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Overexploitation of Blue Swimming Crab (*Portunus pelagicus*) in Parepare Bay, Indonesia: implications for sustainable fisheries management

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Abstract – Blue swimming crab (*Portunus pelagicus*) supports a valuable export fishery in Indonesia, currently estimated at over $400 million per year and employing over 250 thousand workers. High demand has led to the overexploitation of *P. pelagicus* in recent decades. However, accurately assessing stocks and harvest rates can be difficult. Variation in estimates of harvest sustainability among government, industry, and independent institutions highlights the need for comprehensive assessments. In this study, we examine the crab population in an artisanal nearshore fishery in Parepare Bay, South Sulawesi. We conducted a monthly analysis of the fishery for one year using two methods: (1) surveys of harvested crabs at a landing site and (2) collections of unharvested crabs from four sites in the bay using crab traps. From both methods, the average carapace width for male and female *P. pelagicus* was approximately 10 cm, and around half of the harvested crabs had not reached maturity. Estimates of spawning potential ratio for *P. pelagicus* in this fishery were 4%–9%, indicating overexploitation of the stock and impaired recruitment. As an additional aim, we examined the relative abundance of species in the crab community. We found that the bay is dominated by other species of swimming crab, namely *Charybdis anisodon* and *Thalamita crenata*. These other species may be predators of *P. pelagicus*, and high predation rates may further contribute to juvenile mortality in this stock. Achieving a sustainable harvest of *P. pelagicus* will likely require multiple actions such as enforcement of regulations, restocking of juveniles, and the restoration and protection of nearshore habitats.

Keywords: Overfishing / spawning potential ratio / stock assessment / sustainable management / swimming crab

1 Introduction

Blue swimming crab (*Portunus pelagicus*, hereafter referred to as BSC) ranges throughout the Indo-Pacific, supporting valuable fisheries for countries in this region. Most of the harvest (approximately 90%) is exported to the United States, the European Union, and China (Setioko et al., 2024). Indonesia is the largest contributor of BSC to the market, exporting 40,000 tons in 2024, with an approximate value of $512 million (MMAF, 2025). The fishery also supports more than 250,000 local jobs between fishers and processing plants (MMAF, 2020). Consequently, the high value and demand for BSC are affecting the stock in the form of decreased catch-per-unit effort and size (MMAF, 2016; MMAF, 2020). There is interest among the Indonesian government, industry, and local communities to restore and maintain stable BSC stocks. However, the majority of the BSC harvest in Indonesia is conducted by small-scale artisanal fishers in coastal communities operating small fishing vessels (<10 GT) using gillnets, collapsible crab traps, and mini trawler nets (APRI, 2015). Harvested crabs enter the export market through processing facilities spread throughout the country (MMAF, 2020). This decentralized nature of the fishery makes it difficult to accurately assess BSC stocks and exploitation rates, especially in areas where monitoring and enforcement of regulations are limited.

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Over the past two decades, numerous efforts have been made to assess the health of Indonesian BSC stocks and address potential overexploitation. In 2007, US and Indonesian export companies partnered to form the Asosiasi Pengelolaan Rajungan Indonesia (Indonesian Blue Swimming Crab Association, APRI) and established a Fishery Improvement Project (FIP), bringing together different stakeholders and launching community-based management programs (APRI, 2015). In 2011, APRI imposed restrictions on the harvest and purchase of juvenile BSC (minimum size limit of 10 cm in carapace width) and berried females (APRI, 2015). In 2016, the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) established a Fisheries Management Plan (FMP) that imposed a similar legal ban on the harvest of juvenile and berried BSC (MMAF, 2020; MMAF, 2021). Additional regulations are currently being considered, such as gillnet mesh size limits (4.5 in, approximately 11.5 cm) and escape vents in crab traps (APRI, 2022).

As part of the FIP and FMA, spawning potential ratio (SPR) has been adopted as a standard methodology to assess BSC stocks. SPR is a measure of reproductive-sized unfished crabs left after harvest and has been broadly used to set harvest limits for fisheries (Goodyear, 1993). Since maturity is correlated with growth and body size in many species, SPR can be estimated by comparing the observed size structure of the stock to the expected size structure in the absence of fishing (length-based SPR: Hordyk et al., 2015a; Hordyk et al., 2016). Due to its limited data requirements, SPR is a particularly useful method in small-scale fisheries where biological and historical harvest data are lacking (Dowling et al., 2018; Prince et al., 2020). An SPR of 100% indicates an unfished stock, while an SPR of 0% indicates that no spawning is occurring because there are no animals of mature size (Goodyear, 1993; Hordyk et al., 2015a). As a general fisheries management guideline, 30%–40% SPR is considered a target while 20% SPR is considered a "replacement level" benchmark, below which recruitment is likely to be impaired, although actual replacement level SPR can vary among species (Mace and Sissenwine, 1993). For the BSC fishery in Indonesia, 30% SPR is used as a management "target reference point" while 20% SPR is used as a "limit reference point" (MMAF, 2020; APRI, 2021). Recent estimates by APRI indicate that stocks across Indonesia are between 18% to 30% SPR, below management targets but near or above replacement levels (APRI, 2024). Estimates by the MMAF indicate similar values, 19% to 30% SPR (MMAF, 2020). However, stock assessments by independent institutions indicate much higher levels of exploitation in some areas (SPR estimates $< 10\%$: Ernawati et al., 2015; Prince et al., 2020; Nurdin et al., 2022). These low SPR estimates suggest that certain areas or components of the harvest may be missing from government and industry SPR calculations. More comprehensive analyses of BSC fisheries are needed.

