



Monterey Bay Aquarium Seafood Watch

Draft Assessment for Review
April 2023

Blue swimming crab *Portunus pelagicus*



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Thailand: Andaman Sea and Gulf of Thailand Set gillnets, Pots

Report ID 27944

Seafood Watch Standard used in this assessment: Fisheries Standard v3

Disclaimer

All Seafood Watch fishery assessments are reviewed for accuracy by external experts in ecology, fisheries science, and aquaculture. Scientific review does not constitute an endorsement of the Seafood Watch program or its ratings on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this assessment.

Table of Contents

Table of Contents	2
About Seafood Watch	3
Guiding Principles	4
Summary	5
Final Seafood Recommendations	6
Introduction	8
Criterion 1: Impacts on the species under assessment	16
Criterion 1 Summary	16
Criterion 1 Assessments	16
Criterion 2: Impacts on Other Species	20
Criterion 2 Summary	21
Criterion 2 Assessment	24
Criterion 3: Management Effectiveness	30
Criterion 3 Summary	30
Criterion 3 Assessment	31
Criterion 4: Impacts on the Habitat and Ecosystem	37
Criterion 4 Summary	37
Criterion 4 Assessment	37
Acknowledgements	43
References	44
Appendix A: Review Schedule	47
Appendix B: 2023 update summary	48

Draft for Review

About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.
- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.
- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered, or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function, or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught, farmed or managed.

Avoid/Red: Take a pass on these for now; they're caught or farmed in ways that harm other marine life or the environment.

¹ "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report includes recommendations for blue swimming crab (*Portunus pelagicus*), a large-bodied, benthic crustacean caught by collapsible crab pots and bottom-set gillnet. The Thai BSC fishery occurs in the Gulf of Thailand and the Andaman Sea.

A recent blue swimming crab (BSC) stock assessment, has been conducted in the Gulf of Thailand, and indicates that the BSC stock in this region is at the target level for management purposes. No recent BSC stock assessment has been conducted along the Andaman coast – the last assessment was conducted more than 10 years ago, and indicates that the BSC stock is not maintained at a level consistent with B_{MSY} , with stock status likely overexploited for the fishery as a whole, and heavily overexploited in coastal areas. The stock is also undergoing overfishing in both the Gulf of Thailand and the Andaman Sea.

Gillnet and pot fisheries retain all bycatch and interact with some species of concern (e.g., sharks, rays, sea turtles, dugongs, mammals, corals, and other biogenic habitats). Several crab species (mud, musk/crucifix, etc.) are also included, since they comprise more than 5% of the total catch for pots. Sharks, rays and sea turtles limit the Criterion 2 scores for the gillnet fishery, and marine mammals limit the score for the pot fishery.

There is currently a draft BSC Fishery Management Plan in place for the Thai BSC fishery, but, no limit and target reference points have been defined. Although there are some regulations in place, there are no harvest control rules. Because there are very few management measures in place, and those that are in place are not well enforced, management is considered "ineffective."

The Thai BSC fishery has an overall moderate impact on ocean habitats and ecosystems, but the gillnet and pot fisheries in the Andaman Sea are fished over more sensitive, mixed ground and score lower than the fisheries in the Gulf of Thailand.

Overall, the gillnet and pot fisheries in the Gulf of Thailand and the Andaman Sea are rated "red" or "Avoid."

Final Seafood Recommendations

SPECIES FISHERY	C 1	C 2	C 3	C 4	OVERALL	VOLUME (MT) YEAR
	TARGET SPECIES	OTHER SPECIES	MANAGEMENT	HABITAT		
Blue swimming crab Andaman Sea or Burma Sea Indian Ocean, Eastern Gillnets and entangling nets Thailand	1.000	1.000	1.000	2.449	Avoid (1.251)	Unknown
Blue swimming crab Gulf of Siam (Gulf of Thailand) Pacific, Western Central Gillnets and entangling nets	1.526	1.000	1.000	3.000	Avoid (1.463)	Unknown
Blue swimming crab Andaman Sea or Burma Sea Indian Ocean, Eastern Pots Thailand	1.000	1.732	1.000	2.449	Avoid (1.435)	Unknown
Blue swimming crab Gulf of Siam (Gulf of Thailand) Pacific, Western Central Pots	1.526	1.732	1.000	3.000	Avoid (1.678)	Unknown

Summary

The blue swimming crab (*Portunus pelagicus*) is a large-bodied, benthic crustacean common throughout the Indo-Pacific. This report covers BSC caught by collapsible crab pot and bottom-set gillnets in the Gulf of Thailand and the Andaman Sea.

The "Avoid" rank for BSC in both localities is driven by high conservation concerns over stock status, impacts on rays, sea turtle, sharks populations (dugongs for bottom-set gillnets), and management of the fishery's impacts on crab populations.

Eco-Certification Information

The Thai BSC fishery is engaged in a Fishery Improvement Project (FIP) since February 2017. Engagement in a FIP does not affect the Seafood Watch score, because we base our assessments on the current situation. Monterey Bay Aquarium is a member organization of the Conservation Alliance for Seafood Solutions. The Alliance has outlined guidelines for credible Fishery Improvement Projects. As such, Seafood Watch will support procurement from fisheries engaged in a FIP provided it can be verified by a third party that the FIP meets the Alliance guidelines. It is not the responsibility of Monterey Bay Aquarium to verify the credibility or progress of a FIP, or promote the fisheries engaged in improvement projects.

