

Harvest Strategy and Harvest Control Rules of the Kien Giang Blue Swimming Crab Fishery

(Draft version, 2025)



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**Kien Giang Blue Swimming Crab
Fishery Improvement Project**

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List of Abbreviations

BSC: Blue Swimming Crab
BSCF: Blue Swimming Crab Fishery
FIP: Fishery Improvement Project
M: Natural Mortality Rate
F: Fishing Mortality Rate
Z: Instantaneous rate of mortality
CW: Carapace Width
 CW_{∞} : Asymptotic carapace width of crab
 CW_t : Carapace width of crab at the time t
 CW_c : Carapace width of crab in assessment year
 CW_{m50} : Carapace width of crab at first maturity
MSL: Minimum Legal Size
K: Growth rate
E: Exploitation rate
LCC: Length Converted Catch Curve
SPR: Spawning Potential Ratio
LBSPR: Length Based Spawning Potential Ratio
BG: Bottom Gillnet
CT: Collapsible Trap
ChT: Chinese Trap
HCR: Harvest Control Rules
ETP: Endangered, Threatened and Protected (species)

Definitions

Harvest Strategy: a framework covering and explaining selected management measures for a fishery (at the level of fishery management unit) which is required to achieve the agreed biological, ecological, economic and/or social management objectives.

Indicator: a specific variable in the fishery that can be monitored to assess selected management measures in a specific timeframe. Each variable is related to one or more reference points and used to evaluate the status of that fishery variable.

Reference point: the specific point of the indicator that is used as a reference in fishery management.

Target Reference Point: a reference point that is used as a target of the harvest control rules. This point is still acceptable if it is slightly over or below the agreed target reference point.

Limit Reference Point: a reference point that is used as the limit for the control of harvest. This point is minimum value and should not be exceeded.

Spawning Potential Ratio: the reproductive capacity of a species, which is the comparison between biomass of the spawning stock under certain fishing conditions at a specific time compared with the biomass of the unfished stock ($f = 0$)

1. Introduction

This document presents the draft Harvest Strategy and Harvest Control Rules (HCRs) for the Blue Swimming Crab (*Portunus pelagicus*) Fishery in Kien Giang Province, Vietnam. The harvest strategy provides a structured and transparent framework for ensuring that the exploitation of the blue swimming crab (BSC) stock occurs at sustainable levels and that key biological, ecological, economic, and social objectives are met over the long term.

The development of this strategy is aligned with the principles of ecosystem-based fisheries management (EBFM), consistent with the Vietnam Fisheries Law (2017) and related decrees and circulars, as well as regional and international commitments to responsible fisheries. It is also in line with harvest strategy frameworks that emphasize the use of performance indicators, target and limit reference points, and clearly defined management responses through pre-agreed HCRs.

The Kien Giang BSCF is a multi-gear, year-round fishery, primarily operated by small-scale fleets using bottom gillnets (BG), collapsible traps (CT), and Chinese traps (ChT). The fishery plays an important socioeconomic role in the livelihoods of coastal communities, while also interacting with various ecological components including bycatch species, endangered and protected species (ETP), and benthic habitats such as seagrass beds, mangroves, and coral reefs.

This harvest strategy establishes:

- The long-term and operational objectives for the fishery;
- The performance indicators and reference points used to monitor the status of the BSC stock;
- The harvest control rules that define management responses based on the position of indicators relative to reference points;

- The supporting monitoring, research, and reporting systems required to inform decision-making and adaptive management.

By implementing this harvest strategy, Kien Giang aims to ensure the sustainable use of the BSC resources, enhance the resilience of coastal ecosystems, and maintain the economic viability of fishing communities, while contributing to responsible fisheries management.

2. Scope of Management

This harvest strategy relates to the Blue Swimming Crab *Portunus pelagicus* (BSC) resource in Kien Giang province, Viet Nam and fishing activities that impact the resource.

BSC resources in the waters of Kien Giang province are primarily harvested by the Bottom Gillnet (BG), the Collapsible Trap (CT) and the Chinese Trap (ChT). Fishers engaged BSC fishery (BSCF) reside in numerous small fishing communities along the coast, localized to the districts of Ha Tien, Kien Luong, Hon Dat, and Phu Quoc Island.