In this study, we assess the BSC stock in an artisanal nearshore fishery located in Parepare Bay, South Sulawesi, Indonesia (Fig. 1). As our primary objective, we conducted monthly surveys of crabs at a BSC landing site for one year (July 2023–June 2024) to calculate SPR. By surveying BSCs as soon as they were landed, we aimed to assess the total harvest, including crabs sold both to exporters and to the local market. We also conducted monthly sampling of the BSC population in the Bay using traditional collapsible crab traps to obtain a second measure of SPR. By sampling BSCs in the Bay, we aimed to corroborate our assessment of the harvest with a direct assessment of the unfished population. As a tertiary objective, we report the relative abundance of species in the local crab community collected based on our trap samples. An initial analysis of crabs measured in the landing site survey examined the reproductive biology of BSC in Parepare Bay, including sex ratios and spawning seasonality (Fujaya et al., 2025).

2 Materials and methods

2.1 Study site

The study was conducted in Parepare Bay, South Sulawesi, Indonesia (Fig. 1). This site is located on the eastern edge of the Indonesian Fisheries Management Area-713 (FMA-713), and the fishery is managed by the MMAF. The Bay is divided into a northern section ("Upper Bay") and a southern section ("Lower Bay"), with the southernmost extent connecting to the Makassar Strait. Habitats within the Bay include coral reefs near the Bay mouth, seagrass beds, sandflats, and mudflats. Large extents of the Bay, primarily near the shores of the Upper Bay, are used for seaweed farming. The eastern edge of the Bay is mostly urban, bordered by the city of Pare Pare (also written as Parepare). Seasons in the region are divided into rainy (approximately November–April) and dry (approximately May–October). Fishing for BSCs occurs year-round, although fishing activity may be reduced in the rainy season when weather conditions are too severe (personal communication, fishermen at town hall meeting at the Pinrang Region Community Center, March 9, 2024). Within this fishery, BSC are harvested using small boats (<10 m) with gillnets and traditional collapsible fishing traps in shallow waters (<5 m in depth). A 2010 survey of the BSC fishing fleet in South Sulawesi reported 2317 boats, of which 48% used gillnets (Wiyono and Ihsan, 2018).

2.2 Survey of harvested crabs at landing site

Surveys of crabs were conducted at a landing site 3–8 days per month for one year (July 2023 to June 2024) by teams of students from Hasanuddin University (Fig. S1). The landing site was located on the northern edge of the Upper Bay in the Pinrang Regency (location: −3.98093, 119.60861; Fig. 1B). Crabs at this site are primarily caught using gillnets (mesh size of 3 in, approximately 7–8 cm; Fig. S2). A total of 5777 BSCs were sexed and measured for carapace width during the surveys.

2.3 Crab trap sampling

Samples were collected for one year (July 2023 to June 2024) at four sites in Upper Parepare Bay (Fig. 1B). The sampling sites were selected to roughly cover different habitats and sections of the Bay, although a detailed environmental and habitat analysis of the sites was not conducted. Site 1 was in the northwest section of the Bay and covered deeper (5–8 m) sand flats bordering seaweed farms (location: −3.98568,