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

Best Choice/Green = Final Score >3.2, and no Red Criteria, and no Critical scores

Good Alternative/Yellow = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern², and no more than one Red Criterion, and no Critical scores

Avoid/Red = Final Score \leq 2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

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² Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report includes recommendations for Blue swimming crab (*Portunus pelagicus*), a large-bodied, benthic crustacean caught by collapsible crab trap and bottom-set gillnet. The fishery occurs in the Gulf of Thailand (key recruitment areas are Chanthaburi and Surat Thani; east) and the Andaman Sea (Ranong and Krabi; west).

Species Overview

Species overview

Blue swimming crabs (BSC) are brachyuran crabs that belong to the Portunidae family. Crabs from this family are usually recognized by their flat, disc-shaped hind legs, used as paddles for swimming, and by the nine spikes (aka. horns) along their carapace, on either side of their eyes (GWA DOF 2011). Males are bright blue in color with white spots and with characteristically long chelipeds; the females are a duller green/brown, with a more rounded carapace (BFAR 2012). Spawning occurs year-round, with peak spawning seasons in Thailand typically between October and December (Banks and Trumble 2012). Female blue crabs mate only during molting, with the male crabs carrying and protecting them until molting and mating occurs. BSC are common throughout the Indo-Pacific in inshore and continental shelf habitats, including sand, mud, algae and seagrass near reefs and mangrove areas, and are found from the intertidal up to depths of 70 m (Ingles 1988) (Germano et al. 2006). BSC are a focal point of fishery industries in the region, such as in Indonesia, Philippines, Vietnam, Cambodia, Malaysia, Thailand, India, and Sri Lanka (Crech et al. 2016); Figure 1, and they are cosmopolitan in Thai coastal waters. BSC are fished year-round in Thailand, with the peak fishing season from May to September (Banks and Trumble 2012). They mature quickly (about one year), have short lifespans (about three years), and are partial brooders (Josileen and Menon 2007) (Kangas 2000).

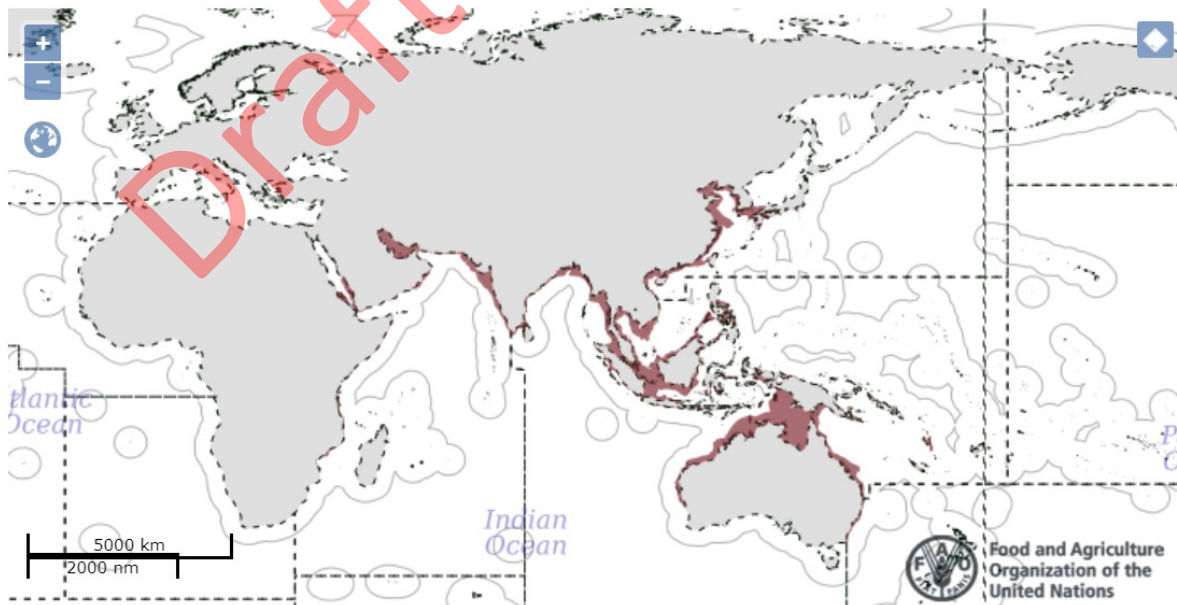


Figure 1: Global distribution of BSC. Taken from FAO 2022.

Thai BSC fishery locations and gear

The major commercial fishing grounds in the Gulf of Thailand are Pattani, Prachuab-Kirikhan, Phetchaburi, Rayong, Surat Thani, Chonburi, Chanthaburi, Chumphon, Nakohn Si Thammarat, Narathiwat, Trat and Songkhla; coastal activities take place from almost all the Gulf of Thailand provinces, as well as Krabi, Phang Nga, Phuket, Trang, Satun and Ranong on the Andaman Sea (Banks and Trumble 2012), Figure 2.

The major gears used by Thai fishers are bottom-set gillnet and crab traps (Figures 3 and 4), which are fished using a range of boat sizes varying from small coastal boats to larger commercial fleets (ibid). Depending on the size of the vessel, gillnets may comprise several tiers of approximately 180 m per tier and 1 to 2 m in depth (ibid). For coastal fishers, maximum lengths range from 400 to 2,000 m, and up to 8 nets can be deployed at any one time for a soakage period of up to 24 hours. Commercial fishers, on the other hand, deploy one net over the course of around 40 hours (setting and retrieving) which can be up to 5 km in length. Gillnet mesh size is typically around 6.4 cm (2.5 in) for inshore netters and 8 cm (3.2 in) for offshore commercial vessels (ibid).