The BSCF in Kien Giang is open access, and fishing activities occur throughout the year, with the main season from April to August. In 2018, the number of vessels engaged in BSCF was 1,844, including 1,706 BG; 99 ChT and 39 CT. Most of fishing vessels are small in size, with an overall length <15m.

In addition to considering fishing impacts on the target species (*P. pelagicus*) and other retained (non-target) species, this harvest strategy also covers impacts on bycatch, endangered, threatened and protected (ETP) species, habitats and other ecological components to ensure any risks to these elements are managed appropriately.

2.1. Geographical Area

Kien Giang waters located in the Southwestern Sea (SWS) of Vietnam (Figure 1), as part of the Gulf of Thailand, is a shallow water seabed, characterized by tropical climate with two distinct monsoon seasons: the rainy season (RS; April - September) and the dry season (DS; October - March). Ecologically, it encompasses two ecological production units (VI and VII) in the Sea of Vietnam (Bell et al. 2021), featuring high biological diversity and productivity (Pham & Nguyen 1997) with most of the typical marine ecosystems existed such as coral reefs, seagrass beds, mangrove forests, and estuarine tidal flats.

Coral reefs, which are primarily distributed around the archipelagos of Phu Quoc, Hai Tac, Nam Du, and Tho Chu, covering a total estimated area of about 558 hectares. These reefs occur at depths of 2–7 meters and serve as important habitats for reef-associated species.

Seagrass meadows are particularly extensive around Phu Quoc Island, with major beds reported in Bai Bon, Rach Vem, and Bai Vong, contributing to a total area of approximately 10,063 hectares. Additional patches (~30 ha) are also present in the Hai Tac Archipelago (Nguyen & Vo, 2018). These meadows serve as critical nursery grounds for juvenile fish, crustaceans, and endangered megafauna such as dugongs and sea turtles.

Mangrove forests, located along the coast from Ha Tien to An Bien district and surrounding Phu Quoc Island, with total coverage approximately 2,538 ha.

Although the region's climate is typically tropical and monsoonal, with relatively stable sea surface temperatures (27–30°C) and salinity (28–33 PSU), rainfall is strongly seasonal. Annual precipitation ranges from 2,000 to 2,500 mm, with 85–90% concentrated during the wet season from April to September, peaking in July and August (Nguyen et al., 2019; Bell et al., 2021). This seasonal freshwater input significantly affects coastal salinity, turbidity,

and nutrient dynamics, thereby influencing the growth, reproduction, and recruitment patterns of marine fisheries resources. As a result, the coastal and inshore waters of Kien Giang function as major spawning and nursery grounds for various marine species, playing a critical role in sustaining regional fishery stocks.