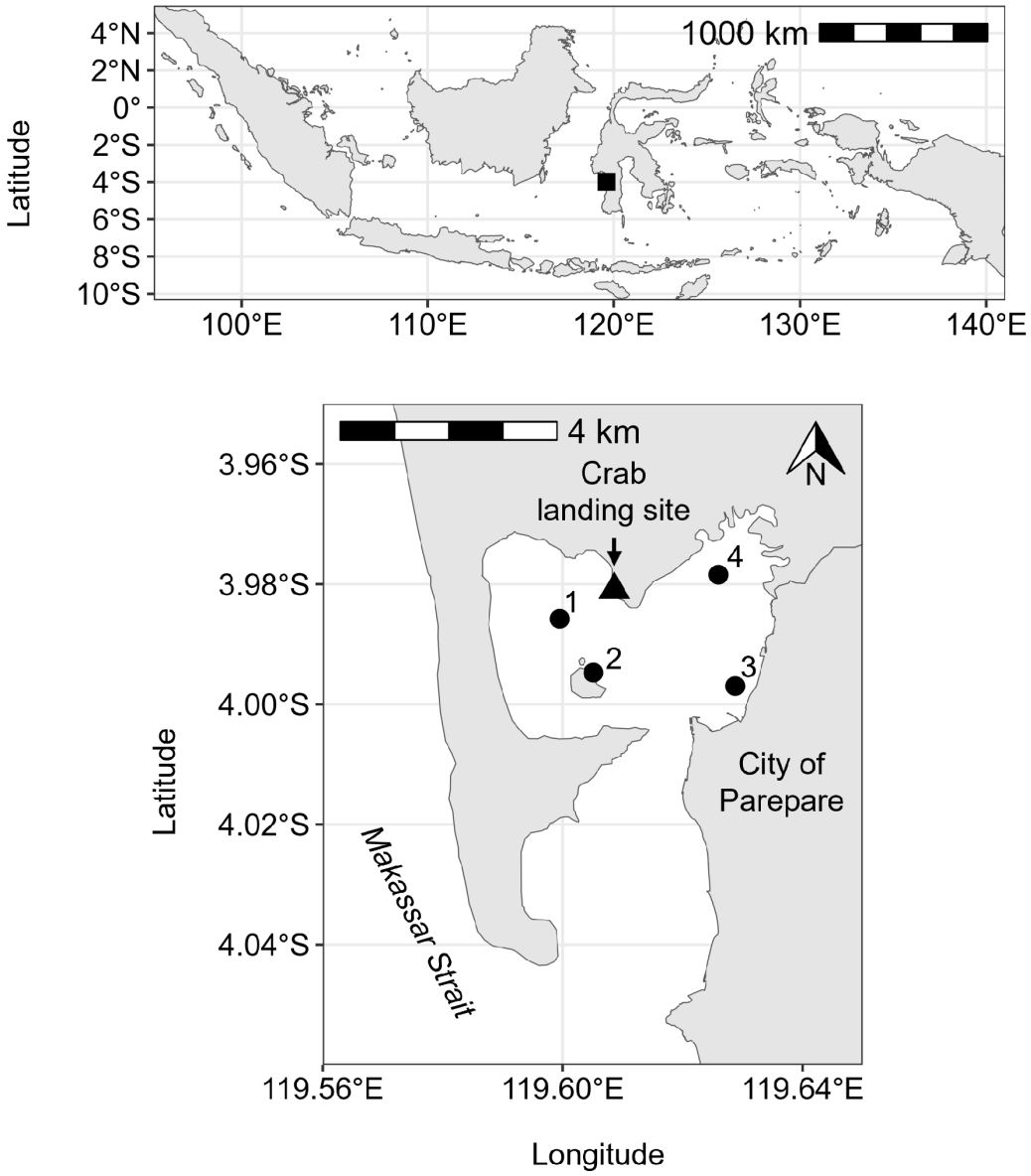


Fig. 1. Location of Parepare Bay (black square) in South Sulawesi, Indonesia (top). Locations of sampling sites within the northern portion of Parepare Bay (bottom), including the landing site at which surveys of harvested crabs were conducted (black triangle) and the four sites in which trap samples were conducted (black circles, labeled 1–4). The city of Parepare (also written as Pare Pare) lines the eastern edge of the Bay.

119.59963). Site 2 was near a mangrove-covered island in the southwest corner of the Upper Bay and covered a shallow (1–2 m) seagrass bed (location: −3.99484, 119.60491). Site 3 was near the port of Parepare in the southeast corner of the Upper Bay and covered deeper (3–7 m) sand/mud flats (location: −3.99638, 119.62814). Site 4 was in the northeast corner of the Upper Bay near seaweed farms and covered deeper (5–8 m) mud flats (location: −3.97726, 119.62448). Crabs were captured using 200 handmade collapsible crab traps (approximately width = 30 cm, approximately height = 10–15 cm, and mesh size = 1.5 and 2.5 cm stretched; Figs. S3 and S4) of the kind typically used in the local fishery. Traps were baited with either chicken or fish and deployed overnight for 24 h. Each site was sampled once per month in this way. All captured crabs were identified to species, sexed, and measured for carapace width.

2.4 SPR calculations

We separately calculated length-based SPR for BSCs surveyed at the landing site and BSCs captured in the trap samples. Measures of SPR were calculated using a maximum likelihood model in the *LBSPR* v 0.1.6 package in R v. 4.2.2 (R Core Team, 2022). For a full explanation of the model, assumptions, and evaluation, see Hordyk et al., 2015a; Hordyk et al., 2015b; Hordyk et al., 2016. SPR was estimated by comparing the size (carapace width) distribution of the