The collapsible crab traps are 30 x 60 x 20 cm and are made of aluminium wire and green nylon net with a mesh size of 1.4 cm. The minimum mesh size limit for trap floors is 2.5 in, but there are no escape vents. Traps are attached to a main rope, which can be up to 1 km in length and has trap intervals of 20 m. During each trip, fishers deploy up to 300 traps in coastal waters and up to 3,500 traps using longboats and up to 4,500 traps using larger commercial vessels in offshore commercial waters (ibid). Coastal fishers use bait taken from fish caught in baitfish gillnets, whereas commercial vessels buy Indian mackerel and sometimes mussels (ibid). Coastal fishers set traps at depths of 2 to 5 m, usually 3 km from shore, whereas offshore fishers lay traps in depths of up to 30 to 50 km, 5 to 7 km from shore (ibid). Other gears that may be used (but are not included in this report) are otter trawl, pair trawl, shrimp trammel net, and push net. However, trawling is banned in coastal waters.



Figure 2: Distribution of BSC in Thailand (from MRAG 2018).
 Red asterisk indicates Ban Don Bay (the FIP region).}

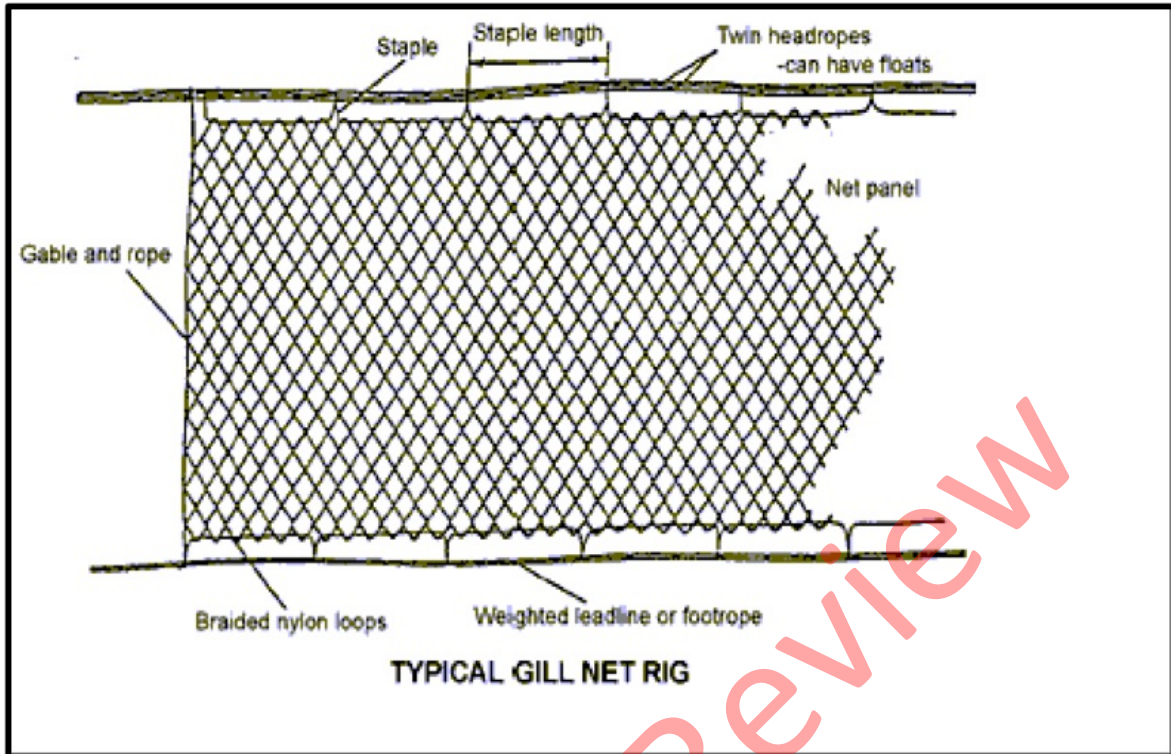


Figure 3: Bottom-set gillnet rig used in the BSC fishery (from Banks and Trumble 2012).