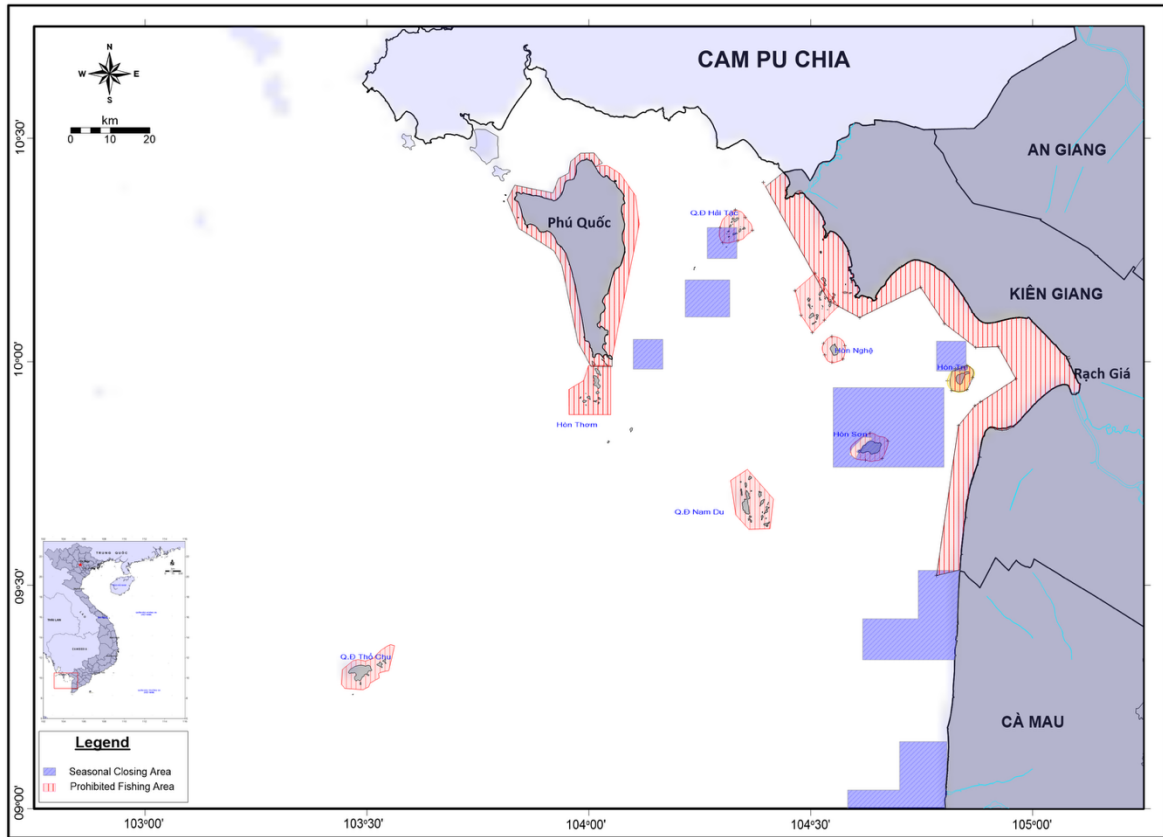


Figure 1. Map of Kien Giang waters with the seasonal closure areas and prohibited fishing areas.

2.2. Target species

Blue swimming crab (*P. pelagicus*) are a tropical species 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 & 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.



Figure 2. Blue Swimming Crab (Portunus pelagicus): male (top) and female (bottom). Photos taken by Vu Viet Ha at Ham Ninh landing site, Phu Quoc District, Kien Giang Province, during the survey conducted in March 2013

BSC in the waters of Kien Giang exhibit multiple spawning peaks, with a major spawning season from February to April and a secondary peak from August to October. The size at first maturity (CW_{50}) was estimated at approximately 99.28 mm based on biological data collected in 2013 (Ha et al. 2014). A subsequent re-estimation in 2023 revealed a CW_{50} of 98.1 mm, with a 95% confidence interval of 97.1 to 99.2 mm. The von Bertalanffy growth function (VBGF) parameters for BSC were first estimated in 2013 ($n = 4,370$) indicating an asymptotic carapace width (CW_{∞}) of 175.8 mm. The growth constant (K) was 0.99, and the growth performance index (ϕ') was 4.570 for males and 4.464 for females.

The size of BSC varies among different fishing gears. BG and CT gears generally capture larger crabs with a wider size range compared to those caught by ChT. Size data collected in 2024 indicated that the average CW of crabs caught by BG, CT, and ChT was 103.4 mm, 105.1 mm, and 92.2 mm, respectively. Compared to the minimum legal size (MLS), the average size of

crabs caught by ChT is below the MLS, whereas those caught by both BG and CT are above it.

2.3. Fishing activities

2.3.1. Fishing fleet and Metier

In Kien Giang province, BG, CT and ChT are primary fishing gears used to harvest BSC. BG typically has a mesh size ranging from 80-100 mm. CT mesh size is usually ranged from 20-26mm, while ChT use relatively small mesh size, only 18 mm.

Fishing fleets are categorized based on the overall length of fishing vessels. The categories include fleets of <6 m, 6–12 m, 12–15 m, 15–24 m and > 24 m. Fleets with vessels >15 m are managed by the central government and are required to install a Vessel Monitoring System (VMS), while those with vessels >15 meters are managed by provincial authorities and not required the VMS.