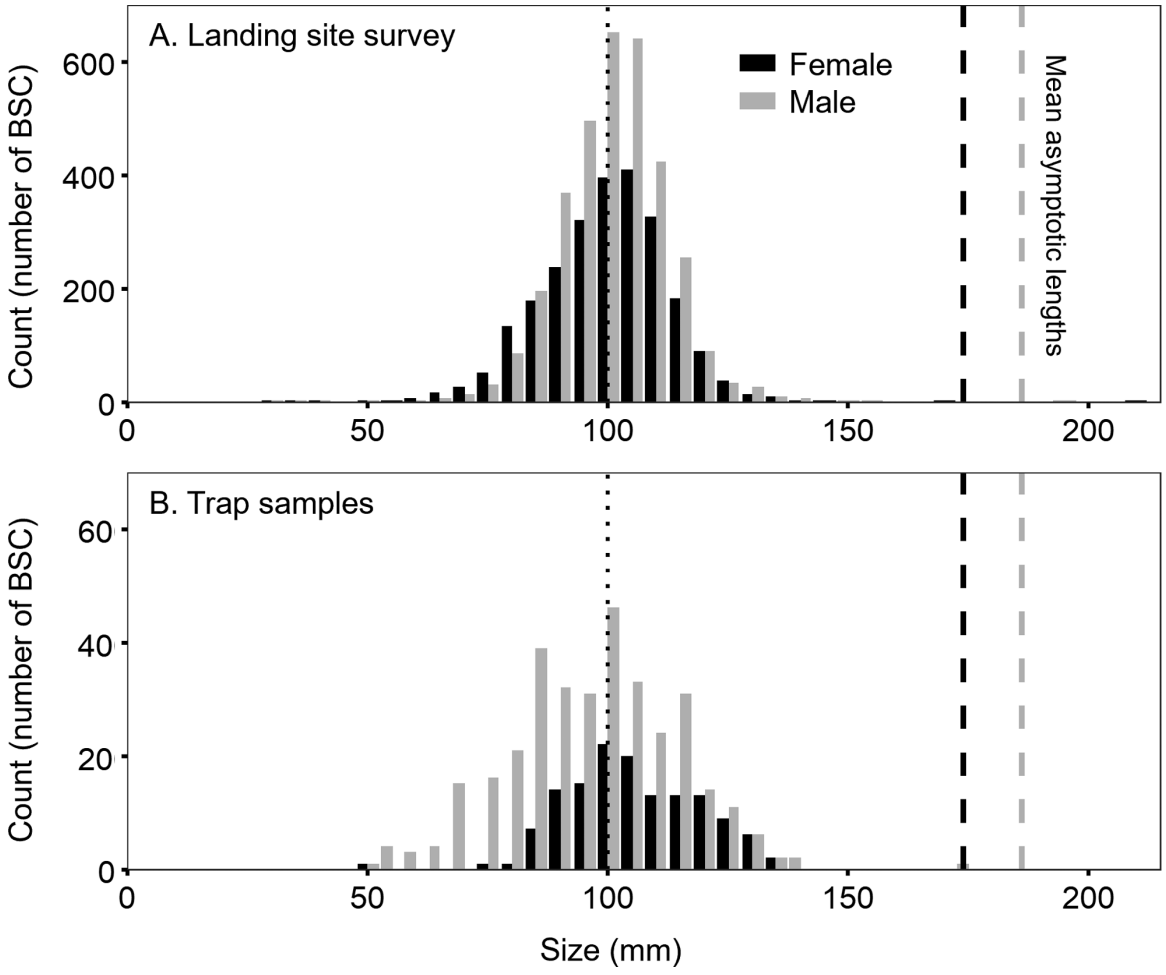


Fig. 2. Size distribution of female (black) and male (gray) Blue Swimming Crab (BSC, *Portunus pelagicus*) surveyed at the landing site in Parepare Bay (A) and captured in trap samples (B). A vertical dotted line at 100 mm is the minimum size limit for harvesting BSC per government and industry regulations (APRI, 2015; MMAF, 2020). Vertical dashed lines are the mean asymptotic lengths for female (174 mm) and male (186 mm) BSCs in South Sulawesi (Ihsan et al., 2014).

surveyed BSCs with an expected size distribution of an unfished stock (Prince et al., 2020). The expected size distribution is approximated based on three life history parameters: (1) M/K, where M is natural mortality and K is the von Bertalanffy growth coefficient; (2) L_m/L_∞, where L_m is the size at which crabs are mature and L_∞ is the asymptotic size; and (3) $CV_{L\infty}$, the coefficient of variation in L_∞ (Hordyk et al., 2015a, Hordyk et al., 2016). Since the size at maturity can vary within a stock, L_m can be approximated using the mean lengths at which 50% (L_{50}) and 95% (L_{95}) of the crabs reach maturity (Prince et al., 2020).

The life history parameters (M/K, L_{50}, L_{95}, L_∞, and $CV_{L\infty}$) used in our analyses were measured in previous studies of the BSC population in South Sulawesi (Ihsan et al., 2014) and have been used to calculate SPR in other stock assessments in the region (Prince et al 2020). For female crabs, SPR was estimated using M/K = 1.06/year, L_{50} = 101 mm, L_{95} = 103 mm, L_∞ = 174 mm, and $CV_{L\infty}$ = 0.10. For male crabs, SPR was estimated using M/K = 0.96/year, L_{50} = 101 mm, L_{95} = 103 mm, L_∞ = 186 mm, and $CV_{L\infty}$ = 0.10.

Estimates of SPR were calculated at annual and monthly scales. Previous sensitivity analyses of the models used in this study suggest that SPR estimates are consistent at small sample sizes ($n \leq 100$), but that errors and variability increase (Hordyk et al., 2015a). Thus, caution should be taken when interpreting comparisons of SPR calculated from small datasets, as in our resulting monthly scale SPR estimates (see Tabs. S1 and S2 for sample sizes).

2.5 Crab community in Parepare Bay

We identified different crab species captured in our traps. We focused on larger, potentially marketable species, including swimming crabs (genus *Portunus*, *Charybdis*, and *Thalamita*) and stone crabs (genus *Myomenippe*). We used catch per unit effort (CPUE, crabs per 100 traps) as a measure of relative abundance. CPUE of the crab species was compared at each of the four sampling sites.

3 Results

3.1 Survey of harvested crabs at landing site

For the harvested BSC surveyed at the landing site, 2437 were female, 3338 were male, and 2 were of unknown sex

