100 mm carapace width (Figure 1.11).

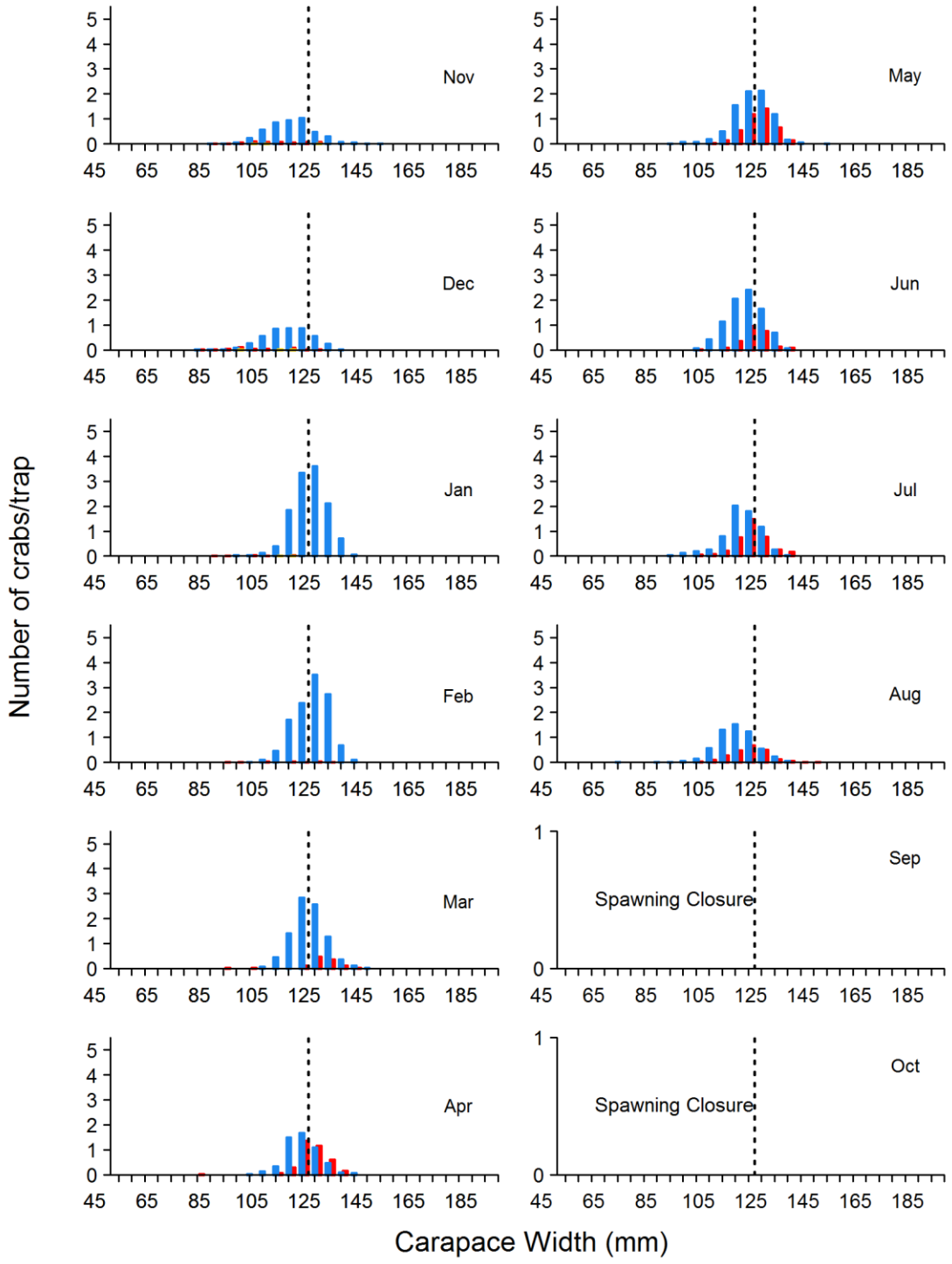

Figure 1.9. Monthly length frequencies of commercial trap catches of male (blue), female (red) and juvenile (yellow) blue swimmer crabs in the PHE during the 2018/19 fishing season (1 November – 31 August). The minimum commercial size limit of 127 mm carapace width is indicated by the vertical dashed lines.