2.3.2. Fishing grounds

Main fishing grounds of fleets <15m are the northern waters of Kien Giang province, with high concentration from cluster islands of Hai Tac to Nam Du. The CT and ChT are primarily concentrated between the Ba Lua Archipelago, the Hai Tac Archipelago, and the coastal region of Ha Tien District. The BG are located southeast of the Nam Du to Hon Son islands.

The fleets >15m include 115 vessels registered for the crab fishery. The fishing grounds of these fleets are in the southern waters of Kien Giang province with the highest fishing intensity observed between An Thoi and Nam Du Island.

2.3.3. Total Catches

Total catches of BSC in Kien Giang province exhibit a distinct pattern of fluctuation. The catch volume was at its highest in 2013, with 7,854 tons,

followed by a gradual decline in subsequent years. By 2016, catches had recovered slightly to 7,232 tons before experiencing a significant downturn, dropped to 3,632 tons in 2017 and further to a low of 2,072 tons in 2018. This marked reduction, particularly between 2016 and 2018, may be because of environmental pollution. It is noted that a catastrophic event happened in 2017 in the coastal area, affecting the depletion of BSC stock biomass and total catches (Ha & Cuong 2020). In 2019, a reversal of this downward trend became evident, as catches increased to 3,899 tons, continuing the upward trajectory to 6,712 tons by 2023. The recovery in catch volumes in the latter period might indicate changes in fishing intensity from the lower fishing effort in 2017 and 2018 (Ha & Cuong 2020) and relative high fishing effort in 2023.

2.3.4. Governance

The BSC resources in the waters of Kien Giang are accessed by both commercial fisheries using fleets >15 meters and small-scale fisheries using fleets <15 meters. The fishing activities of these sectors are managed by the Provincial Department of Agriculture and Rural Development of Kien Giang for fleets <15 meters, and by the Ministry of Agriculture and Rural Development for fleets >15 meters.

The Law on Fisheries (2017) provides the overarching legal framework for fisheries management in Vietnam. In accordance with this Law, a series of implementing decrees and circulars have been promulgated to regulate fisheries management and the conservation of aquatic resources, including those relevant to the BSCF in Kien Giang province. The legal framework for fisheries management in Vietnam is established through the following key regulatory instruments:

- Decree No. 26/2019/ND-CP dated March 08, 2019, issued by the Government, providing detailed regulations and measures for the implementation of the Law on Fisheries. This Decree sets out provisions on

aquaculture management, fishing vessel registration, fishing licenses, conservation of aquatic resources, and responsibilities of relevant authorities.

- Decree No. 37/2024/ND-CP dated April 15, 2024, issued by the Government of Vietnam, providing amendments and supplements to certain articles of Decree No. 26/2019/ND-CP on the implementation of the Law on Fisheries. This Decree includes updates on procedures related to fishing vessel registration, licensing, and data reporting; strengthens provisions for fisheries inspection and enforcement; and aligns national regulations with international commitments on the prevention of IUU (Illegal, Unreported, and Unregulated) fishing activities. Notably, the Decree provides a list of Minimum Legal Sizes (MLS) for key commercially exploited species, including the blue swimming crab (BSC), to support sustainable resource management and stock recovery.

- Decree No. 42/2019/ND-CP dated May 16, 2019, prescribing penalties for administrative violations in the fisheries sector. The Decree outlines violations and corresponding fines related to illegal fishing, use of prohibited fishing gear, non-compliance with logbook and reporting requirements, and other breaches of fisheries regulations.

- Circular No. 21/2018/TT-BNNPTNT dated November 15, 2018, issued by the Ministry of Agriculture and Rural Development, regulating the recording and submission of fishing logbooks and reports; the designation of fishing ports authorized to verify the origin of fishery products from capture; the publication of lists of illegal, unreported, and unregulated (IUU) fishing vessels; and the certification of fishery raw materials and harvested aquatic resources for domestic and export purposes. The Circular states that all fishing vessels > 15 m are required to maintain a logbook to record fishing activities and must submit a catch report upon disembarkation.

- Circular No. 19/2018/TT-BNNPTNT dated November 15, 2018, providing technical guidelines on the protection and development of aquatic resources,

including the establishment of closed seasons, marine protected areas, artificial reefs, and measures for the rehabilitation and enhancement of fishery resources.