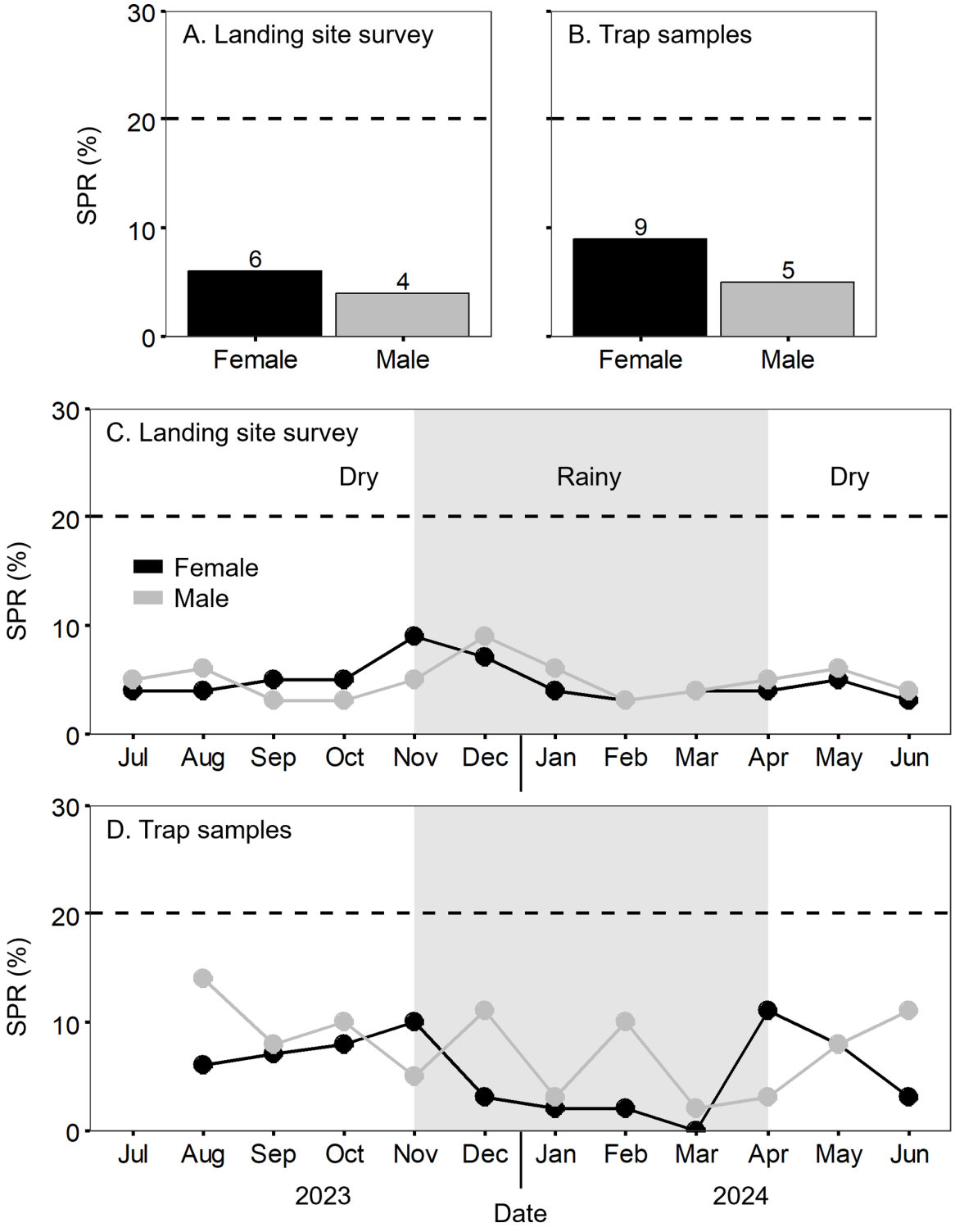


Fig. 3. Annual SPR of female (black) and male (gray) BSCs surveyed at the landing site (A) and from trap samples (B) in Parepare Bay. Monthly Spawning Potential Ratio (SPR) of female (black) and male (gray) BSCs surveyed at the landing site (C) and from trap samples (D) in Parepare Bay (C). Dashed lines at 20% SPR indicate the hypothetical replacement level for BSC. Approximate duration of the rainy (gray) and dry (white) seasons in C and D indicated by background shading.

(Tab. S1). Average carapace width was 10.0 ± 1.3 cm (mean ± sd) for females and 10.1 ± 1.1 cm for males (Fig. 2A). Approximately 50% (1214) of female BSC and 49% (1623) of male BSC were harvested before reaching maturity (L_{50} = 101 mm, L_{95} = 103 mm), while approximately 45% (1096) of female BSC and 42% (1410) of male BSC were harvested before reaching the 10 cm harvestable size limit. There were two outliers in this survey, a 21.1 cm female and a 19.4 cm male. The overall annual size

distribution of harvested BSCs resulted in an annual estimated SPR of 6% for females and 4% for males (Fig. 3A), well below the target replacement level of 20%. SPR varied month-to-month, peaking at 9% in November 2023 for female crabs and 9% in December 2023 for males (Fig. 3C), coinciding with the start of the rainy season in South Sulawesi. For female BSC harvested in Parepare Bay, 21% had eggs (506 out of 2437 surveyed, previously reported in Fujaya et al., 2025).

3.2 Crab trap sampling

A total of 473 BSCs were captured in trap samples. Of those crabs, 137 were female and 336 were male (Tab. S2). Average carapace width (mean ± sd) was 10.5 ± 1.4 cm for females and 9.7 ± 1.8 cm for males (Fig. 2B). The overall annual SPR for BSCs captured in trap samples was 9% for females and 5% for males (Fig. 3B). SPR peaked at 11% in April 2024 for female crabs and 14% in August 2023 for males (Fig. 3D). SPR for female BSC could not be calculated for March 2024, as no females were captured in trap samples in that month. There was month-to-month variation in CPUE for BSC depending on the sampling site (Fig. S5 and Tab. S2). Note that this was likely the result of each site only being sampled once per month and not an accurate reflection of seasonal changes in crab abundance. Additionally, caution should be taken when interpreting SPR estimates calculated from trap samples due to the low sample size (Hordyk et al., 2015a). For captured female BSCs, 12% had eggs (16 out of 137 sampled).