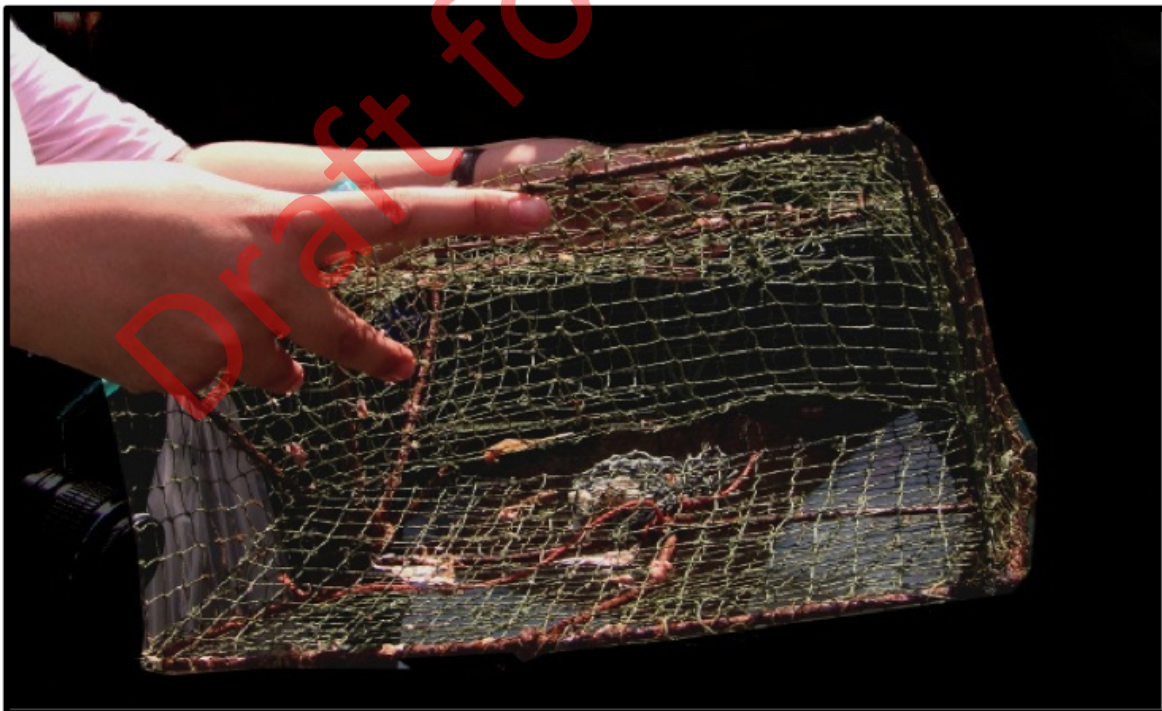


Figure 4: Collapsible trap used in the BSC fishery (from Banks and Trumble 2012).

History of Thai BSC fishery

In Thailand, when pot gear was introduced from Japan in 1981, fishing for BSC increased and resulted in decreases in catch per unit effort and crab size, with an increase in sub-adult crab catch {Boutson et al. 2009}.

There appear to be two distinct stocks in the Andaman Sea and the Gulf of Thailand with potentially other genetic distinctions within the Gulf of Thailand (Banks and Trumble 2012).

Management

There is no unified worldwide body that manages fisheries for BSC. Instead, each country has its own individual management system. At the national level in Thailand, the Department of Fisheries (DOF) leads fisheries management (Banks and Trumble 2012). National Government appoints Provincial Governors and District Officers at the Provincial and Local Government level to act as representatives of DOF. The DOF then delegates to the local authority regarding responsibility for monitoring, control and enforcement (ibid).

FIP

The BSC FIP in Thailand is managed by the Thai Crab Product Group (TCPG), which was formed under the umbrella of the Thai Frozen Foods Association in 2012. TCPG is the industry lead for the Thai BSC sustainability initiative (NFICC 2016). A Marine Stewardship Council (MSC) pre-assessment was conducted in 2012, and the FIP was initiated in 2013; since then, it has sparked numerous meetings between the Thai Department of Fisheries and WWF on the best ways to address the issues brought forth. A revised action plan to facilitate the FIP implementation has been completed and consists of 4 strategies: (a) improving information on BSC fisheries and relevant resources, (b) establishing the direction on BSC restoration, (c) controlling inputs to BSC fisheries, and (d) promoting local participation and responsible BSC fishing (ibid). The Thai FIP, in-part with WWF, will focus on Ban Don Bay in Surat Thani, which is the biggest landing site of Thailand (ibid).

Production Statistics

The increasing global demand for the BSC and their wide distribution throughout the Indo-Pacific make them an important species for a number of countries (Creech 2013) (FAO 2016a), and there has been a steady increase in global supply since the 1960s, until 2018, after which global production has slightly declined (FAO 2022b) (Figure 5). In 2020, the total global production of BSC was 251,915 tonnes, of which Thailand contributed about 38,318 tonnes (FAO 2022).

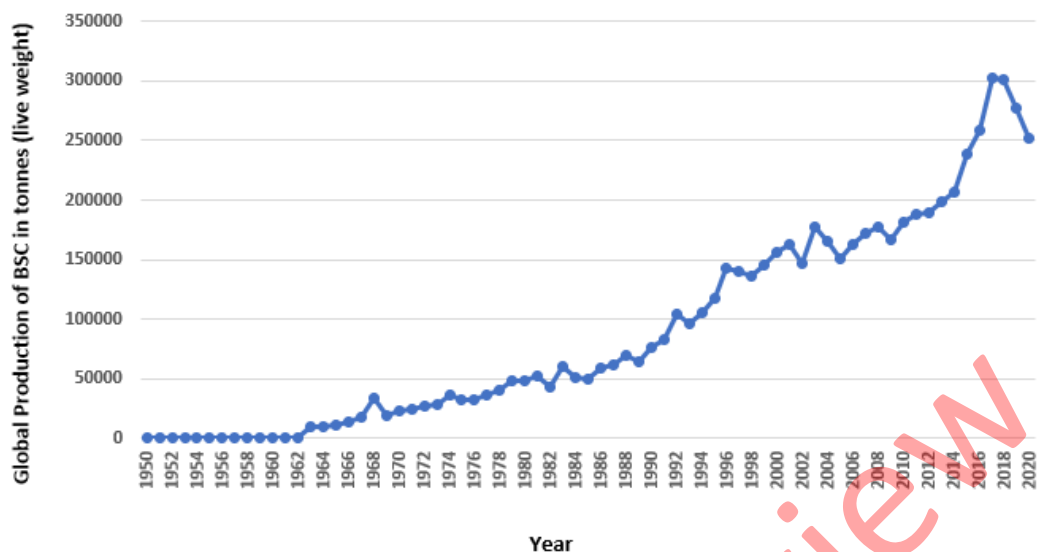


Figure 5: Global production of blue swimmer crab in tonnes (live weight). Taken from FAO 2022.

Importance to the US/North American market.

The United States is an important export destination for pasteurized crabmeat, hence the US market drives global BSC demand (BFAR 2012). Imports of portunid crabs (species not identified) from Thailand into the US were high in 2008, but steadily declined since then (Figure 6). Thailand is the seventh major supplier of portunid crab imports to the US, with Indonesia, the Philippines, China, Vietnam, and India ranking in the top five (Figure 7a).

In 2021, 531.07 tonnes of portunid crabs (species not identified) were imported into the U.S. from Thailand, with a value of about USD 11.4 million (NMFS 2022)(NMFS 2022b) (Figures 7 a, b), which represents 2% of Portunid crabs by volume and value (NMFS 2022)(NMFS 2022b) (Figures 7 a, b).