3. Harvest Strategy

3.1. Longterm objectives

To ensure the biological sustainability of all captured aquatic resources, minimize the negative impacts of fishing activities on fishery resources, habitats, and ecosystems, and secure the long-term socio-economic benefits for fishing communities.

Ecologically, the longterm objectives are defined as:

- 1) To maintain stock of BSC and other retained species at a level where the main factor affecting recruitment is the environment.
- 2) To ensure fishing impacts do not result in serious or irreversible harm to BSC population, bycatch species, ETP species.
- 3) To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function, and ecological processes.

In term of economic and social benefits, the longterm objectives are:

- 1) To support flexible opportunities to ensure fishers can maximise economic return while maintaining or enhancing their livelihood, within the constraints of ecological sustainability.
- 2) To maintain or provide opportunity to maximise the flow of commercial fishing related economic benefit to the broader community, within the constraints of ecological sustainability.

3.2. Operation objectives

Operational objectives aim to:

- 1) Maintain the BSC stock within the threshold level or rebuild/restore the BSC resource if it has fallen below the limit levels.
- 2) Minimise the incidence of the ETP species in catches of BSC fishery

These operational objectives are implemented as short-term goals, using one or more performance indicators that are measurable and evaluated against clearly defined reference levels. This allows for effective monitoring of the strategy's performance and the application of adaptive management where necessary.

3.3. Harvesting and Management Approaches

3.3.1. Reference level and management approaches

The Harvest Strategy for blue swimming crab resources in Kien Giang province follows a constant exploitation approach, whereby the annual catch adjusts in proportion to fluctuations in stock abundance. This strategy acknowledges the high variability in blue swimming crab recruitment and applies a relative indicator approach to assess stock status and maintain harvests at sustainable levels.

Appropriate indicators have been selected to evaluate the condition of the crab stock against clearly defined reference points that distinguish acceptable from unacceptable performance. These reference levels include:

- Target level: the desired condition of the indicator.
- Limit level: the point below which there is a substantially increased risk of recruitment impairment, and which must be avoided.

- Threshold level: an intermediate range between the target and limit levels, signaling a need for caution.

Harvest Control Rules (HCRs) specify the management responses that should be taken based on the position of each performance indicator relative to these reference levels.

3.3.2. Biological performance indicators and reference points

3.3.2.1 *Blue swimming crabs*

The primary biological performance indicators for the BSC stock are based on fishery biology survey data and are compared annually to specified reference levels to determine stock status. Suggested biological performance indicators used in harvest strategy for blue swimming crabs in Kien Giang are:

- 1) Spawning Potential Ratio (SPR) or Exploitation rate (E).
- 2) Length frequency distribution and average size of blue swimming crabs in catches.

Biological reference points reflect the status of blue swimming crab stock and could be expressed as limit reference points and target reference points. Table 1 indicates the performance indicators, target and limit reference point applied for managing the BSCF in Kien Giang province.

Table 1. Performance indicator and reference points for the BSCF

Performance indicator	Target reference point	Limit reference point
Exploitation rate	≤ 0.5	0.6
Spawning Potential Ratio	$> 20\%$	20%
Mean CW	$> 100\text{mm}$	100mm

Depending on annual stock assessment results, the management authority will determine whether to adjust fishing activities to ensure the fishery meets its sustainability objectives.

3.3.2.2 Other Ecological Components

Other ecological assets incorporated in this harvest strategy include other retained species, bycatch, ETP species, habitats and ecological processes that may be affected by commercial crab trap fishing.

4. Harvest Control Rules

A Harvest Control Rules (HCR) provides guidance on the management actions required to achieve sustainability objectives, based on a performance indicator and its associated reference levels. HCRs aim to maintain the resource above the threshold level and as close as possible to the target level, or to rebuild it when it falls below the threshold (undesirable) or the limit (unacceptable) levels.

When indicators suggest that the fishery's impact on a resource has become unacceptable, the HCR typically triggers a comprehensive review of all available information to identify a suitable management response. The scope of action depends on how far a performance indicator has exceeded a reference point, with more severe responses required as the risk to the resource increases. This process may also include additional research and monitoring to help return the indicator to its target level, along with compliance measures to ensure that management adjustments are effectively enforced.