3.3 Crab community in Parepare Bay

The crab community varied among the four sampling sites. At no site was BSCs the dominant species. At Site 1 in the northwest section of the Bay, the community was dominated by orange-clawed swimming crabs (*Charybdis anisodon*) with a CPUE of 10 crabs/100 traps. BSCs were the second most abundant at Site 1, with a CPUE of 2 per 100 traps (Fig. 4A). At Site 2, the community was dominated by the mangrove swimming crab (*Thalamita crenata*) with a CPUE of 13 crabs/100 traps. BSCs were ranked third at Site 2 with a CPUE of 3 per 100 traps (Fig. 4B). At Site 3, *C. anisodon* was the most abundant species with a CPUE of 12 crabs/100 traps, while BSC ranked second with a CPUE of 6 (Fig. 4C). At Site 4, the community again was dominated by *C. anisodon* with a CPUE of 13 crabs/100 traps, while BSCs were co-dominant with a CPUE of 11 per 100 traps (Fig. 4D).

4 Discussion

Our estimates of SPR for both the landing site survey and trap samples (4%–9%) indicate that the BSC population in Parepare Bay is overfished to unsustainable levels that impair recruitment. These low SPR values are due to approximately half of the crabs being harvested (50% of females and 49% of males) before reaching maturity, meaning these crabs are removed from the population before having a chance to reproduce. Our SPR results are notable for being much lower than estimates throughout Indonesia from government (19%–30%; MMAF, 2020) and industry (18%–30%; APRI, 2024) sources. We know of only a few other stock assessments in Indonesia from independent institutions that report similarly low SPR values: a 2014 stock assessment around Belitung, an island east of Sumatra, reported an SPR of 5% (Ernawati et al., 2015); a 2016 stock assessment in the Spermonde Archipelago southwest of Sulawesi reported an SPR of 7% (Nurdin et al., 2022); and a 2017–2018 stock assessment off Kendari, a city in Southeast Sulawesi, reported an SPR of 4% (Prince et al., 2020). Like our study, these assessments were also conducted in small-scale nearshore fisheries, suggesting these types of fisheries are a less sustainable component within the overall Indonesian BSC fishery.

4.1 Reasons for lower SPR in Parepare Bay compared with other areas

We propose that there are three potential reasons that the SPR estimates reported here are lower than estimates from other areas in Indonesia: study design, BSC ecology, and social factors. Regarding study design, our results highlight the need to account for temporal variation in SPR. By measuring SPR multiple times over the course of a year, we demonstrate that estimated values can vary month-to-month in Parepare Bay. This was particularly the case for crabs collected in trap samples, where the sample size of crabs was smaller. If a stock assessment had only been conducted in August, our reported SPR for male crabs would have been 14%, a much higher value than the overall estimate of 5%. Fishing activity and crab abundance in nearshore areas can fluctuate seasonally (Wiyono and Ihsan, 2018). A stock assessment generated from data collected only a few times a year could bias SPR estimates.

The ecology of BSC may predispose areas like Parepare Bay to overexploitation. Juvenile BSCs are more common in shallow nearshore habitats, such as sheltered bays and intertidal areas, while mature adults are widely dispersed among both nearshore habitats and oceanic habitats (Edgar, 1990; Sumpton et al., 1994; McDonald et al., 2005; Kunsook et al., 2014). Thus, fisheries that are concentrated in shallow nearshore areas, like Parepare Bay, are predisposed to harvesting a higher proportion of juvenile BSC. Broader stock assessments conducted by government and industry may be grouping data at larger scales, including crabs caught in offshore and nearshore habitats. It is possible that we were only able to identify the degree of unsustainable harvest in Parepare Bay because we narrowed the focus of our assessment to this single nearshore fishery. Additional high-resolution stock assessments are needed to compare the SPR of offshore and nearshore areas. Identifying coastal areas, habitats, or environmental gradients across which harvest is more sustainable or unsustainable could help inform the management of protected areas for BSC.

Social responses to BSC fishing regulations could be biasing stock assessment data. Government restrictions on the harvest of juvenile (10 cm carapace width) and female crabs with eggs are meant to address overexploitation and promote sustainability. However, these restrictions may have unintentionally created a data gap for managers. Restricted crabs may continue to be harvested, as we observed in Parepare Bay, but now they go unreported. Crabs from unreported harvests may

