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Performance Indicators of Blue Swimming Crab Fisheries Improvement Project in 2025

By

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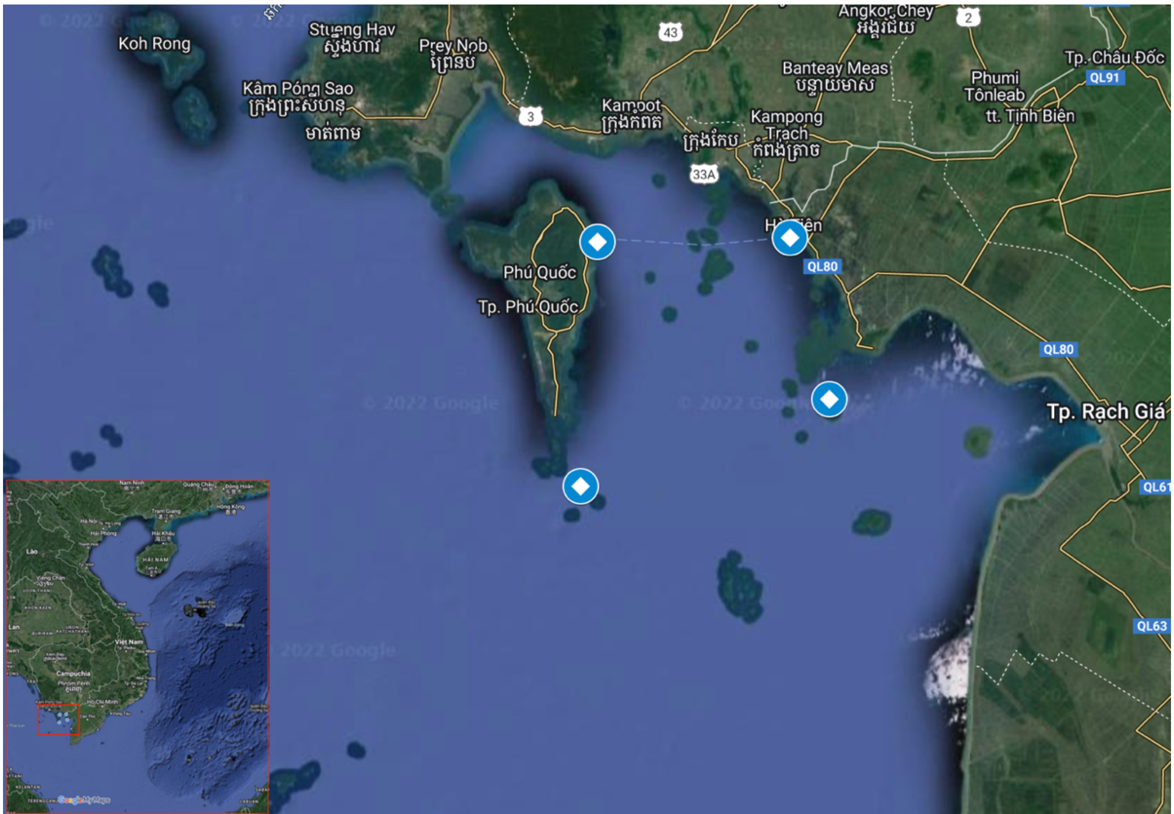

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1. INTRODUCTION

The Blue Swimming Crab (BSC), *Portunus pelagicus* (Linnaeus 1758) (Family: Portunidae), is widely distributed in the coastal zones of tropical waters. They are found from the intertidal zone to a depth of 50m throughout the Indo–West Pacific. BSC inhabits various environments, including mangroves, seagrass beds, coral reefs, and estuaries, on both sandy and muddy bottoms, with a concentration in the depth range of 5-25m (Williams 1982, Edgar 1990, Clarke and Ryan 2004). In Vietnam, BSC is distributed along the coastal waters from North to South and is densely aggregated in the waters of Kien Giang.

The BSC fishery has been a long-lasting sector in the Kien Giang province, localized to the districts of Ha Tien, Kien Luong, Hon Dat, and Phu Quoc Island. Fishers reside in numerous small fishing communities along the coast, relying heavily on this fishery for their livelihoods. They utilize small fishing boats equipped with engines ranging from 20-33HP. Bottom gillnets and traps (Chinese traps and collapsible traps) are the primary fishing gears targeting the BSC. Ha Tien and Phu Quoc are the two main landing sites where the majority of the catches are landed. Additionally, along the coasts of Kien Luong and Hon Dat districts, catches are landed locally.

The BSC fishery in Kien Giang is open access, and fishing activities occur throughout the year, with the main season from April to August. The BSC stock has been heavily exploited since 2009.

To promote effective fisheries management for the sustainable use of Blue Swimming Crab (BSC) resources, WWF Vietnam, VASEP Crab Council and RIMF have collaborated to support the Kien Giang Department of Agriculture and Rural Development (Kien Giang DARD) in implementing the Fisheries Improvement Project (FIP). The Fishery Action Plan, adopted in 2012 with 26 indicators were monitored covering three core principles of the FIP as Principle 1: Sustainable target fish stocks; Principle 2: Environmental impact of fishing and Principle 3: Effective management. Stock assessments of BSC indicated over-exploitation during the period 2012-2016; however, there was a gradual recovery observed in the period 2017-2019 (Ha and Cuong 2020).

Since 2020, the Kien Giang BSC FIP has been inactive after seven years implementation. A key challenge has been the significant gap in updated information related to stock assessments, fisheries data, and the management of BSC fisheries. To address this issue, the Vietnam Association of Seafood Exporters and Producers (VASEP), with support from the National Fisheries Institute (NFI), Ocean Outcomes (O2), and the Research Institute for Marine Fisheries (RIMF), is working to reactivate the Kien Giang BSC FIP and it was successful reactivation in Sep 2024.

Along with document preparation for the FIP activation, several priority activities were implemented in 2024 including: 1) Review and update information on the Kien Giang BSC stock and fisheries; 2) Inspection of minimum landing sizes of BSC; 3) Checking on mesh sizes of fishing gears and 4) Interviewing the frequency of fishing operations in closed areas. These tasks contribute to Action 1, Action 2, Action 3, and Action 11 in the FIP Work Plan, which relate to PIs 1.1.1, 1.1.2, 1.2.1, 1.2.2, and 3.2.3. Results achievement in 2024 including:

1*) Data of BSC are available for stock assessment*: Two surveys in June and November 2024 were sampled and analysed a total of 1,370 crabs with 447 females and 923 males supporting for stock assessment.

2) Size of BSC in catches: Size data of BSC sampled in 2024 reveals that the BG and CT is low risk to the BSC population in comparison to that of ChT since the the average size of crabs caught by ChT smaller than the MLS, while both BG and CT are caught the larger crabs with the average size is bigger than the MLS.

3) Mesh size violations: Fishing gears used in BSC fisheries, including BG, CT, and ChT, frequently fails to meet the minimum legal mesh size stipulated by Decision 23/2015/QD-UBND of Kien Giang Province

4) Regulatory awareness: Among 115 fishermen surveyed, 62.6% reported being aware of fishery regulations, whereas 37.4% indicated a lack of knowledge. This gap in awareness highlights the need for enhanced dissemination of legal information.