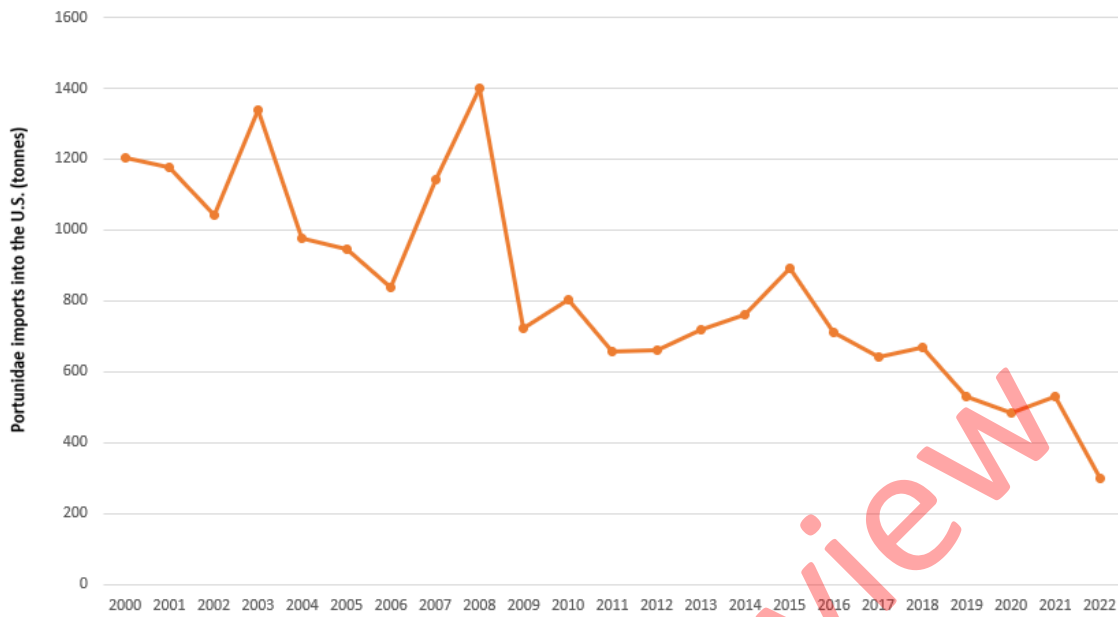


Figure 6: Portunidae (swimming crab) imports from Thailand into the U.S. in tonnes from 2000-2022 (data from NMFS 2022b)

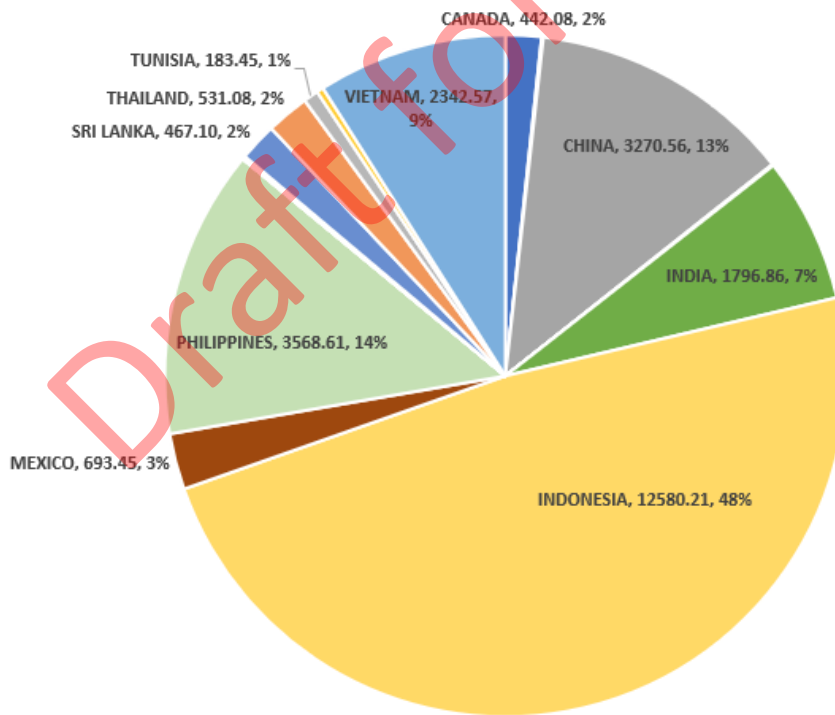


Figure 7: Portunid crab imports into the U.S. (by tonnes) in 2021 (data from NMFS 2022).