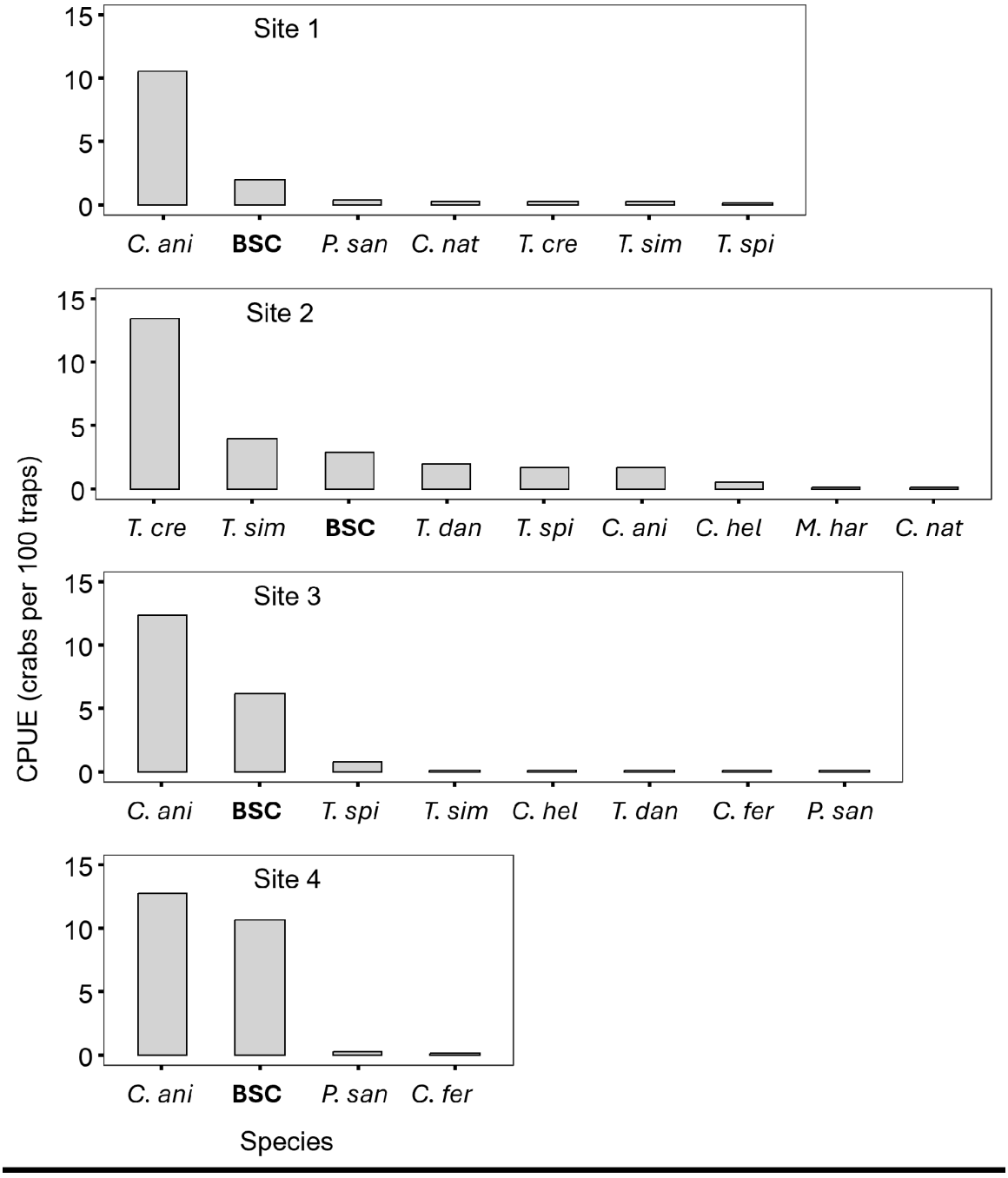


Fig. 4. Ranked abundance, as measured by catch per unit effort (CPUE, crabs per 100 traps), of crab species captured in trap samples at Sites 1–4 in Parepare Bay. Abbreviated species names are used except for *P. pelagicus*, which is listed as BSC in bold. In addition to BSC, species include other swimming crabs of the genus *Portunus* (*sanguinolentus*), *Charybdis* (*anisodon*, *feriata*, *helleri*, *natator*), *Thalamita* (*crenata*, *danae*, *sima*, *spinimana*), as well as one species of stone crab (*Myomenippe hardwickii*).

be kept for personal consumption by fishermen or sold to local markets instead of exporters. Thus, current measures of SPR in government and industry surveys may be inflated if they are missing data from this component of the fishery. Future assessments of local markets are needed to understand how much this component is contributing to the overexploitation of BSC.

4.2 High amount of berried female BSC in harvest

An analysis of crabs measured in the landing site survey found that 21% of harvested female crabs had eggs (initially reported in Fujaya et al., 2025). Compared with the harvest, we found that only 12% of female crabs in trap samples had eggs. This difference in ovigerous female BSC between the harvest

and trap samples could be due to our experimental design. Our trap sample sites were chosen to roughly cover different habitats in sections of the Upper Bay. In contrast, fishermen in Parepare Bay were likely targeting areas where crabs were most abundant based on local knowledge. Regardless of the reason, it is concerning that the proportion of female BSC with eggs was higher in the harvest than in our random trap sampling of the unharvested stock. This suggests that fishing practices may be intentionally or unintentionally targeting berried females. In 2024, it was estimated that 9% of total harvested female BSCs in Indonesia had eggs (APRI, 2024). As with juvenile crabs, the harvest of bred females is prohibited by the export industry and the Indonesian government (APRI, 2015; MMAF, 2020). We similarly suspect that the berried female component of the harvest goes mostly unreported and is sold to local markets.

4.3 Crab community composition

The relative abundance of crabs captured in trap samples indicates differences in species richness and diversity among habitats in Parepare Bay. Site 2 was the only site in proximity to seagrass beds and mangroves and was dominated by mangrove swimming crabs (*T. crenata*). Sites 1, 3, and 4 were on sand or mud flats and were dominated by orange-clawed swimming crabs (*C. anisodon*). Previous surveys of the nearshore crab community in Southeast Sulawesi found similar community composition to that observed in Parepare Bay, but in those studies, BSC were the dominant species (Astuti et al., 2022; Sara et al., 2024).

A detailed habitat analysis of the sites in Parepare Bay was not conducted, and any comparisons of crab community composition in this study are preliminary. Regardless, these results have implications for the BSC population in Parepare Bay. While the adults of other swimming crab species do not grow as large as mature BSC, they are likely predators of juvenile BSC. The high abundance of potential predators relative to BSC may indicate high natural mortality rates for juvenile BSC. High predation rates may lessen the effectiveness of any future BSC recovery efforts, even if fishing pressure is reduced. Future studies are needed to examine the feeding rates and diets of the different swimming crab species to assess their relative predation pressure on BSC. While there is currently no export market for these other crab species, all are captured as bycatch in the Parepare Bay BSC fishery and may be sold in the local market (personal communications with fishermen). Future assessments of local markets could also examine the economic value of these other crab species.