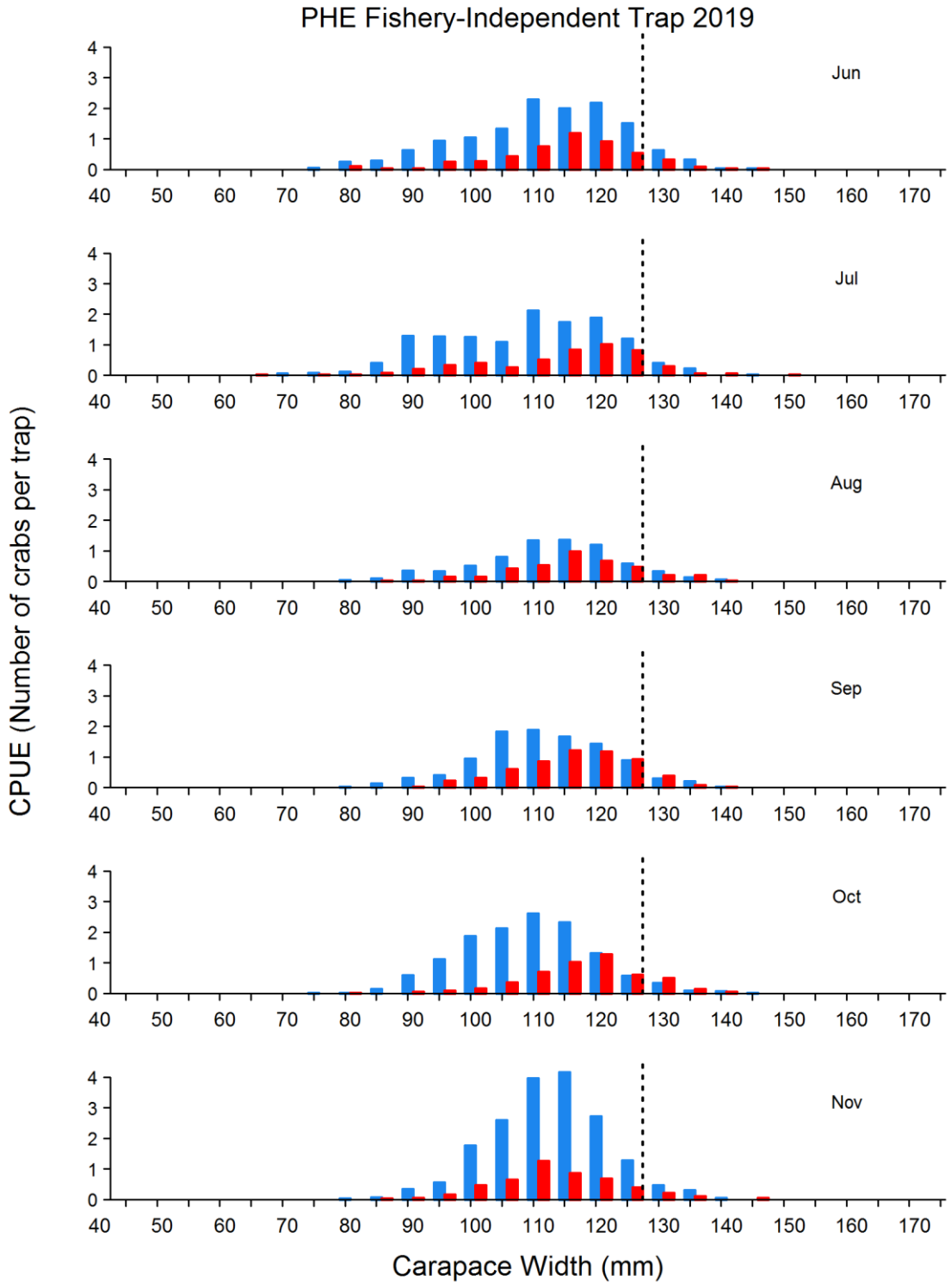

Figure 1.10. Monthly length frequencies of fishery-independent trap catches of male (blue), female (red) and berried (yellow) blue swimmer crabs in the PHE between June and November 2019. The minimum commercial size limit of 127 mm carapace width is indicated by the vertical dashed lines.

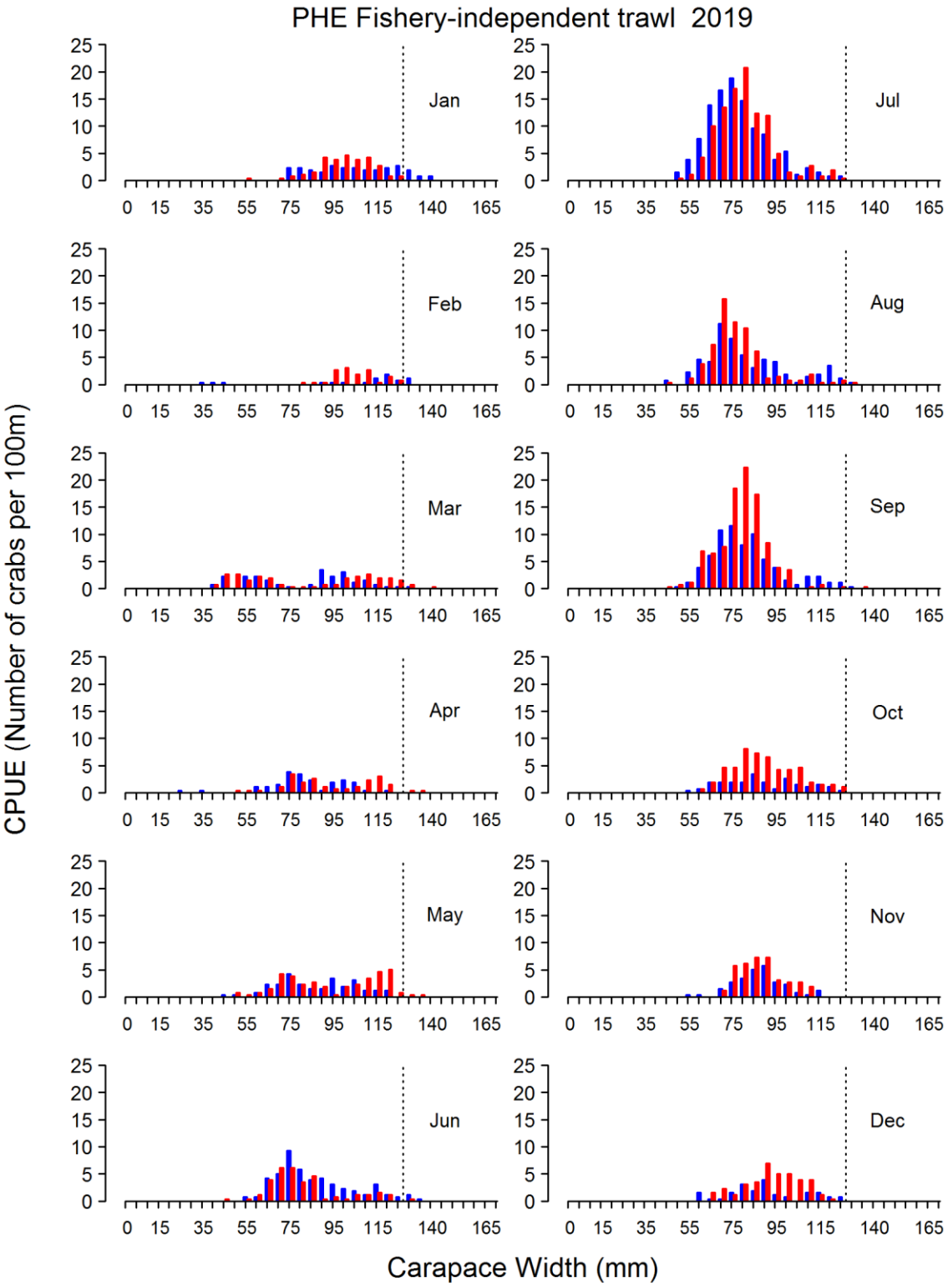

Figure 1.11. Monthly length frequencies of fishery-independent trawl survey catches of male (blue), female (red) and juvenile (yellow) blue swimmer crabs in the PHE in 2019. The minimum commercial size limit of 127 mm carapace width is indicated by the vertical dashed lines.