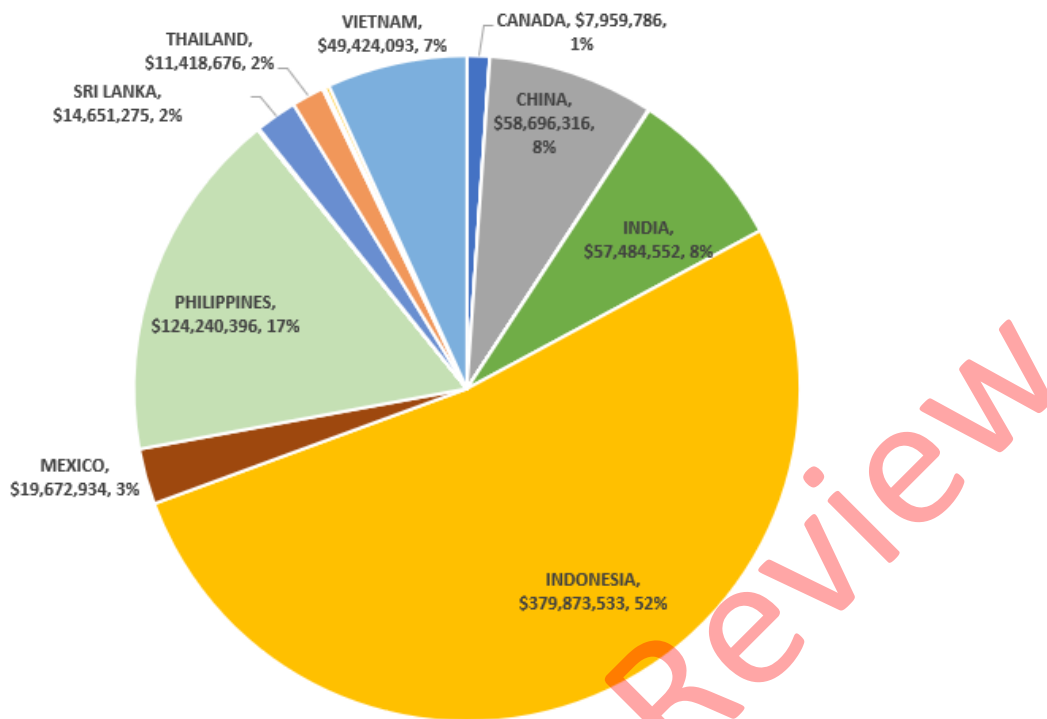


Figure 8: Portunid crab imports into the U.S. (by value) in 2021 (data from NMFS 2022).

Common and market names.

Blue swimming crab is also known as flower crab, blue crab, blue swimmer crab, blue manna crab, horse crab, sand crab, swimming crab (GWA DOF 2011) (FDA 2016) {Fishsource 2016}.

Primary product forms

Portunid crabs are sold interchangeably and these species can include RSC, BSC, and others, like *Portunus sanguinolentus* and *P. trituberculatus* (Lai et al. 2010) (Sea Fare Group 2011). BSC are exported by seafood companies as fresh, frozen, and canned products. Fresh crab is either exported as "head on" or "cut crab" products. Cut crabs are processed by removing the top shell, guts and gills, and then brushed clean and cut into two sections. Canned crab is a pasteurized product that involves picking the meat from boiled crabs. Crab meat is graded according to type and size. Grades include colossal, jumbo, B jumbo, flower, lump, special, claw, B claw and finger. Canned crab products include "fancy," "special," "jumbo lump," "back fin," "lump," "white," and "claw" (Creech 2013).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*

Criterion 1 Summary

BLUE SWIMMING CRAB			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Andaman Sea or Burma Sea Indian Ocean, Eastern Gillnets and entangling nets Thailand	1.000: High Concern	1.000: High Concern	Red (1.000)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Gillnets and entangling nets	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Andaman Sea or Burma Sea Indian Ocean, Eastern Pots Thailand	1.000: High Concern	1.000: High Concern	Red (1.000)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Pots	2.330: Moderate Concern	1.000: High Concern	Red (1.526)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

Blue swimming crab

Factor 1.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

High Concern

No updated stock assessment has been conducted from Trang province on the Andaman coast of Thailand where BSC are harvested. The last stock assessment from this region was conducted more than 10 years ago (Songrak and Choopunth 2011). As the stock was previously overfished and there is no updated stock assessment, it is still considered as overfished (Banks and Trumble 2012). Hence abundance has been scored as "high concern".

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderate Concern

According to the most recent data-limited stock assessments conducted from Surat Thani province in the Gulf of Thailand, the length-based spawning potential ratio (LB SPR) of the BSC stock from Ban Don Bay was 37% from data collected in 2020, and 46% from data collected in 2021 and 50% from data collected in 2022 (STBSCFIP 2020)(STBSCFIP 2021)(STBSCFIP 2022)(FishChoice 2021). An SPR of 30-40% may be considered as a target level for management purposes (Prince et al. 2020), which would warrant a Seafood Watch score of low concern. However, it has been noted that the LB SPR% was based on uncertain estimates of natural mortality and there were uncertainties in the data collected (FishChoice 2021)(Anonymous 2022); hence the abundance estimate is likely over-optimistic. Further, there is a possibility that the stock has been artificially enhanced by crab banks (FishChoice 2021). For these reasons an abundance score of "moderate concern" is suggested.

Factor 1.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

High Concern

Although there has been no recent stock assessment in the past 10 years, as the previous stock assessment of BSC in Sikao Bay Trang Province (Andaman Sea) indicates that fishing mortality was high at 5.38, with an exploitation rate of 0.77 and an optimum exploitation rate of 0.5 (Songrak and Choopunth 2011), it is assumed that overfishing is still taking place. Thus fishing mortality is deemed "high concern".

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling

nets

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

High Concern

A recent update from Surat Thani province in the Gulf of Thailand indicates that the fishing mortality was 3.75/year (STBSCFIP 2020b). Results of the Thompson and Bell analysis from FISAT-II of BSC from Ban Don Bay showed that the current fishing level (at f-factor=1) had slightly exceeded the level of maximum sustainable yield (at f-factor = 0.9) (ibid) (see figure below), which indicates that the fishery is experiencing overfishing. Hence fishing mortality has been scored as "high concern".