To achieve the management responses outlined in the HCRs, a variety of measures may be implemented, such as:

- Reducing the catch of undersized crabs;

- Limiting fishing effort through spatial and temporal closures around spawning and nursery habitats.

Actions are implementing in accordance with BSC stock status from annual assessment are:

Case 1: When the annual assessment indicates $E < 0.5$, $SPR > 20\%$, and $CW_c < MLS$, the level of fishing effort may be maintained or increased.

Case 2: When the annual assessment indicates $E = 0.6$, $SPR = 20\%$, and $CW_c > MLS$, consider reducing fishing effort or implementing measures to control the minimum landing size of blue swimming crabs.

Case 3: When the annual assessment indicates $E > 0.6$, $SPR < 20\%$, and $CW_c > MLS$ for two consecutive years, it is recommended to reduce fishing effort and partially close fishing areas for blue swimming crabs as an appropriate management response.

5. Stock Assessment and Research Supporting the Harvest Strategy and Harvest Control Rules

5.1. Research services

Vietnam Association of Seafood Exporters and Producers (VASEP) with support from Nation Fisheries Institute (NFI) will contract reserch services for the BSCF. Research Institute for Marine Fisheries (RIMF) is the primary research provider for BSCF

5.2. Data collection and analysis

RIMF completed the first stock assessment report for the Blue Swimming Crab Fishery (BSCF) in 2013 and continued to provide annual reports until 2019 under the Kien Giang BSC Fishery Improvement Project (FIP). Data used for

stock and fishery assessments were collected through biological sampling at landing ports, fishing vessel logbooks, and onboard observer programs.

In periods 2020-2022, the stock assessment has not been conducted due to the suspension and inactivity of the BSC Fishery Improvement Project (FIP).

In 2023, VASEP and RIMF signed a contract to continuous implementing the BSC stock assessment. The Length Based Spawning Potential Ratio (LBSPR) was applied alternatively with the Length Converted Catch Curve (LCCC) method to assess the BSC stock status. Ecological risk assessment of fishery on secondary species, ETP species, habitat and ecosystem are also included. Information on data collection is summarized below:

5.2.1. Biological data sampling

Biological samples of BSC were collected at landing sites along the coast of Kien Luong, Ha Tien, and Phu Quoc districts in Kien Giang province. Sampling was conducted on a monthly basis during the period 2013–2015, and on a quarterly basis during 2016–2019 and in 2023. Since 2024, a seasonal sampling strategy has been applied, with two field visits in June and November, representing the rainy season (RS) and dry season (DS), respectively.

5.2.2. Species composition data sampling

Sampling for species composition of the BSCF was conducted quarterly onboard fishing vessels by RIMF from 2013 to 2019, aiming to gather information on secondary species, bycatch, and ETP species. Since 2024, following the reactivation of the Kien Giang BSC FIP, a seasonal port-based sampling strategy has been applied and is implemented annually in May and November starting from 2025.

5.2.3. Logbook

Logbook data collection for the BSCF in Kien Giang was conducted on a monthly basis from 2013 to 2015, and on a quarterly basis between 2016 and 2019. The program was suspended due to the inactivity of the Kien Giang BSC FIP since 2020. In 2024, with the reactivation of the BSC FIP, logbook data collection is expected to resume, with technical support from the Research Institute for Marine Fisheries

5.3. Reporting

- Stock Assessment Report: This is a major report published annually. It documents, analyzes, and interprets the available data and assesses the Kien Giang BSC stock and fishery against the performance indicators identified in the management plan.
- Ecological Risk Assessment Report of BSCF to secondary species and ETP species: This report is published periodically in accordance with the plan of the Kien Giang Blue Swimming Crab Fishery Improvement Project (BSC FIP).
- Review of BSC Stock and BSC Fishery Indicators: This review is conducted annually to provide scientific information that supports fisheries management of the Blue Swimming Crab Fishery in Kien Giang province.

All relevant reports are submitted to VASEP and to the Kien Giang Department of Agriculture and Environment.

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