The fishery-independent trap survey data are used to predict annual commercial catch for the PHE (year t+1), which is based on the abundance of legal sized crabs in November (year t). Based on the 2018 November legal index of 1.48, the predicted commercial catch for the 2018/19 season was ~80 t (95% CI: 68–94 t). The actual catch was 66.5 t, within the predictive range (Figure 1.12). The predicted catch for the 2019/20 season was 86 t (95% CI: 81−104 t) based upon a November legal index of 1.83 (Figure 1.12). This is within the range of recent annual catch totals.

The reasons for the lower than predicted catch in 2018/19 may be due to water temperatures below the long term average during the season resulting in smaller crabs. Together with an index of recruitment being developed from the trawl survey data, this fishery-independent information will continue to be considered in addition to the current harvest strategy performance indicators in an overall weight of evidence approach to stock assessment in this fishery.

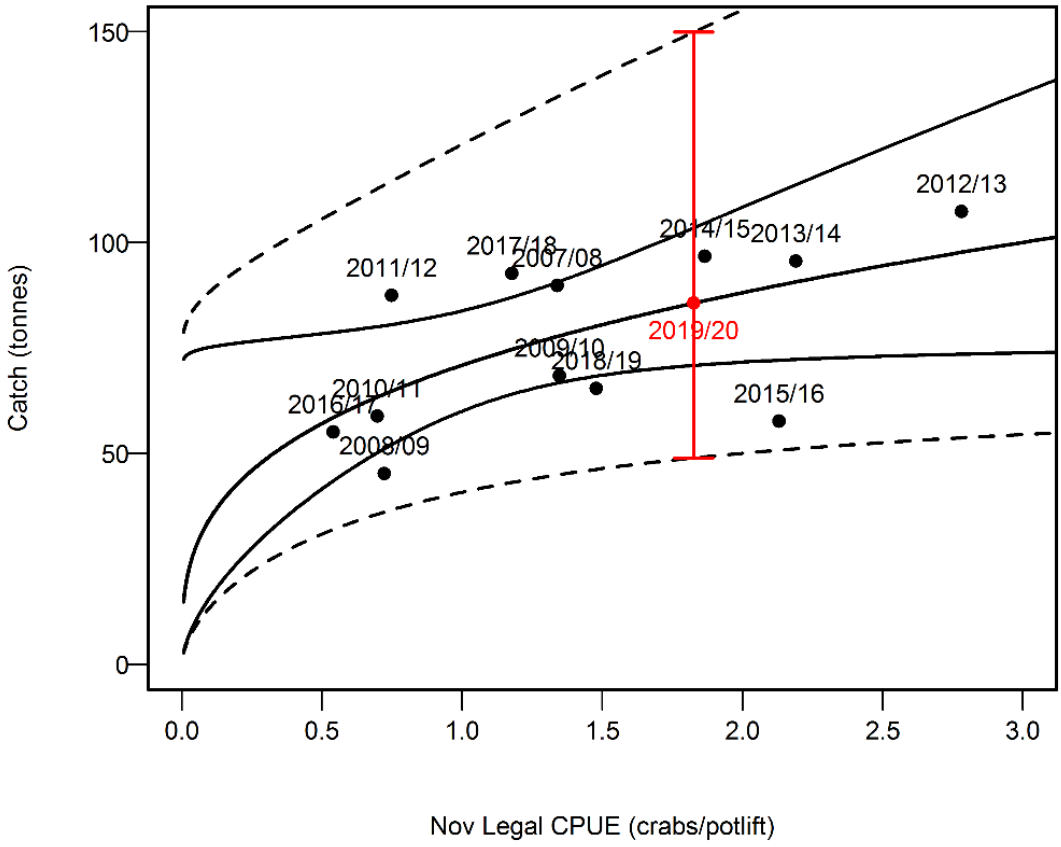

Figure 1.12. Catch prediction model using the fishery-independent November trap catch rates of legal sized blue swimmer crabs (year t) as predictor of commercial catch for the following (November-August) fishing season (year t+1) (power relationship). The solid black line indicates the fitted regression line (bias corrected for estimation in log space), and the 95% confidence limits are indicated by the black line. The dotted line indicates the 95% prediction limits. The predicted catch and its prediction limits for 2019/20 are shown in red.

MSC Principle 2

2. Other Retained Species

This section reports available catch information on species other than the 'target' (P1) species that are retained by commercial fishers in the commercial WCEMF (Area 2) and recreational blue swimmer crab fishers in the PHE. Note that the harvest strategies for these resources have recently been reviewed and updated (see DPIRD 2020a, b), with changes made to the indicators used to monitor retained species other than sea mullet and blue swimmer crabs (see below for more detail).

2.1 Commercial net fishery

In addition to sea mullet, the commercial haul and gill net fishery in the PHE also retains a number of other nearshore and estuarine finfish species (Table 2.1). Since fishers started using crab traps to target blue swimmer crabs in 2000, the majority of finfish catches have been taken by haul nets used to visually target schools of mullet and other species in the estuary (Figure 2.1). Gill (set) net catches now only comprise a very minor component of the total retained catches (Figure 2.1), mostly used by some fishers in winter to target demersal species such as cobbler.

Table 2.1. Retained catches (tonnes) in the PHE haul and gill net fishery between 2015 and 2019, and proportions of the total retained catch.