5) Knowledge of fishermen on mesh size requirements: Awareness of minimum legal mesh size was reported by 61.7% of respondents, while 38.3% were unfamiliar with these regulations, underscoring a potential barrier to achieving compliance.

6) Illegal Fishing in Restricted Areas: Survey data revealed that 27.8% of respondents admitted to fishing in closed areas, while 72.2% complied with the restrictions. The presence of a substantial minority engaging in illegal activities suggests the need for addressing underlying factors, such as enforcement deficiencies or economic pressures.

7) The findings regarding fishermen's behaviour toward egg-bearing crabs indicate critical challenges in sustainable fishing practices since 99,1% fishermen reported keeping the egg-bearing crabs and only 0.9% releasing them. This behaviour highlights a widespread lack of adherence to sustainable practices aimed at protecting reproductive crab populations.

8*) Some indicators on BSC fisheries* include the average number of crew members on board, the average number of net settings, CPUE

(Catch Per Unit Effort), and the price of crabs categorized by fishing gear and grade were reported.

In 2025, to support improvements in fisheries management, some activities and tasks are prioritized, including:

- Census of the number of fishing boats engaged in BSC fisheries, review of net mesh sizes

- Implementation of the logbook program for BSC fisheries

- Port sampling for biological data of BSC supporting the stock assessment, evaluation of sizes of landed crabs.

- Port sampling for species composition and catch composition to support the ecological risk assessment of BSC fisheries concerning secondary species and ETP species.

2. MATERIALS AND METHODS

2.1. Data collection

2.1.1. Port sampling

Biological information collection of BSC: Data were collected from the catches of fishing boats at landing sites along the coast of Kien Luong, Ha Tien, and Phu Quoc ward in An Giang province (new name of Kien Giang province), where the majority of catches of this species are landed using bottom gillnets (BG), collapsible trap (CT), Chinese trap (ChT). The locations of the sampling sites are indicated in Figure 1.

In June and November 2025, ten-day field visits were conducted each month to collect BSC samples from catches of fishing boats, representative for the northeast and southwest monsoon season, respectively. Crab samples, each weighting approximately 2.5 kg, were randomly collected from unloaded boats for size measurement and biological analysis.

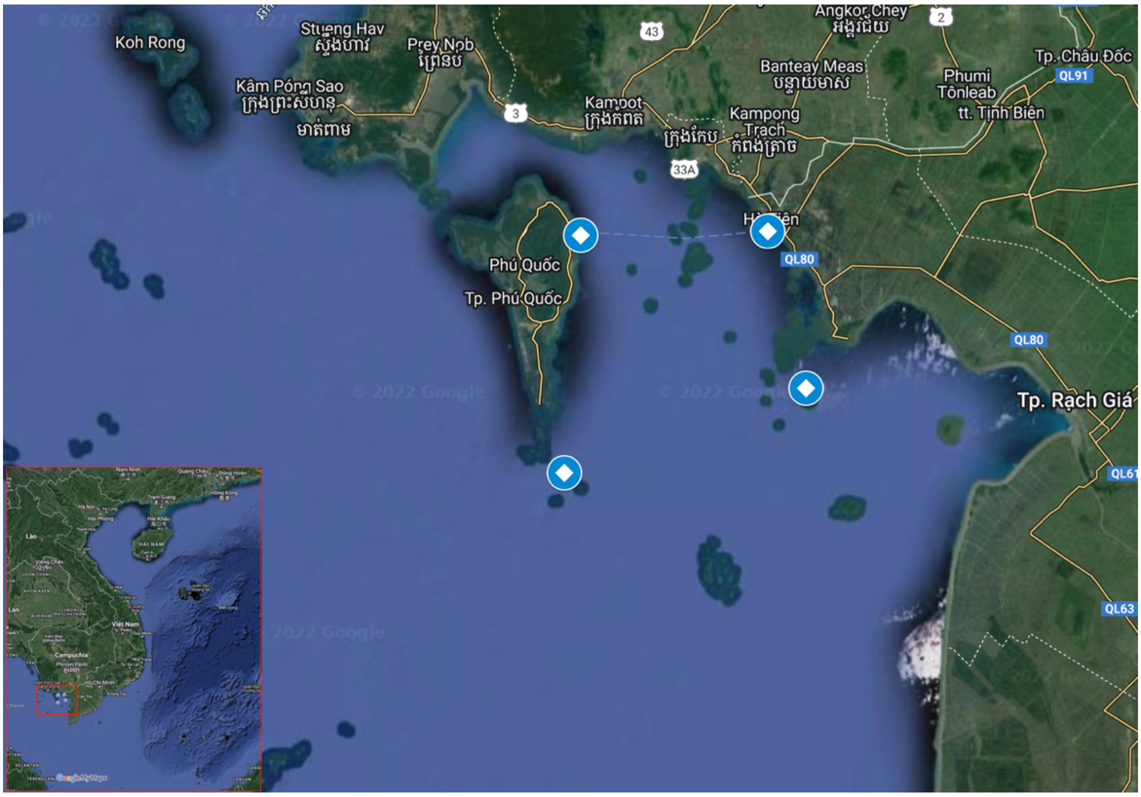

Figure 1. Sampling sites for BSC biological data in An Giang Province

Each crab was individually examined for abdominal morphology to determine sex. Carapace width (CW) was measured to the nearest 0.1 mm using a Palme ruler. Body weight (BW) and gonad weight (Wg) were measured to 0.01 grams using an electric weight scale. The gonad maturity stage was determined using a 5-level scale as described by Sumpton et al. (1994).

Figure 2. Photos of Blue Swimming Crab: upper: male and lower: female. Taken by Vu Viet Ha in Ham Ninh landing site, Phu Quoc District, Kien Giang Province during the survey in March 2013

Species composition of BSC fisheries: Port samplings were conducted on May and November 2025 for species composition of catch landing from BSC fisheries. At ports of An Thoi, Ha Tien and Ba Hon, samplers from Research Institute for Marine Fisheries (renamed to the Northern Research Center for Marine Fisheries since January 2026) conducted catch sample randomly from catches of the bottom gillnet, Chinese trap and Normal trap to analyze for species composition.

Catches were identified to species level using morphological identification methods. Species identification was conducted based on FAO taxonomic references for marine fishes and non-fish marine organisms (Compagno 1984, Carpenter and Niem 1999, 1999, 2001) as well as other taxonomic literature including Nguyễn Hữu Phụng (1995, 1997, 1999), Nguyễn Hữu Phụng and Trần Hoài Lan (1994) and Jorgen & Kilburn (2003). After completing species identification, species or species group was counted and weighed each species separately then the ratio between total catch and sample catch was applied to estimate the composition of the whole trip catch.