Justification:

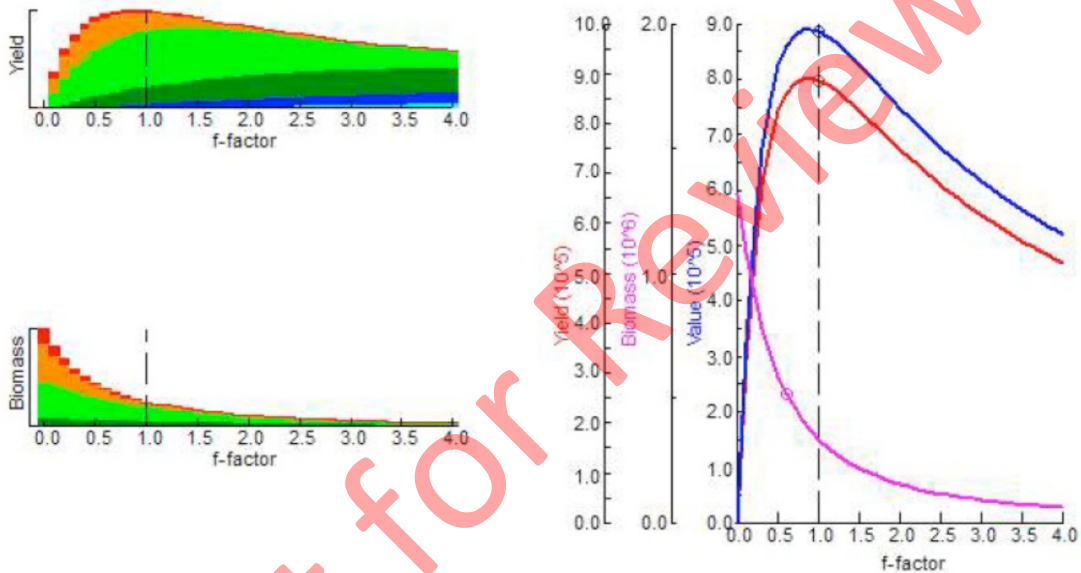


Figure 9: Graph of Thompson and Bell analysis from FISAT of BSC in Ban Don Bay. Taken from STBSCFIP 2020b.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

BLUE SWIMMING CRAB			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Andaman Sea or Burma Sea Indian Ocean, Eastern Gillnets and entangling nets Thailand	1.000	1.000: < 100%	Red (1.000)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Gillnets and entangling nets	1.000	1.000: < 100%	Red (1.000)
Andaman Sea or Burma Sea Indian Ocean, Eastern Pots Thailand	1.732	1.000: < 100%	Red (1.732)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Pots	1.732	1.000: < 100%	Red (1.732)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

ANDAMAN SEA OR BURMA SEA INDIAN OCEAN, EASTERN GILLNETS AND ENTANGLING NETS THAILAND			
SUB SCORE: 1.000		DISCARD RATE: 1.000	SCORE: 1.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Blue swimming crab	1.000: High Concern	1.000: High Concern	Red (1.000)
Rays	1.000: High Concern	1.000: High Concern	Red (1.000)
Sea turtles	1.000: High Concern	1.000: High Concern	Red (1.000)
Sharks	1.000: High Concern	1.000: High Concern	Red (1.000)
Marine mammals	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

ANDAMAN SEA OR BURMA SEA INDIAN OCEAN, EASTERN POTS THAILAND			
SUB SCORE: 1.732		DISCARD RATE: 1.000	SCORE: 1.732
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Blue swimming crab	1.000: High Concern	1.000: High Concern	Red (1.000)
Marine mammals	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
True crabs	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

GULF OF SIAM (GULF OF THAILAND) | PACIFIC, WESTERN CENTRAL | GILLNETS AND ENTANGLING NETS

SUB SCORE: 1.000		DISCARD RATE: 1.000		SCORE: 1.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE	
Rays	1.000: High Concern	1.000: High Concern	Red (1.000)	
Sea turtles	1.000: High Concern	1.000: High Concern	Red (1.000)	
Sharks	1.000: High Concern	1.000: High Concern	Red (1.000)	
Blue swimming crab	2.330: Moderate Concern	1.000: High Concern	Red (1.526)	
Marine mammals	1.000: High Concern	3.000: Moderate Concern	Red (1.732)	

GULF OF SIAM (GULF OF THAILAND) | PACIFIC, WESTERN CENTRAL | POTS

SUB SCORE: 1.732		DISCARD RATE: 1.000		SCORE: 1.732
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE	
Blue swimming crab	2.330: Moderate Concern	1.000: High Concern	Red (1.526)	
Marine mammals	1.000: High Concern	3.000: Moderate Concern	Red (1.732)	
True crabs	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)	

All bycatch in the Thai BSC fishery is retained. Species that are commonly caught in either gillnets and/or traps are unidentified sharks and rays, several crab species (mud, musk/crucifix, etc.), shrimp, and prawns (Table 1). Some sea turtle interactions have been confirmed in interviews with fishing communities and are not always reported (e.g., turtles that are released alive or keeping dead turtles for their shells) (Banks and Trumble 2012). There have also been reports of dugongs in the same area as crab fishers, but dugongs are confined to seagrass beds, which are largely protected (Adulyanukosol and Sombat 2006), and only one interaction between dugongs and crab fishers was reported between 1979 and 1999 (Adulyanukosol 1999).

Sharks, rays, sea turtles, and dugongs are included as Criterion 2 species due to their high conservation concern and the fact that they (sharks and rays) are predominant in the retained catch, and that not all interactions with sea turtles are recorded. Marine mammals, corals, and sponges are also assessed in the BSC pot fishery. Other species that comprised more than 5% of the total catch and were considered under Criterion 2 as "true crabs" are blue spot crab (sp. unidentified), three spotted crab (*Portunus sanguinolentus*), mud crab (*Scylla serrata*), and the musk/crucifix crab (*Charybdis cruciate/feriatus*).

For the gillnet fishery, sharks, sea turtles, and rays limit the score for Criterion 2 due to their high vulnerability, high conservation concern, and high potential to interact with this gear type. Marine mammals limit the score for the pot fishery.