Species	Retained catch (tonnes)						% of total retained
	2015	2016	2017	2018	2019	Average	
Sea Mullet	91.0	86.4	100.5	102.7	81.5	92.4	69%
Yellowfin Whiting	29.6	19.0	12.7	11.7	15.8	17.8	13%
Yelloweye Mullet	5.8	11.4	12.7	11.2	9.6	10.2	8%
Australian Herring	2.7	3.1	4.3	6.1	6.5	4.5	3%
Perth Herring	2.5	2.8	4.4	3.5	1.9	3.0	2%
Tailor	6.3	1.3	1.1	3.4	2.3	2.9	2%
Estuary Cobbler	1.3	1.2	1.9	1.7	0.2	1.2	0.9%
King George Whiting	0.4	0.8	0.1	1.6	1.8	0.9	0.7%
Whitings, other	0.1	0.8	0.4	0.3	1.4	0.6	0.5%
Trevallies	1.1	0.8	0.4	0.3	0.2	0.5	0.4%
Australian Sardine	0.2	0.1	0	0	0	0.05	0.04%
Common Silverbiddy	0.02	0.07	0.002	0.01	0.04	0.03	0.02%
Black Bream	0.01	0.02	0.03	0.02	0	0.02	0.01%
Silver Trevally	0.08	0	0	0	0	0.02	0.01%
Flatheads	0.01	0.01	0.03	0.01	0.02	0.01	0.01%
Southern Garfish	0.01	0	0	0	0.002	0.001	<0.01%
Squid	0	0	0	0	0.01	0.001	<0.01%
General Fish	0	0	0.01	0	0	0.001	<0.01%
Leatherjackets	0	0	0	0	0.01	0.001	<0.01%
Flounders	0	0	0.002	0	0.003	0.001	<0.01%
Total	141.0	127.8	138.6	142.5	121.3	134.2	

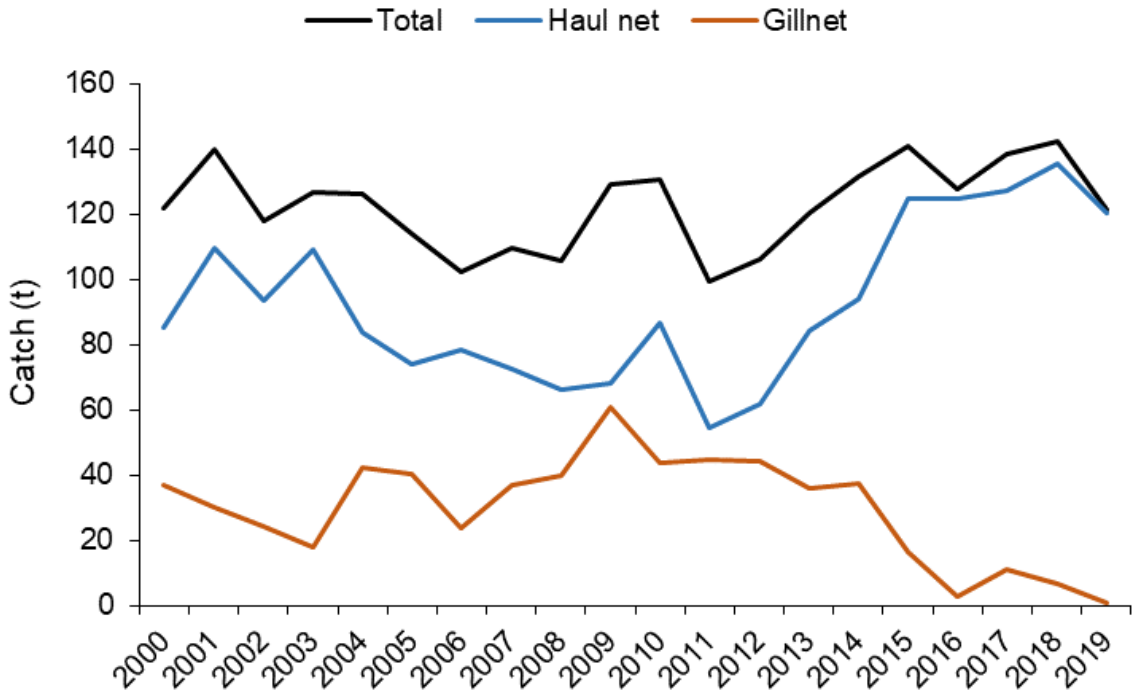

Figure 2.1. Retained catches (tonnes) of finfish by commercial haul and gill netting in the PHE between 2000 and 2019.

The first harvest strategy developed for the finfish resources of the PHE (2015-2020) included a number of catch-based indicators and reference levels for key retained species, which have been applied to measure changes in fish abundance and/or the level of targeting by fishers (Department of Fisheries 2015a). In 2019, the catches of all these key species, except for yellowfin whiting, were within their respective target reference levels (see Table 2.2).

A recent age-based assessment of yellowfin whiting, undertaken in response to increases in catch in 2014 and 2015 to above the levels observed during the 2000-2011 reference period, indicated that the abundance of this species in the PHE fluctuates in response to variations in recruitment between years (Resource Assessment Report, in prep.). The catch curve and per-recruit assessment of yellowfin whiting age composition data sampled in 2015 and 2016 indicated that the WCB stock is being fished at a sustainable level (Steer and Smith 2018; Resource Assessment Report, in prep.). An Ecological Risk Assessment (ERA) undertaken with a broad range of stakeholders in September 2020 (which considered the 2019 catch data of yellowfin whiting) scored the current risk of fishing in the PHE on this stock as medium, i.e. acceptable (Table 2.2; Fisher et al. 2020). The new (2020-2025) harvest strategy for this resource (see DPIRD 2020a) also includes a commercial catch tolerance level of 12 t (with a 10 t ‘soft trigger level’) for yellowfin whiting in the PHE, agreed to between commercial and recreational fishing sectors as part of a recent Voluntary Fisheries Adjustment Scheme (VFAS).

Recognising that the stocks of many of the finfish species retained in the PHE extend outside the estuary, and thus catches in the PHE may not provide reliable indicators of stock abundance, the scope of the new harvest strategy (2020-2025) has been extended to include the broader estuarine and nearshore finfish resource of south-western WA (DPIRD 2020a). This harvest strategy will monitor the impacts of fishing in the PHE on retained species other than sea mullet and blue swimmer crabs based on risk (DPIRD 2020a; Table 2.2). The 2020 ERA of fisheries in the PHE scored the risks to each species retained by commercial netting, based on all available scientific monitoring and research (Fisher et al. 2020). The risk to all retained species, except Perth herring, was scored as moderate or lower, which the harvest strategy considers to be acceptable (DPIRD 2020a).