2.1.2. Census for number of fishing vessel engaged BSC fisheries

A comprehensive census of fishing vessels engaged in the BSC fishery is scheduled to be conducted in 2025 by the Department of Agriculture and Rural Development (DARD) of Kien Giang province (now is Department of Agriculture and Environment (DAE) of An Giang province. This activity aims to establish an accurate and up-to-date baseline of the number, characteristics, and operational status of fishing vessels participating in the fishery. The expected results expect to provide essential input data for assessing annual fishing effort, supporting fisheries management decisions, and informing Fishery Improvement Project (FIP) activities.

The census is planned to implement through a structured data collection process at the commune level. DAE staffs will coordinate with local authorities to collect vessel-specific information directly from fishing communities. Data will be gathered through a combination of household interviews, review of vessel registration records, and cross-checking with existing fisheries databases.

Key information to be collected includes: vessel identification details (registration number, owner, and home port), vessel characteristics (length, engine capacity, gear type), fishing activity (target species, fishing grounds, and seasonality), and operational status (active, inactive, or temporarily suspended). Special attention will be given to vessels participating in the BSC fishery using bottom gillnets or traps.

To ensure data quality and consistency, standardized data collection forms and guidelines will be developed and provided to all enumerators. Training sessions will be organized for DAE staffs prior to the census implementation.

The finalized dataset will be compiled, analyzed, and reported by DAE. The findings will contribute to improved estimation of fishing effort, support the development of harvest strategies for the BSC fishery in Kien Giang Province.

2.1.3. Implement logbook data collection

A logbook data collection system is planned to implement in 2025 to record fishing activities of vessels participating in BSC fishery. The objective of this activity is to generate reliable, fine-scale data on fishing effort, catch composition, and spatial-temporal fishing patterns, thereby supporting stock assessment and BSC fisheries management.

Standardized logbook templates have been designed by RIMF during the previous phase of BSC FIP in 2013. The logbook templates are distributed to coordinators at local fishing, who are responsible for further distributing them to selected fishing vessels. Priority is given to vessels actively engaged in the BSC fishery using bottom gillnets and traps. As designed, each fleet, categorized by gear type, is expected to collect 32 completed logbooks per month. The logbooks will record key information including date of fishing trips, fishing location, gear specifications, fishing effort, catch volume by species, and bycatch information.

Collected logbook data will be submitted periodically to DAE, which then forwards to RIMF (now is NRCMF) for compilation, validation, and analysis. Data verification procedures include cross-checking logbook records with landing site interviews conducted by NRCMF as part of port sampling activities. The resulting dataset will contribute to improved monitoring of fishing effort and more accurate estimation of total catch.

2.2. Data analysis

2.2.1. Descriptive analysis

BSC biological and species composition data were encoded into the Fisheries Biology Database at the NRCMF. Quantitative biological indicators, such as mean size, size frequency and catch composition were analysed descriptively. The R packages 'dplyr' (Wickham H, François R et al. 2023) and "ggplot2" (Wickham H 2016) were utilized for statistical analysis and visualization of the indicators.

The risk of the fisheries to BSC stock was assessed by comparing the proportion of BSC individuals smaller than the minimum legal size (MLS) in the catch of each fishing gear. According to Decision No. 23/2022/QD-UBND of the People's Committee of Kien Giang Province, the MLS for BSC is set at 10 cm. In addition, SPR values estimated for different fishing gears in 2025 were used as indicators and compared against reference points to determine the exploitation status of the population

2.2.2. Stock Assessment

Length Based Spawning Potential Ratio (LBSPR) methodology is a simplified form of assessment developed for data-poor fisheries lacking essential information for biomass trend assessments. This method is designed for stocks with only available data on catch size composition (Beverton 1963, Prince, Hordyk et al. 2014, Hordyk, Loneragan et al. 2015, Hordyk, Ono et al. 2016). Prince et al (2020) indicated that the data inputs required for the LBSPR methodology are:

1. Catch size composition data that are indicative of the size of the adult crab in a population. If the type of fishing being conducted fails to catch the largest size classes of a crab species, then the estimate of SPR produced for that species will be too small.
2. Estimates of the size at which crabs become adults (Lm) which is defined by L50 and L95, the sizes at which 50% and 95%, respectively, of a population are observed to be mature.
3. The two life history ratios (LHR) that characterize differing taxa and which determine the relative shape of population size and age compositions (Hordyk et al. 2015a). The LHR are:
   a) $L50/L\infty$ - the relative size of maturity being the size of maturity (L50) divided by the average maximum size individuals might attain if they survived to infinite age ($L\infty$); and
   b) M/K - the rate at which a cohort of crabs dies off from natural causes, divided by the von Bertalanffy growth parameter (K), which is the annual rate of grows to $L\infty$.

In an unfished state, the spawning potential ratio (SPR) is assumed to be 100%. This value declines as fishing effort increases and impacts the population. In fisheries management, an SPR above 40% is generally considered sustainable, while an SPR below 20% indicates that the stock is overexploited. The R package 'LBSPR' (Hordyk 2021) is utilized to estimate the SPR for BSC in An Giang Province.

In this report, the SPR is estimated using the available length frequency data collected during period 2013-2019 and 2023-2025. The analysis applies von Bertalanffy growth function (VBGF) parameters estimated in 2018 (CW_∞ = 168 mm, K = 0.9 $year^{-1}$ for combined sexes), a natural mortality rate (M) of 1.05 $year^{-1}$, and maturity parameters (L50 and L95) derived from samples collected in 2023, estimated at 98.1 mm and 116 mm, respectively.

3. RESULTS

3.1. Data for stock assessment

Table 1 provides a summary on the number of BSC sampled for size measurement and biological analysis during June and November 2025, broken down by female and male. A total of 1,448 individuals were sampled, comprising 640 females and 808 males. Region II (An Thoi landing site) contributed a larger share of the samples (838 individuals) compared with Region I (Ham Ninh, Ha Tien and Ba Hon landing site) (610 individuals). In both regions, bottom gill nets and traps were the primary fishing gears used for sampling.

Table 1. Number of BSC sampled for size measurement and biological analysis in June and November 2025

Region/Fishing Gear	Female	Male	Total
Region I	274	336	610
Bottom Gill net	122	129	251
Trap	152	207	359
Region II	366	472	838
Bottom Gill net	161	259	420
Chinese Trap	205	213	418
Grand Total	640	808	1448

In Region I, traps accounted for a higher number of samples than bottom gill nets, while in Region II, the number of samples collected from bottom gill nets and Chinese traps was relatively similar. Overall, male BSC were more frequently sampled than females across all regions and fishing gears.

3.2. BSC fishing vessel statistics and logbook data collection

In 2025, VASEP held a meeting with the Department of Agriculture and Environment of An Giang province to discuss the implementation of the logbook program and the compilation of statistics on the number of fishing vessels engaged in the blue swimming crab fishery. Both parties agreed to proceed with the discussed activities and to sign a memorandum of understanding to formalize the implementation of the work in 2026.