4.4 Management implications

Current government and industry regulations include a ban on the harvest of juvenile BSCs (size <10 cm) and berried females (APRI, 2015; MMAF, 2020). Our results suggest that juvenile and berried female BSCs are still being harvested at high rates despite these bans. A similar lack of enforcement of fisheries regulations has been observed in many areas of Indonesia (Daris et al., 2022; Dirhamsyah et al., 2022). New regulations, such as gillnet mesh size limits (APRI, 2022), could hypothetically contribute to a more sustainable BSC harvest. However, without compliance, new regulations will likely be ineffective. Non-compliance with regulations is potentially the largest contributing factor to the unsustainability of the Indonesian BSC fishery. Enforcement of regulations was found to outperform alternative management strategies in other crab fisheries (*Callinectes bellicosus* and *C. arcuatus*, Ainsworth et al., 2012). Thus, it is unlikely that other management strategies alone, without enforcement of regulations, can overcome the detrimental effects of high harvest rates of juvenile and berried female BSCs.

Even with enforced regulations, estimated SPR is so far below replacement levels in Parepare Bay and other nearshore areas (e.g., Ernawati et al., 2015; Prince et al., 2020; Nurdin et al., 2022) that additional restoration actions may be needed for the population to return to management target levels. Conservation and restoration of shallow nearshore habitats used by juvenile crabs may offset some juvenile mortality from harvest and predation. Stock enhancement, through the release of hatchery-produced crabs, can be used to increase the spawning stock of recruitment-limited populations (e.g., Hines et al., 2008; Hamasaki et al., 2011; Abrenica et al., 2021). Finally, the BSC fishery in Indonesia may also benefit from the government and industry aligning their research and goals with broader international programs, such as the UN's Sustainable Development Goals (SDG 14: Life Below Water; UN, 2025a). The recent Indonesia–United Nations Sustainable Development Cooperation Framework 2026–2030 prioritizes sustainable resource management and could provide a foundation for expanding and enforcing sustainable management of BSC (UN, 2025b).

5 Conclusion

We assessed the BSC stock in an artisanal nearshore fishery located in Parepare Bay, South Sulawesi, Indonesia. Sustainability of the stock (estimated using SPR) was measured from monthly surveys of harvested crabs at a landing site and from crabs collected in trap samples. Our results suggest that BSCs in Parepare Bay are overexploited, and SPR values were notably lower (4%–9%) than government and industry estimates of the country-wide harvest (18%–30%; APRI, 2015; MMAF, 2020). The proportion of berried females in the harvest (21%; Fujaya et al., 2025) and in trap samples (12%) was also higher than industry estimates (9%; APRI, 2024). There are several reasons why the BSC harvest in Parepare Bay may be more unsustainable than estimates in other areas. Ecologically, shallow nearshore habitats may have a higher abundance of juvenile BSC, meaning that harvests from these habitats are predisposed to having a higher proportion of juvenile crabs. Socially, legal restrictions on the harvest of juvenile BSC and berried females may have created a data gap for managers, as restricted crabs go unreported or are sold to unregulated local markets.

The BSC fishery in Parepare Bay is unsustainable due to the high harvest levels of juvenile crabs and berried females. Given that stock assessments in other small-scale nearshore BSC fisheries have reported similar levels of overexploitation (e.g., Prince et al., 2020; Nurdin et al., 2022), we propose that this may be a widespread problem across Indonesian BSC fisheries of this type. The stock may benefit from conservation

actions similar to those proposed in other stock assessments where overexploitation has been observed (e.g., Kunsook et al., 2014; Suman et al., 2020; Nurdin et al., 2022; Yulianto et al., 2024). The primary beneficial action is the enforcement of, and compliance with, existing BSC harvest regulations, but additional actions include the protection and restoration of nearshore habitats for juvenile BSC and stock enhancement.

Acknowledgments

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Data availability statement

Crab measurements and biological sampling data for landing surveys and trap samples are publicly available on Figshare (https://doi.org/10.25573/serc.31394871).

Supplementary Materials

Tab. S1. Dates (month and days) on which surveys were conducted. Number of female and male BSC measured each month.

Tab. S2. Dates (month and days) on which trap sampling was conducted. Traps were deployed on the date and then collected 24 hrs later. Number of female and male BSC measured each month.

Fig. S1. Landing site in Parepare Bay at which harvested crabs were surveyed (location: -3.98093, 119.60861).

Fig. S2. Gillnet used to harvest BSC in the Parepare Bay fishery.

Fig. S3. Collapsible crab trap used to sample Parepare Bay (approx. stick height = 40cm, approx. width = 30cm, approx. height = 10–15cm, mesh size = 1.5cm and 2.5cm stretched).

Fig. S4. Collapsible crab trap with captured BSC in Parepare Bay. This trap was baited with chicken and deployed overnight at Site 2.

Fig. S5. Monthly CPUE (crabs per 100 traps) of BSC captured in trap samples at Sites 1–4 in Parepare Bay. Approximate duration of the rainy (gray) and dry (white) seasons indicated by background shading.

The Supplementary Material is available at https://www.alr-journal.org/10.1051/alr/2026024/olm

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