The commercial catch of Perth herring in the PHE increased in 2017 and 2018 to 4.4 and 3.5 t, respectively, but returned to a lower level of around 2 t in 2019 (Table 2.2; Figure 2.2). The capture and retention of this species in the commercial net fishery was scored a high risk in the 2020 ERA, given the inherent vulnerability of this anadromous species to fishing pressure and indications from available data that the total mortality in the PHE is three times greater than that of the unfished stock in the Swan River (Fisher et al. 2020). Further control measures to reduce the risk to an acceptable level are required, which will be determined following a review process initiated by the harvest strategy.

The ERA risks for the PHE will be reviewed periodically (every 3-5 years) to re-assess any current or new issues that may arise in the fisheries, however, a new risk assessment can also be triggered if there are significant changes identified in fishery operations or management activities or controls that are likely to result in a change to previously assessed risk levels (Fisher et al. 2020). As outlined in the new harvest strategy, the risk to each retained finfish species will also be evaluated annually based primarily on changes in catch (DPIRD 2020a).

Table 2.2. Comparison of current (2015-2020) harvest strategy reference points for retained finfish species other than sea mullet in the PHE to 2019 commercial catches, and risk scores from the 2020 Ecological Risk Assessment, which considered all available information on each species.

Species	Target catch	Target met in 2019	2020 ERA risk score
Yelloweye mullet	<46 t	Yes, 9.6 t in 2019	Low (acceptable)
Yellowfin whiting	<12 t	No, 15.8 t in 2019	Medium (acceptable)
Australian herring	<9 t	Yes, 6.5 t in 2019	Negligible (acceptable)
Tailor	<9 t	Yes, 2.3 t in 2019	Negligible (acceptable)
Cobbler	<9 t	Yes, 0.2 t in 2019	Medium (acceptable)
Perth herring	<2.7 t	Yes, 1.9 t in 2019	High (undesirable)
Other finfish	<5% of total	Yes, 3.5 t (3%) in 2019	Negligible (acceptable)

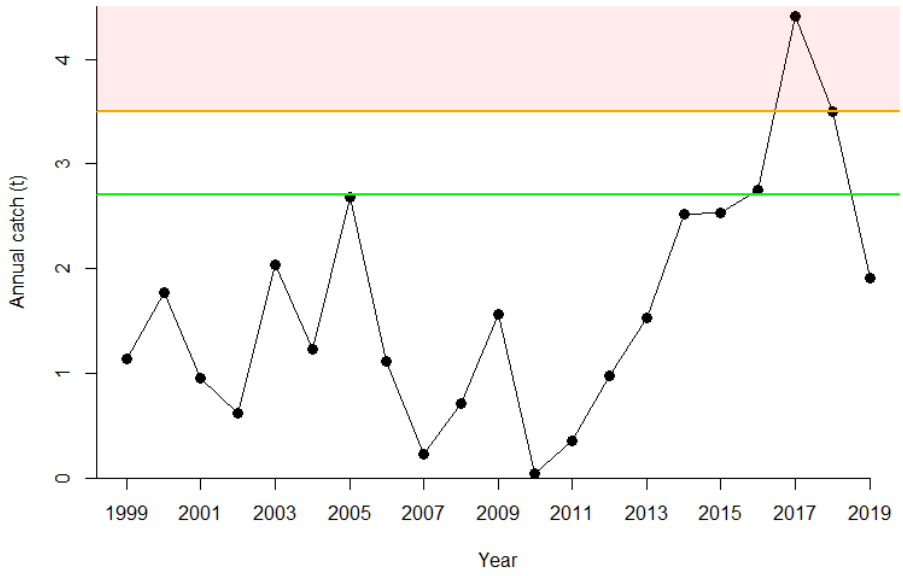

Figure 2.2. Annual commercial catch (tonnes) of Perth herring in the PHE haul and gillnet fishery relative to the current (2015-2020) harvest strategy reference points (green line = target, orange line = threshold, shaded area = limit).

2.2 Commercial trap fishery

The only other species retained in the commercial trap fishery for blue swimmer crabs has been octopus, with the catch ranging from 5 to 129 kg annually over the past five-year period (Fisher et al. 2020). This represents a very small component of the total catch from the broader WA stock, which is primarily targeted by the Octopus Interim Managed Fishery (Hart et al. 2018). The 2020 ERA scored the risk to this stock as low (Fisher et al. 2020) based on a recent weight-of-evidence assessment, which included fishery-independent data from depletion experiments suggesting that the fisheries currently target less than 10% of potential octopus habitat (Hart et al. 2018).

2.2.1 Bait usage

Commercial monitoring of the trap crab fishery in the PHE since 2007 shows a consistent use of bait in crab traps, with around 300 g of locally-caught sea mullet or yelloweye mullet typically used per trap. Since 2014/15, the bait conversion rate (kg bait used per kg of blue swimmer crab caught) has fluctuated between 0.19 and 0.29 as a result of annual variability in crab abundance (Table 2.3).

Table 2.3. Summary of bait usage in the PHE commercial crab trap fishery since 2014/15.

Year	No. of traplifts	Bait type	Amount used per trap (kg)	Total bait used (kg)	Crab catch (kg)	Conversion rate
2014/15	69,888	Sea mullet Yelloweye mullet	0.3	20,966	96,753	0.22
2015/16	56,746	Sea mullet Yelloweye mullet	0.3	17,024	57,702	0.29
2016/17	52,874	Sea mullet Yelloweye mullet	0.3	15,862	55,095	0.29
2017/18	62,400	Sea mullet Yelloweye mullet	0.3	18,720	96,600	0.19
2018/19	58,044	Sea mullet Yelloweye mullet	0.3	17,413	65,439	0.27

2.3 Recreational drop and scoop net fishery

There has been no further information collected on non-target retained catches (or bait) in the recreational drop and scoop net fishery for blue swimmer crabs since that reported by Johnston et al. (2015), and more recently by Fisher et al. (2020).