3.3. Biological Performance Indicators

3.3.1. The size of BSC in catches

Table 2 presents the results of the descriptive statistical analysis of carapace width (CW) of blue swimming crab (BSC) by region, fishing gear, and sex. A total of 1,448 individuals were measured, with an overall mean CW of 103.9 mm, ranging from 58 to 150 mm. Clear spatial differences in crab size were observed between regions, with larger crabs recorded in Region I than in Region II. Specifically, 610 individuals sampled in Region I had a mean CW of 108.0 mm, whereas 838 individuals from Region II exhibited a lower mean CW of 99.7 mm.

In Region I, fishing gear type strongly influenced the size of crabs captured. Crabs collected from trap fisheries showed a higher mean CW (110.2 mm) compared with those captured by bottom gill nets (105.7 mm). When analyzed by sex, male crabs were consistently larger than females across both fishing gears. For bottom gill nets, the mean CW of males and females was 106.0 mm and 105.5 mm, respectively. In trap fisheries, male crabs reached a mean CW of 111.6 mm, exceeding the mean CW of females (108.9 mm). The minimum CW recorded in Region I was 83 mm, while the maximum CW reached 150 mm, primarily associated with trap-caught crabs.

In Region II, overall crab size was smaller and more variable than in Region I. Crabs caught by bottom gill nets exhibited a substantially larger mean CW (106.3 mm) than those caught by Chinese traps (93.1 mm). Differences in mean CW between males and females within the same fishing gear were minimal. In bottom gill nets, the mean CW was 106.4 mm for females and 106.3 mm for males, while in Chinese traps, mean CW values were 93.0 mm and 93.3 mm for females and males, respectively. The smallest crab measured in the study (58 mm CW) was recorded in the Chinese trap fishery in Region II, whereas the maximum CW in this region reached 143 mm.

Overall, the results indicate that crab size varies markedly by region and fishing gear, with trap fisheries generally capturing larger individuals than gill nets in Region I. In Region II, size of crabs was smaller the those in Region I and the Chinese trap caught relatively small crab in compared to that of the bottom gillnet.

Table 2. Descriptive statistical analysis of crab size among the fishing gears

Region/Fishing Gear/Sex	N	Mean of CW (mm)	Min of CW (mm)	Max of CW (mm)
Region I	610	108.0	83	150
Bottom Gill net	251	105.7	83	128
F	122	105.5	84	125
M	129	106.0	83	128
Trap	359	110.2	85	150
F	152	108.9	85	145
M	207	111.6	88	150
Region II	838	99.7	58	143
Bottom Gill net	420	106.3	78	143
F	161	106.4	80	128
M	259	106.3	78	143
Chinese Trap	418	93.1	58	128
F	205	93.0	62	122

Region/Fishing Gear/Sex	N	Mean of CW (mm)	Min of CW (mm)	Max of CW (mm)
M	213	93.3	58	128
Overall	1448	103.9	58	150

3.3.2. Stock assessment

The fitted length–frequency distributions of BSC collected during period 2013-2019 and 2023-2025 (Figure 3) show that all fisheries (BG, CT, and ChT) follow logistic selectivity patterns, with increasing capture probability at larger sizes. Comparison with the maturity curve indicates an overlap between the size at first capture and size at maturity, suggesting that a fraction of individuals is harvested before reaching full maturity.

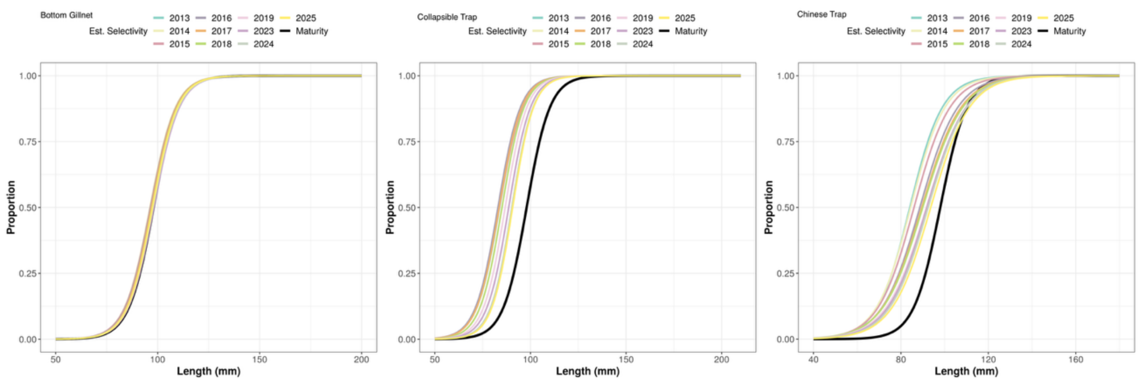

Figure 3. Fitting length frequency of BSC in catches of BG, CT, ChT and maturity curve of BSC

The SPR results are consistent with these observations and differ by gear type. In case of the BG fishery, SPR values ranged from approximately 0.29 to 0.65 during period 2013–2019 (Table 3), indicating moderate exploitation in earlier years. However, SPR declined sharply in recent years, reaching 0.17 in 2023 and further decreasing to 0.11–0.12 in 2024–2025, indicating severe overexploitation.

Table 3. The estimated SPR values, SL50 and SL95 of BSC caught by the bottom gillnet fishery during period 2013-2019 and 2023-2025

Years	SPR	SL50	SL95	F/M
2013	0.34 (0.31 - 0.36)	99.06 (97.49 - 100.63)	116.33 (113.56 - 119.1)	1.52 (1.33 - 1.71)
2014	0.29 (0.26 - 0.31)	92.21 (90.44 - 93.98)	110.46 (107.33 - 113.59)	1.56 (1.36 - 1.76)
2015	0.42 (0.39 - 0.46)	96.99 (94.84 - 99.14)	118.52 (114.68 - 122.36)	1 (0.85 - 1.15)
2016	0.4 (0.37 - 0.42)	95.58 (94.14 - 97.02)	113.71 (111.13 - 116.29)	1.08 (0.96 - 1.2)
2017	0.4 (0.37 - 0.43)	93.98 (92.57 - 95.39)	111.57 (109.02 - 114.12)	1 (0.88 - 1.12)
2018	0.65 (0.59 - 0.72)	97.02 (94.73 - 99.31)	112.63 (108.35 - 116.91)	0.4 (0.28 - 0.52)
2019	0.54 (0.48 - 0.61)	102.66 (99.74 - 105.58)	121.11 (115.92 - 126.3)	0.71 (0.51 - 0.91)
...	...	...	...	...
2023	0.17 (0.15 - 0.2)	103.78 (101.28 - 106.28)	123.56 (119.68 - 127.44)	5.27 (4.27 - 6.27)

Years	SPR	SL50	SL95	F/M
2024	0.12 (0.09 - 0.15)	94.51 (90.71 - 98.31)	117.34 (111.42 - 123.26)	4.68 (3.55 - 5.81)
2025	0.11 (0.09 - 0.12)	96.13 (94.07 - 98.19)	110.78 (107.41 - 114.15)	6.88 (5.51 - 8.25)

For the CT fishery, SPR values are consistently low, generally below 0.20 and frequently approaching or below 0.10 (Table 4). This indicates high fishing mortality and insufficient spawning biomass. These results align with the observed selectivity pattern, where smaller size classes are more vulnerable to capture.