3. Bycatch Species

Monitoring of bycatch in the commercial finfish and crab fisheries in the PHE is ongoing. A bycatch monitoring program for the commercial net fishery was implemented in 2017 to collect data on the component of catches that are discarded, with one year of bi-monthly observer trips undertaken to validate the information (Fisher et al 2020). Bycatch in the crab trap fishery is recorded by Department staff undertaking monitoring on board commercial vessels since 2007. Discard information for the recreational drop and scoop net sector is available from two surveys undertaken in 1998/99 and 2007/08 (see Johnston et al. 2015).

With available data demonstrating very low levels of discarding of species (other than blue swimmer crabs) by the different fishing sectors in the PHE, the 2020 ERA assessed the risk to invertebrate, finfish and elasmobranch bycatch species as negligible (Fisher et al. 2020).

4. ETP Species

No interactions with Endangered, Threatened or Protected (ETP) species such as dolphins, syngnathids or waterbirds have been reported by commercial fishers in the PHE to date (Fisher et al. 2020). One cormorant (*Phalacrocorax* sp.) has been recorded in a crab trap during Departmental research monitoring. While the risk of direct interactions of recreational crab fishers with these ETP species is also considered low due to the high selectivity of fishing methods, there is the potential for recreational fishing activities indirectly impacting waterbirds through disturbance.

The 2020 ERA assessed the impact of fishing activities in the PHE on ETP species as moderate or lower (i.e. acceptable) risk, with the exception of the impact of recreational scoop netting on migratory shorebirds species that have been listed as threatened globally and/or in Australia (Fisher et al. 2020). Migratory shorebird species are present in the estuary during late spring and summer (around October to March) and after the crab fishing season opens on 1 December, recreational scoop-net fishing occurs in the same shallow fringes of the estuary that the wading birds use for feeding and roosting. If birds are disturbed (by scoop netters or other recreational users of the estuary) as they are feeding, there is an energetic cost to the birds resulting in reduced ability to gain condition or be sufficiently rested to undertake their migration back to the northern hemisphere to breed (Fisher et al. 2020). While the potential for disturbance is not uniform across the estuary, surveys of scoop netting effort (Desfosses et al. in prep.) and bird disturbance (Birdlife WA 2019) have indicated some key hotspots of overlap (e.g. Coodanup). As outlined by the blue swimmer crab harvest strategy (DPIRD 2020b), further control measure will be required to reduce the risk to the migratory, threatened shorebird species in the PHE to an acceptable level.

5. Habitat & Ecosystem

Updated habitat information for the PHE have been collected as part of an ARC Linkage Project led by scientists at Murdoch University and analysed for a recently published Honours thesis on changes in macrophyte biomass and distribution (Krumholz 2019). This new information was considered in the 2020 ERA to evaluate the impacts of fishing activities on key benthic habitat types, as required to address the outstanding MSC condition on habitat impact of recreational scoop net fishery.

Chlorophyta and seagrass are the two main contributors to total macrophyte biomass within the PHE (Krumholz 2019). Examination of the historical trends in the main macrophyte communities over a four-decade period (1978 to 2018) has showed a general decline in Chlorophyta biomass over time, particularly in the eastern Peel Inlet (Figure 5.1; Krumholz 2019). This decline occurred concurrently with an increase in seagrass biomass, especially in the northern Harvey Estuary and western Peel Inlet, adjacent to the Dawesville Channel (Figure 5.2; Krumholz 2019).

The 2020 ERA assessed the impacts of commercial and recreational fishing activities on the key benthic habitat types in the PHE (sand, macroalgae and seagrass) as negligible or low risk (Fisher et al. 2020). While there is potential for the PHE fishery to impact on these habitats as fishing gear or wading fishers come into contact with the substrate, this impact was primarily considered to be minor and highly unlikely to result in serious habitat damage due to the naturally dynamic environment of the estuary. For example, overlaying the recreational scoop netting footprint with available habitat information shows that scooping effort in the southern Harvey occurs in an area in which Chlorophyta biomass has markedly increased since the mid-1990s, and key scoop netting areas in the Peel Inlet show an increase in seagrass cover and biomass compared to historical levels (cf. Figure 5.1 and Figure 5.2 with Figure 5.3).

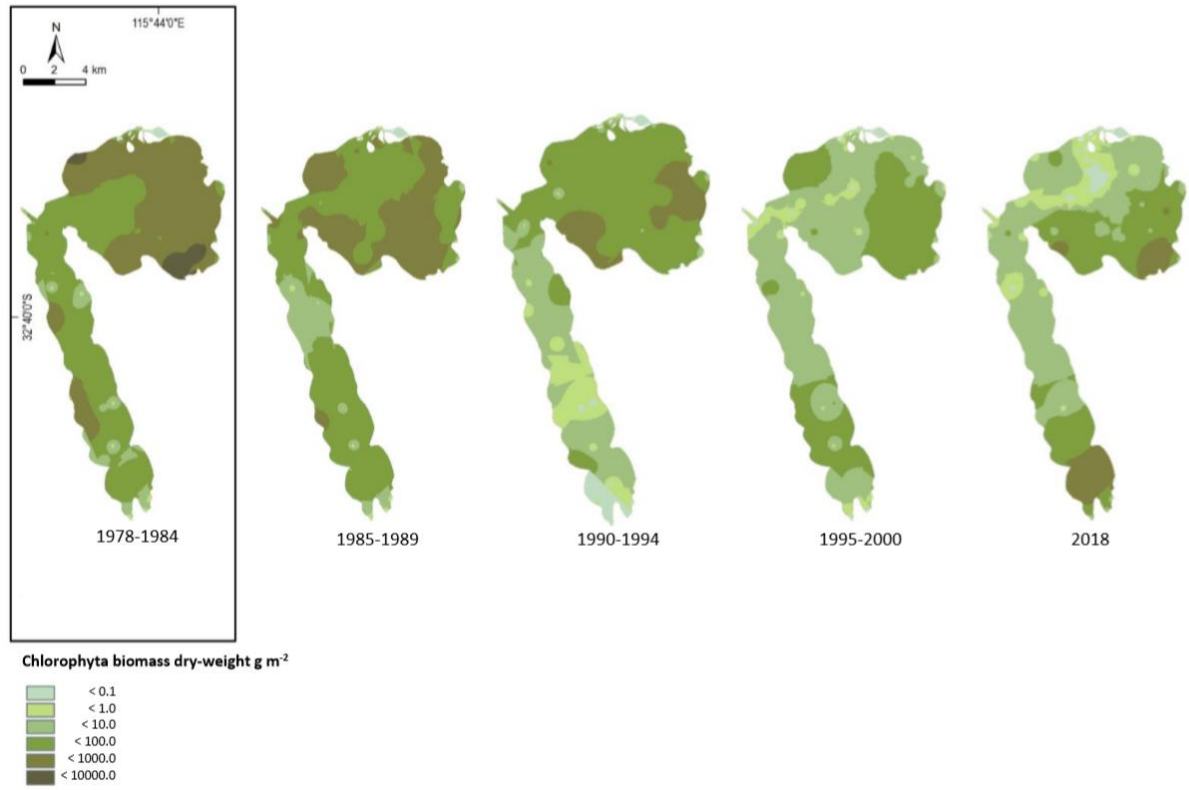

Figure 5.1. Interpolated Chlorophyta biomass (dry-weight in g m^{-2}) across the Peel-Harvey Estuary in each period. (Source: Krumholz 2019).

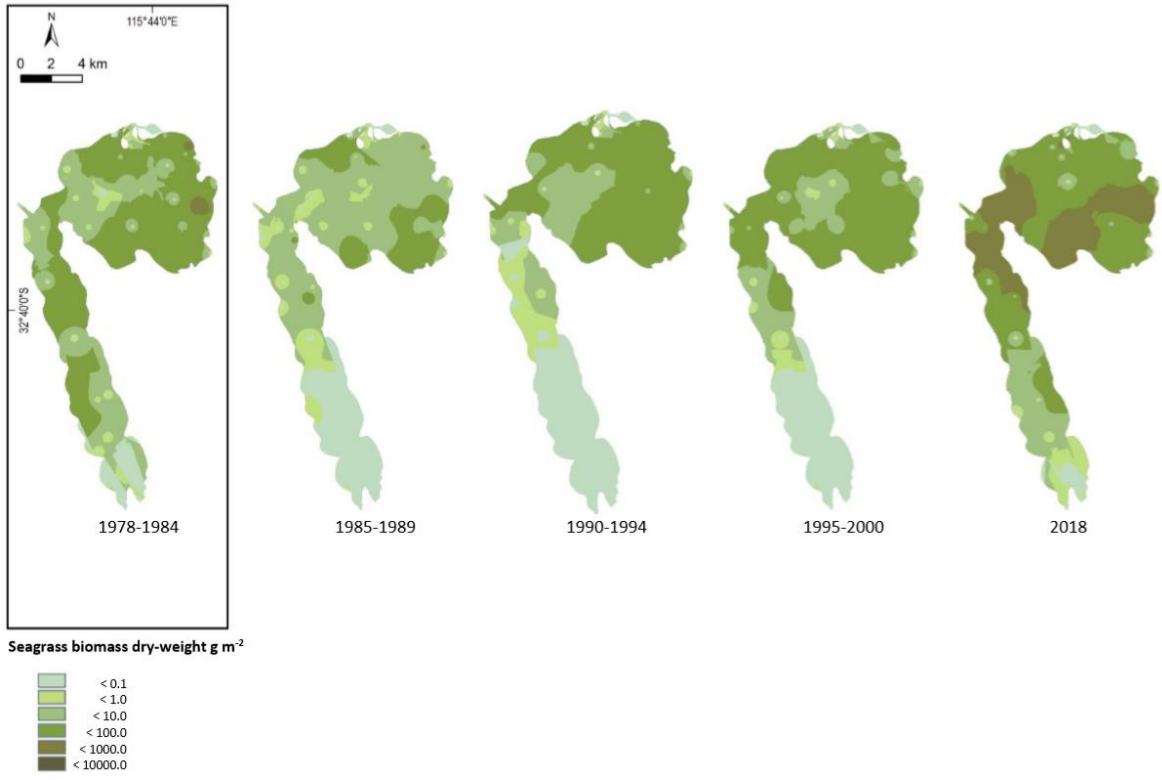

Figure 5.2. Interpolated seagrass biomass (dry-weight in g m^{-2}) across the Peel-Harvey Estuary in each period. (Source: Krumholz 2019).

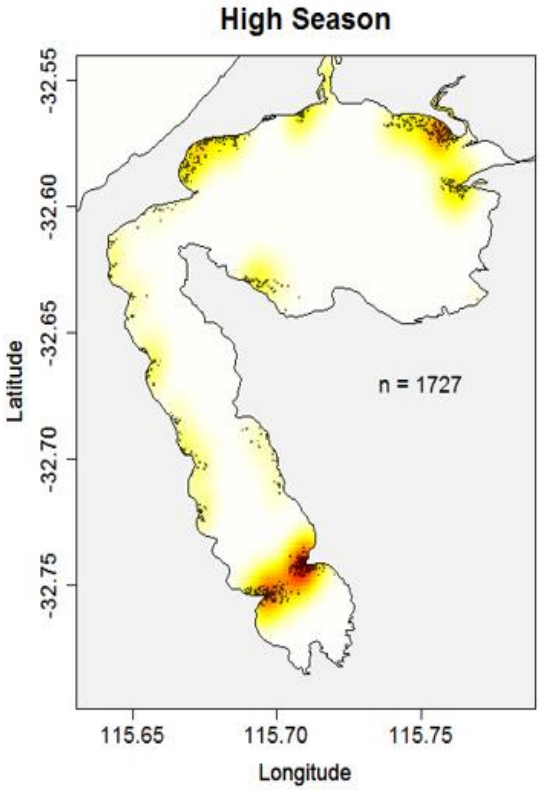

Figure 5.3. Kernel density plots of recreational scoop netting effort in the Peel-Harvey Estuary.