Table 4. The estimated SPR values, SL50 and SL95 of BSC caught by the collapsible trap fishery during period 2013-2019 and 2023-2025

Years	SPR	SL50	SL95	F/M
2013	0.09 (0.07 - 0.1)	85.99 (84.29 - 87.69)	101.84 (98.9 - 104.78)	4.52 (3.93 - 5.11)
2014	0.06 (0.05 - 0.07)	82.31 (80.19 - 84.43)	101.02 (97.48 - 104.56)	5.02 (4.3 - 5.74)
2015	0.08 (0.06 - 0.1)	91.45 (87.85 - 95.05)	116.49 (111.11 - 121.87)	6 (4.68 - 7.32)
2016	0.23 (0.2 - 0.26)	69.12 (67.99 - 70.25)	80.57 (78.44 - 82.7)	1.22 (1.08 - 1.36)
2017	0.11 (0.09 - 0.13)	75.36 (72.81 - 77.91)	96.43 (91.98 - 100.88)	2.46 (2.1 - 2.82)
2018	0.16 (0.13 - 0.18)	82.99 (80.59 - 85.39)	99.13 (94.68 - 103.58)	2.31 (1.94 - 2.68)
2019	0.12 (0.09 - 0.15)	85.04 (82.31 - 87.77)	98.32 (93.31 - 103.33)	3.24 (2.45 - 4.03)
...	...	...	...	...
2023	0.05 (0.03 - 0.08)	90.88 (85.72 - 96.04)	112.93 (105.58 - 120.28)	9.13 (5.71 - 12.55)
2024	0.09 (0.05 - 0.14)	101.99 (96.29 - 107.69)	116.92 (108.9 - 124.94)	15.1 (4.65 - 25.55)
2025	0.17 (0.14 - 0.21)	95.11 (91.86 - 98.36)	108.36 (102.46 - 114.26)	3.33 (2.45 - 4.21)

SPR values estimated using size data collected from ChT fishery shows similar selectivity characteristics to BG with the SPR values remain critically low (approximately 0.05–0.07 across years). This suggests that despite differences in gear configuration, fishing pressure remains high and the stock is heavily depleted.

Table 5. The estimated SPR values, SL50 and SL95 of BSC caught by the Chinese trap fishery during period 2013-2019 and 2023-2025

Years	SPR	SL50	SL95	F/M
2013	0.05 (0.05 - 0.06)	81.18 (79.75 - 82.61)	91.9 (89.17 - 94.63)	5.59 (4.73 - 6.45)
2014	0.04 (0.03 - 0.05)	72.75 (69.69 - 75.81)	95.39 (90.28 - 100.5)	4.44 (3.68 - 5.2)
2015	0.04 (0.03 - 0.05)	74.42 (71.63 - 77.21)	98.16 (93.64 - 102.68)	4.97 (4.18 - 5.76)
2016	0.09 (0.05 - 0.14)	107.18 (101.02 - 113.34)	135.31 (127.52 - 143.1)	13.55 (7.7 - 19.4)
2017	0.07 (0.05 - 0.1)	93.46 (88.5 - 98.42)	126.45 (119.64 - 133.26)	6.62 (4.94 - 8.3)
2018	0.11 (0.07 - 0.15)	77.77 (70.4 - 85.14)	106.62 (94.71 - 118.53)	2.78 (1.92 - 3.64)
2019	0.11 (0.06 - 0.17)	105.99 (97.58 - 114.4)	142.45 (131.49 - 153.41)	7.44 (4.19 - 10.69)
...	...	...	...	...
2023	0.03 (0.02 - 0.05)	88.46 (84.23 - 92.69)	111.53 (105.57 - 117.49)	11.27 (7.77 - 14.77)
2024	0.02 (0.01 - 0.04)	86.5 (80.49 - 92.51)	108.36 (100.17 - 116.55)	13.99 (7.3 - 20.68)
2025	0.03 (0 - 0.09)	105.38 (92.65 - 118.11)	132.07 (117.74 - 146.4)	40.09 (0 - 84.81)

The agreement between the overlap of size selectivity and maturity curves and persistently low SPR values across all fisheries indicates that a substantial proportion of immature individuals is being removed before contributing to reproduction. This leads to reduced spawning potential and diminished stock resilience.

Overall, the combined evidence from length–frequency analysis and SPR estimates indicates that the BSC stock is overexploited across all gear types, with recent SPR values below commonly accepted biological reference points (SPR ≥ 0.20). Management measures aimed at increasing size at first capture and reducing fishing mortality are therefore urgently required.

3.3.3. Risk of fishing to BSC population

Table 6 presents the number and proportion of undersized blue swimming crabs (CW < MLS) and legal-sized crabs (CW ≥ MLS) captured by different fishing gears. Overall, 1,448 crabs were analyzed, of which 476 individuals (32.87) were smaller than the minimum legal size, while 972 individuals (67.13) met or exceeded the MLS.

Marked differences were observed among fishing gears. Chinese traps showed the highest proportion of undersized crabs, with 257 individuals accounting for 61.48 of the catch, indicating a substantial risk of juvenile exploitation. In contrast, bottom gillnets captured a much lower proportion of undersized crabs, with 156 individuals (23.25), while collapsible traps exhibited the lowest proportion, with only 63 undersized individuals (17.55). Correspondingly, collapsible traps recorded the highest proportion of legal-sized crabs (82.45), followed by bottom gillnets (76.75), whereas Chinese traps had the lowest proportion of legal-sized individuals (38.52).

These results indicate that fishing gear selectivity plays a significant role in determining the size composition of the catch. In particular, Chinese trap fisheries pose a higher risk to the BSC stock due to the high proportion of undersized crabs in the catch, whereas bottom gillnets and collapsible traps appear to be more selective toward legal-sized individuals.

Table 6. Number and proportion (%) of undersized blue swimming crabs (CW < MLS) and legal-sized crabs (CW ≥ MLS) captured by different fishing gears

Fishing Gear	CW<MLS		CW≥MLS		Total	
	Number	%	Number	%	Number	%
Bottom Gillnet	156	23.25	515	76.75	671	100.00
Chinese Trap	257	61.48	161	38.52	418	100.00
Collapsible Trap	63	17.55	296	82.45	359	100.00
Grand Total	476	32.87	972	67.13	1448	100.00

The Figure 4 illustrates the size-frequency distributions of blue swimming crab (BSC) carapace width (CW) by fishing gear in 2025. Distributions are shown separately for bottom gillnets, Chinese traps, and collapsible traps, with the minimum legal size (MLS = 100 mm CW).

It is notable differences in size selectivity among fishing gears are evident. Collapsible trap generally captured larger crabs, with size distributions concentrated around and above the MLS. The proportion of crabs exceeding the MLS appears relatively stable over seasons, indicating consistent gear selectivity toward legal-sized individuals.

Bottom gillnet also showed a strong tendency to capture legal-sized crabs, with modal CW values clustered close to or slightly above the MLS. During the Southwest monsoon season, the collapsible trap distributions shifted further toward larger size classes, suggesting improved selectivity or changes in fishing grounds or practices. Only a limited proportion of undersized crabs was observed in this gear type.

In contrast, Chinese traps consistently exhibited size distributions skewed toward smaller CW values, with a substantial proportion of the catch falling below the MLS during the Southwest monsoon season.

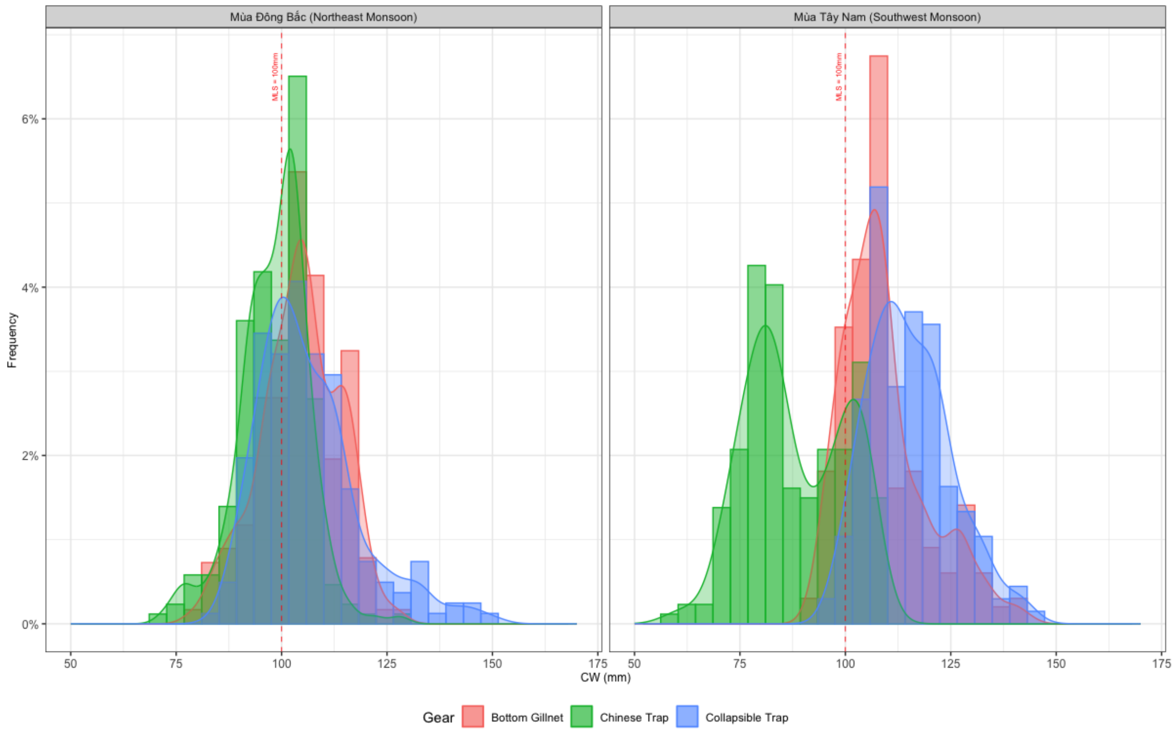

Figure 4. Distribution of crab size (CW, mm) among different fishing gears, seasons and the MLS according to Decision 23/2025/QD-UBND of Kien Giang Province

Overall, the figure highlights persistent differences in gear selectivity, with Chinese traps posing a higher risk to the BSC stock due to the consistent capture of undersized individuals. Bottom gillnets and collapsible traps demonstrate more favorable size selectivity, supporting their potential role in reducing growth overfishing and promoting sustainable exploitation of the BSC resource.

The SPR values estimated from data collected in 2025 were below the limit reference point (Figure 5) for all gear types, including Chinese traps, collapsible traps, and bottom gillnets, indicating that the BSC population is overexploited and depleted

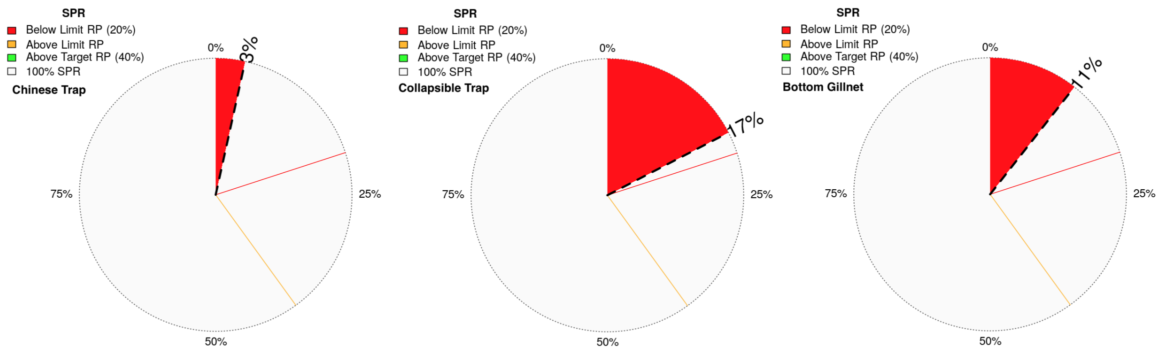

Figure 5. SPR values estimated in 2025 from data collected from Chinese trap, Collapsible trap and Bottom gillnet

3.3.4. Species composition of the BSC fisheries

Table 7 presents the species composition of catches from bottom gillnets during the north-east (NE) and south-west (SW) monsoon seasons, based on port sampling conducted in 2025. Overall, the catch was strongly dominated by blue swimming crab (*Portunus pelagicus*), which accounted for 80.65 of the total catch across both seasons. The dominance of this species was evident in both monsoon periods, contributing 71.06 of the catch during the NE monsoon and increasing substantially to 87.70 during the SW monsoon.

Several other crustacean species contributed smaller but notable proportions to the catch. *Charybdis affinis* was the second most abundant species overall, representing 4.37 of the total catch, with higher occurrence in the NE monsoon (6.24) than in the SW monsoon (2.99). *Podophthalmus vigil* was exclusively recorded during the SW monsoon, accounting for 2.83 of the seasonal catch and 1.63 overall. Other portunid crabs, including *Charybdis japonica*, *Charybdis feriatus*, and *Charybdis natator*, occurred at relatively low proportions, with some species showing clear seasonal patterns, such as *C. japonica*, which was only observed during the SW monsoon.

Non-crustacean species collectively formed a minor component of the catch. Molluscs such as *Murex trapa* (3.40 overall) and *Hemifusus colosseus* (2.90 overall) were more prevalent during the NE monsoon, while cephalopods including *Sepia lycidas* and *Sepia pharaonis* contributed marginally to the total catch. Several fish species, such as *Gerres filamentosus*, *Platycephalus indicus*, and *Pennahia* spp., were recorded at very low proportions, each contributing less than 0.5 to the overall composition.