MSC Principle 3

6. Management Update

6.1 South-West blue swimmer crab review

Following the public comment period for Fisheries Management Paper No. 288 (*Protection of the blue swimmer crab resource in the south west*) in 2018, all submissions were collated for consideration by the Minister for Fisheries. In August 2019, the outcomes of the review were announced[1], including:

- The extension of the closed season for commercial and recreational crabbing (now from 1 September to 30 November) in all waters from the Swan-Canning Estuary to 15 km south of Bunbury.
- A new bag limit of 5 crabs in the Swan-Canning Estuary (bag and boat limits of 10 and 20 crabs, respectively, remain elsewhere).
- Geographe Bay to remain open to recreational blue swimmer crab fishing all year, however, a maximum of 5 female crabs is allowed as part of the 10 crab bag limit.

[1] http://www.fish.wa.gov.au/Documents/recreational_fishing/additional_fishing_information/blue_swimmer_crab_changes_2019.pdf

- A voluntary buy-back scheme for commercial fishing licences and Exemptions from oceanic fisheries (Cockburn Sound, Warnbro Sound and the Mandurah to Bunbury Developmental Fishery), leading to their permanent closure to commercial crab fishing.

The changes to these rules were made to provide additional protection to the female crab breeding stock while they were mated and vulnerable to capture. Recfishwest, the Western Australian Fisheries Industry Council and the Southern Seafood Producers Association were extensively involved in developing the new arrangements.

The 3-month crabbing closure and bag limit changes were introduced as legislation in 2019. The buyback scheme commenced on 11 February 2020, with one licence from the Cockburn Sound Crab Managed Fishery removed to date. In 2020 the Department also made offers for Act of Grace payments to the holders of the Exemptions providing access to the Mandurah to Bunbury Developmental Crab Fishery. To date no Exemptions have been removed.

6.2 Buy back of commercial licences in the Peel-Harvey Estuary

In September 2018, a Voluntary Fisheries Adjustment Scheme (VFAS) for the PHE was established to re-allocate a component of the blue swimmer crab resource from the commercial sector to the recreational sector and ecosystem. The scheme aimed to buy back 3-5 commercial fishing licences, with 4 licences bought back at the conclusion of the scheme. There are now 7 commercial licences permitted to fish haul and gill nets in the PHE, of which 6 are also permitted to fish with crabs using traps. The *West Coast Estuarine Managed Fishery Management Plan 2014* will be revised to reduce the Area 2 (Peel Harvey Estuary) capacity in proportion to the number of licences bought back.

A revised commercial catch tolerance range for the PHE of 36-72 t (previously 45-104 t) has been included in the new blue swimmer crab harvest strategy (2020-2025; DPIRD 2020b). The lower and upper tolerance level has been based on 12 t multiplied by the remaining number of licences (6), while the lower tolerance level was set proportionally to the original tolerance range per fisher (~ 6 t). As a secondary objective of the VFAS, the finfish harvest strategy has also included a catch tolerance level of 12 t for yellowfin whiting in the PHE, with a 10 t ‘soft’ trigger (DPIRD 2020a).

The *West Coast Estuarine Managed Fishery Management Plan 2014* will be amended in 2021 to reduce the Area 2 (Peel Harvey Estuary) capacity in proportion to the number of licences remaining in the Peel-Harvey Estuary (being 7 with 6 having access to crabs).

7. Compliance & Enforcement

Compliance effort in the PHE, with regards to overall presence of Fisheries Officers has remained very similar since 2014/15, however, increased in 2019/20 as a result of staffing in Mandurah being back at full capacity, and with some extra assistance called in from the Metropolitan region for the peak season. The number of compliance contacts made with fishers increased in 2018/19 compared to the previous three years, and remained high in 2019/20 (Table 7.1). A lack of increase in contact numbers to follow the substantial increase

in officer presence in 2019/20 is likely due mainly to the shorter crabbing season since the extension of the closure in 2019 to include November, and an increase in the number of prosecution briefs issued, which typically take more time to process.

An updated summary of offences by recreational fishers is provided in Table 7.2. The data continues to show that retention of undersized crabs remains the main offence type in the recreational crab fishery. The number of crabbing offences increased slightly in 2019/20 compared to the previous three years, mostly due to a greater number of infringements and warnings issued during the closed season (Table 7.2). The number of recreational netting offences have remained at a low level (Table 7.2).

Table 7.1. A summary of offence data relative to the compliance effort in the broader PHE area, noting that this also incorporates oceanic waters outside of the estuary

Financial year	Total Presence (Officer Hours) in area	Rec Crabbing Compliance Contacts in area	Rec Crabbing Offences in area	Rec Netting Offences in area
2012/13	3,562	5,854	511	41
2013/14	3,788	9,286	1,058	20
2014/15	4,506	10,930	1,009	49
2015/16	4,910	7,422	773	36
2016/17	4,646	7,156	432	31
2017/18	4,233	7,429	361	13
2018/19	3,890	10,527	435	9
2019/20	6,530	9,256	492	29

Table 7.2. Summary of detected offences by recreational fishers in the PHE between 2016/17 and 2019/20.

Offence Type	Prosecution Briefs				Infringement Notices				Infringement Warnings			
	16/17	17/18	18/19	19/20	16/17	17/18	18/19	19/20	16/17	17/18	18/19	19/20
Crabbing												
Closed Season	1				6	2	3	10		2	1	22
Closed Waters	1			1		1						
Excess Bag	22	7	12	18	6	22	12	12	27	22	23	20
Excess Gear					1							
Illegal Gear	4		1		2			4	21	2	13	
Licensing												
No Licence				1	2	1	9	4	1	7	7	4
Obstruction	5	8	5	6								
Species												
Undersize	28	12	18	34	173	161	160	177	127	113	169	179
Processing	4					1						
Other	1		2									
TOTAL	**66**	**27**	**38**	**60**	**190**	**188**	**184**	**207**	**176**	**146**	**213**	**225**
Netting												
Closed Season	3			1			1					
Closed Waters	6	1	3	2	7	4		5	1			
Excess Bag				1				5			1	1
Illegal Gear	3	1	1	2	1			1	3	2		2
No Licence		1	1	2	1	2	2	2	1			2
Undersize												
Other	2				2	1		1	1	1		2
TOTAL	**14**	**3**	**5**	**8**	**11**	**7**	**3**	**14**	**6**	**3**	**1**	**7**

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