Seasonal variation in species composition was apparent, with the NE monsoon showing greater species diversity and a higher contribution of non-target species compared with the SW monsoon, during which the catch was more strongly concentrated on *P. pelagicus*. Overall, the results indicate that bottom gillnet fisheries in 2025 were highly selective toward blue swimming crab, particularly during the SW monsoon season, while still capturing a diverse assemblage of associated species at relatively low proportions.

Table 7. Species composition (%) of the bottom gillnet in the south-west (SW) and north-east (NE) monsoon season based on the port sampling in 2025

Species	NE monsoon season (May-Jun)	SW monsoon season (Oct-Nov)	Overall
Alepes kleinii	0.00	0.03	0.02
Charybdis affinis	6.24	2.99	4.37
Charybdis feriatus	0.71	0.10	0.36
Charybdis japonica	0.00	1.84	1.06
Charybdis natator	0.11	0.52	0.35
Cistopus indicus	0.14	0.00	0.06
Cymbiola nobilis	0.57	0.00	0.24
Cynoglossus arel	0.00	0.14	0.08
Dendrophysa russelli	1.03	0.17	0.54
Erugosquilla woodmasoni	0.89	0.06	0.41
Gerres filamentosus	0.18	0.30	0.25
Gerres oyena	0.27	0.00	0.11
Harpiosquilla harpax	2.14	1.08	1.53
Harpiosquilla raphidea	0.27	0.45	0.37
Hemifusus colosseus	6.42	0.31	2.90
Johnius belangerii	0.00	0.19	0.11
Miyakaea nepa	0.71	0.18	0.41
Murex trapa	8.02	0.00	3.40
Oratosquilla interrupta	0.00	0.03	0.02
Oratosquilla oratoria	0.30	0.00	0.13
Paramonacanthus japonicus	0.00	0.02	0.01
Pennahia anea	0.00	0.06	0.04
Pennahia argentata	0.18	0.00	0.08
Platycephalus indicus	0.11	0.15	0.13
Podophthalmus vigil	0.00	2.83	1.63
Portunus pelagicus	71.06	87.70	80.65
Scylla serrata	0.00	0.10	0.06
Sepia lycidas	0.14	0.17	0.16

Species	NE monsoon season (May-Jun)	SW monsoon season (Oct-Nov)	Overall
Sepia pharaonis	0.18	0.00	0.08
Sillago sihama	0.00	0.08	0.05
Terapon theraps	0.00	0.13	0.07
Thalamita crenata	0.33	0.37	0.35
Grand Total	**100.00**	**100.00**	**100.00**

Table 8 summarizes the species composition of catches from Chinese trap fisheries during the north-east (NE) monsoon season (May–June) and the south-west (SW) monsoon season (October–November), based on port sampling conducted in 2025. The results indicate a highly diverse catch composition, comprising crustaceans, molluscs, and numerous finfish species, with marked seasonal variation in species dominance and relative abundance.

Overall, the catch was dominated by crustacean and molluscan species. *Charybdis affinis* was the most abundant species, accounting for 36.62% of the total catch, with a substantially higher contribution during the SW monsoon (47.23%) compared with the NE monsoon (33.58%). *Hemifusus colosseus* was the second most important species overall, representing 24.88% of the total catch; however, its contribution was strongly seasonal, being much higher during the NE monsoon (29.71%) than during the SW monsoon (7.99%). The target species, blue swimming crab (*Portunus pelagicus*), constituted a relatively modest proportion of the Chinese trap catch, contributing 9.10% overall, with a higher proportion during the SW monsoon (15.95%) than in the NE monsoon (7.15%).

Several other crustacean species contributed notable proportions to the catch. *Miyakaea nepa* accounted for 3.51% overall, with a higher occurrence during the NE monsoon. Mantis shrimps, including *Dendrophysa russelli* and *Oratosquilla oratoria*, were consistently present in both seasons, though generally at low to moderate levels. Penaeid shrimps such as *Penaeus monodon*, *P. merguiensis*, and *Metapenaeus* spp. collectively contributed a small but non-negligible fraction of the catch, with higher proportions observed during the SW monsoon.

Finfish species were diverse but individually represented small proportions of the total catch. Species such as *Allenbatrachus grunniens* (3.95% overall), *Plotosus canius* (3.10%), *Sillago sihama* (1.86%), *Otolithes ruber* (1.22%), and *Pennahia argentata* (1.38%) were among the more frequently recorded fishes. Several species exhibited clear seasonal occurrence patterns, appearing predominantly or exclusively in one monsoon season, reflecting seasonal shifts in habitat use or availability.

Overall, the results demonstrate that Chinese trap fisheries are characterized by low selectivity for blue swimming crab and a high level of bycatch diversity, with strong seasonal variation in species composition. The relatively high proportions of non-target species, particularly during the NE monsoon, highlight the potential ecological impacts of this fishing gear and underscore the need for management measures aimed at improving selectivity and reducing bycatch in the Chinese trap fishery.

Table 8. Species composition (%) of the Chinese trap in the south-west (SW) and north-east (NE) monsoon season based on the port sampling in 2025

Species	**NE monsoon season (May-Jun)**	**SW monsoon season (Oct-Nov)**	**Overall**
Alepes kleinii	0.29	0.00	0.23
Alepes melanoptera	0.01	0.00	0.01
Allenbatrachus grunniens	4.08	3.47	3.95
Alpheus sp.	0.01	0.00	0.01
Apogon kiensis	0.00	0.21	0.05
Apogon quadrifasiatus	0.00	0.88	0.19
Apogon semilineatus	0.70	0.19	0.58
Bothus sp.	0.00	0.03	0.01
Charybdis affinis	33.58	47.23	36.62
Charybdis feriatus	0.04	0.00	0.03
Cirrhinus microlepis	0.00	0.24	0.05
Cistopus indicus	0.13	0.84	0.29
Cociella crocodila	0.00	0.28	0.06
Cynoglossus bilineatus	0.03	0.00	0.02
Dendrophysa russelli	0.88	0.69	0.84
Dorippe facchino	0.08	0.37	0.15
Epinephelus sexfasciatus	0.32	0.19	0.29
Gerres filamentosus	0.01	0.00	0.01
Gerres oyena	0.15	1.37	0.42
Harpiosquilla harpax	0.03	0.00	0.02
Harpiosquilla raphidea	0.21	0.28	0.23
Hemifusus colosseus	29.71	7.99	24.88
Johnius belangerii	0.07	0.00	0.06
Leiognathus nuchalis	0.27	0.75	0.37
Lethrinus microdon	0.05	0.00	0.04
Lutjanus russelli	0.00	0.16	0.04
Metapenaeus affinis	0.00	0.98	0.22
Metapenaeus brevicormis	0.00	0.64	0.14
Metapenaeus ensis	0.13	0.61	0.24

Species	NE monsoon season (May-Jun)	SW monsoon season (Oct-Nov)	Overall
Miyakaea nepa	4.41	0.33	3.51
Mugil cephalus	0.84	0.23	0.71
Oratosquilla gravieri	0.00	0.19	0.04
Oratosquilla oratoria	0.21	1.24	0.44
Otolithes ruber	1.57	0.00	1.22
Palaemon sp.	0.00	0.35	0.08
Parachaeturichthys polynema	0.18	0.34	0.21
Paramonacanthus japonicus	0.02	0.00	0.02
Parapenaeopsis hungerfordi	0.09	0.00	0.07
Parapenaeopsis maxillipedo	1.53	0.07	1.20
Penaeus merguiensis	0.63	2.06	0.95
Penaeus monodon	1.61	2.34	1.77
Penaeus semisulcatus	0.09	0.00	0.07
Pennahia anea	0.35	0.00	0.27
Pennahia argentata	1.59	0.67	1.38
Platycephalus indicus	0.02	0.00	0.01
Plotosus canius	3.99	0.00	3.10
Plotosus lineatus	0.40	0.00	0.31
Polynemus dubius	0.03	0.00	0.02
Portunus pelagicus	7.15	15.95	9.10
Scatophagus argus	0.41	2.60	0.90
Scylla serrata	0.11	1.12	0.33
Sepia lycidas	0.09	0.00	0.07
Sepia pharaonis	0.13	0.00	0.10
Sepiella inermis	0.19	0.19	0.19
Siganus canaliculatus	0.37	0.00	0.29
Siganus guttatus	0.00	0.37	0.08
Siganus javus	0.05	0.00	0.04
Sillago sihama	1.87	1.82	1.86
Terapon puta	0.64	1.17	0.76
Terapon theraps	0.08	0.28	0.13
Thalamita crenata	0.00	1.12	0.25
Trypauchen vagina	0.13	0.16	0.14
Upeneus tragula	0.30	0.00	0.23
Valenciennea wardii	0.09	0.00	0.07

Table 9 presents the species composition of commercial groups captured by collapsible traps during the north-east (NE) monsoon season (May–June) and the south-west (SW) monsoon season (October–November), based on port sampling conducted in 2025. The results show seasonal differences in the composition of commercial groups and species retained by this fishing gear.

During the SW monsoon season, the catch was dominated by the "mixed crabs and shrimps" commercial group, which accounted for 87.46% of the total catch. Within this group, mantis shrimps were the most prevalent component, particularly *Harpiosquilla harpax*, which alone contributed 69.34% of the group composition. Other species in this group, including *Charybdis affinis*, *Podophthalmus vigil*, and blue swimming crab (*Portunus pelagicus*), occurred at relatively lower proportions, each contributing less than 15% of the group.

In contrast, during the NE monsoon season, the catch structure shifted markedly toward single-species commercial groups. Blue swimming crab constituted 30.69% of the total catch, while mantis shrimp represented the largest share at 69.31%. Within the blue swimming crab group, *Portunus pelagicus* overwhelmingly dominated, accounting for 96.25% of the group composition, with a small contribution from *Charybdis feriatus* (3.75%). Similarly, the mantis shrimp group was almost entirely composed of *Harpiosquilla harpax* (96.68%), with *Erugosquilla woodmasoni* forming a minor component.

When both seasons are combined, blue swimming crab accounted for 24.38% of the total collapsible trap catch, while mantis shrimp represented 45.21%. The mixed crabs and shrimps group contributed 30.42% overall, reflecting its dominance during the SW monsoon. Overall, the results indicate that collapsible traps exhibit strong seasonal variation in catch composition, with higher aggregation of mixed-species catches during the SW monsoon and more species-specific targeting during the NE monsoon season. This seasonal pattern has important implications for catch utilization and management of commercially important species in the collapsible trap fishery.

Table 9. Species composition (%) of commercial group in Collapsible trap in the south-west (SW) and north-east (NE) monsoon season based on the port sampling in 2025

Commercial Group/Species	NE monsoon season (May-Jun)	SW monsoon season (Oct-Nov)	Overall
Mixed Crabs and Shrimps	**0.00%**	**87.46%**	**30.42%**
Charybdis affinis		7.70%	7.70%
Erugosquilla woodmasoni		1.31%	1.31%
Harpiosquilla harpax		69.34%	69.34%
Harpiosquilla raphidea		0.54%	0.54%
Miyakaea nepa		0.92%	0.92%
Podophthalmus vigil		7.09%	7.09%
Portunus pelagicus		13.10%	13.10%
Blue Swimming Crab	**30.69%**	**12.54%**	**24.38%**
Charybdis feriatus	3.75%	0.00%	3.08%
Portunus pelagicus	96.25%	100.00%	96.92%

Matis Shrimp	**69.31%**	**0.00%**	**45.21%**
Erugosquilla woodmasoni	3.32%		3.32%
Harpiosquilla harpax	96.68%		96.68%
Grand Total	**100.00%**	**100.00%**	**100.00%**

3.3.5. ETP species

Two port sampling surveys were conducted in 2025, representing the northeast and southwest monsoon seasons. The results indicated that no sea turtles or sharks were observed in the catches of fishing vessel engaged the BSC fisheries.

4. CONCLUSION REMARKS

+ BSC data for stock assessment:

In 2025, a total of 1,448 blue swimming crabs were sampled for size measurement and biological analysis, including 640 females and 808 males, from major landing sites in An Giang. Data were collected from bottom gillnets, collapsible traps, and Chinese traps, providing an updated and representative dataset to support future stock assessment.

+ Vessel statistics and logbook data collection

In 2025, coordination between VASEP and the DAE of An Giang province was disccussed to implement a logbook program and compile statistics on fishing vessels engaged in the BSC fishery. These actions represent an important step toward strengthening data collection and fisheries management in An Giang and will be implemented in 2026.

+ Biological performance indicators:

- Size of crab in catches:

The overall mean carapace width was 103.9 mm, with larger crabs recorded in Region I (108.0 mm) than in Region II (99.7 mm). The proportion of undersized crabs (CW < 100 mm) accounted for 32.87% of the total catch. Chinese traps showed the highest proportion of undersized crabs (61.48%), while bottom gillnets and collapsible traps recorded significantly lower proportions (23.25% and 17.55%, respectively), indicating clear differences in gear selectivity.

- Species composition:

Bottom gillnets were highly selective for blue swimming crab, which accounted for 80.65% of the total catch, increasing to 87.70% during the SW monsoon. In contrast, blue swimming crab represented only 9.10% of the Chinese trap catch, which was dominated by non-target species such as *Charybdis affinis* (36.62%) and *Hemifusus colosseus* (24.88%). Collapsible traps showed strong seasonal variation, with mixed crabs and shrimps dominating the SW monsoon (87.46%), while blue swimming crab and mantis shrimp accounted for 30.69% and 69.31% of the NE monsoon catch, respectively.

No sharks or sea turtles were observed in the catches from any of the fishing gears, including Chinese traps, collapsible traps, and bottom gillnets.

- Stock assessment:

Stock assessment of BSC using SPR method based on data collected during the periods 2013-2019 and 2023-2025 indicated that the stock is overexploited across all gear types, with SPR values estimated in 2025 below limited biological reference points (SPR ≥ 0.20). Management measures aimed at increasing size at first capture and reducing fishing mortality are therefore urgently required.

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