Table 1. Retained species caught in bottom-set gillnet and crab trap (from Banks and Trumble 2012).

Bottom-set gillnet				
Gulf of Thailand			Andaman Sea	
Species	Tons	% total catch	Tons	% total catch
BSC	9,539	83.6%	5,720	95%
Tiger shrimp (<i>Panaeus monodon</i>)	251	2.2%		0%
White banana shrimp (<i>Panaeus indicus</i>)	61	0.5%		0%
Mantis shrimp (<i>Odontodactylus scyllarus</i>)	188	1.6%		0%
Mangrove crab (<i>Aratus pisonii</i>)	308	2.7%		0%
Blue spot crab (sp. unidentified)	652	5.7%		0%
Squid	11	0.1%	3	0%
Sharks	77	0.7%		0%
Rays	42	0.4%	64	1%
Sea catfish	12	0.1%		0%
Croaker	4	0.0%		0%
Eel-tailed catfish (<i>Tandanus tandanus</i>)	2	0.0%		0%
Other food fish	249	2.2%	242	4%
Mackerels	11	0.1%	11	0%

Trap				
Gulf of Thailand		Andaman Sea		
Species	Tons	% total catch	Tons	% total catch
BSC	3,353		717	50%
Three spotted crab (<i>Portunus sanguinolentus</i>)		25-50% dependent on season	215	15%
Mud crab (<i>Scylla serrata</i>)	496		400	28%
Other crab (includes musk crab, <i>Charybdis cruciate/feriatus</i> and other <i>Charybdis</i> spp.)	21		102	7%

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

	Ratio of bait + discards/landings	Factor 2.3 score
<100%		1
>=100		0.75

Marine mammals

Factor 2.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

High Concern

Marine mammals are at risk of entanglement in pot lines and gillnets. They are considered highly vulnerable according to the SFW criteria; therefore an abundance score of "high" concern is given.

Factor 2.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderate Concern

It is unlikely that marine mammals such as dugong are retained. There have been reports of dugongs in the same area as crab fishers, but dugongs are confined to seagrass beds, which are largely protected (Adulyanukosol and Sombat 2006), and only one interaction between dugongs and crab fishers was reported from 1979 to 1999 (Adulyanukosol 1999).

Marine mammal fishing mortality is scored as a "moderate" concern, since the last known interaction was over 10 years ago; however, due to limited monitoring, there is insufficient evidence to support a score of "low" concern, or to remove them from the report entirely.

Rays

Factor 2.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

Most pelagic rays are highly inherently vulnerable and are classified as "Near Threatened" {Dulvy et

al. 2008}. According to the SFW criteria, rays are listed as "high" concern for abundance.

Factor 2.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

Rays are not specifically included in the SFW Unknown Bycatch Matrices, but finfish receive a fishing mortality score of 2 for bottom-set gillnets. We have therefore scored rays as a 2 out of 5, or "high" concern.

Sea turtles

Factor 2.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

Sea turtles are listed as endangered or threatened throughout the world {NOAA 2016}, and are therefore scored as "high" concern using the SFW criteria.

Justification:

There are two species of turtle in the Gulf of Thailand: green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricate*); and four species in the Andaman Sea: green, hawksbill, olive ridley (*Lepidochelys olivacea*), and the leatherback turtle (*Dermochelys coriacea*). Declines in the Gulf of Thailand and Andaman sea turtle populations have been attributed mostly to interactions with trawlers, and up until the 1980s, from direct targeting by fishers (Shanker and Pilcher 2003). The Department of Marine and Coastal Resources has recorded some crab gillnet interactions; however, the scale of these interactions relative to the total population size is not clear because live releases are not reported (Banks and Trumble 2012).

Factor 2.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

For bottom-set gillnet fisheries in Southeast Asia, sea turtles are scored a 1 out of 5, or "high"

concern, for fishing mortality using the SFW Unknown Bycatch Matrix.

Sharks

Factor 2.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

According to the SFW Unknown Bycatch Matrices, sharks have a high stock status concern for bottom-set gillnet fisheries. Sharks also have high inherent vulnerability according to the SFW criteria. For these reasons, their abundance is ranked "high" concern.

Justification:

In Kung Krabaen Bay (in eastern the Gulf of Thailand), the ridgebacked bamboo shark, *Chiloscyllium indicum* was the dominant bycatch species found in crab gillnets (pers. comm., C. Kunsook, 3 September 2017). The IUCN considers ridgebacked bamboo sharks as "Near Threatened" with an unknown population status (Barratt et al. 2003).

Factor 2.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

High Concern

According to the SFW Unknown Bycatch Matrices, sharks score a 2, or "high" concern, for bottom-set gillnet fisheries.

True crabs

Factor 2.1 - Abundance

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Moderate Concern

Benthic invertebrates are ranked as "moderate" concern for abundance based on the SFW criteria.

Justification:

Blue spot crab (sp. unidentified), three spotted crab (*Portunus sanguinolentus*), mud crab (*Scylla*

serrata), and crucifix crab (*Charybdis cruciate/feriatus*) all comprise >5% of the total BSC catch from pots and are retained. (Kunsook and Dumrongrojwattana 2017) found that 17 different species of crab were caught alongside blue swimming crab in traps set in Kung Krabaen Bay and represented the majority of the bycatch. There are no stock assessments for these species in Thai waters.

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderate Concern

Benthic invertebrates are ranked as moderate concern for abundance as per the SFW criteria.

Justification:

Blue spot crab (sp. unidentified), Three spotted crab (*Portunus sanguinolentus*), Mud crab (*Scylla serrata*) and Crucifix crab (*Charybdis cruciate/feriatus*) all comprise >5% of the total BSC catch from pots and are retained.

During a study at the Kung Krabaen Bay fishery (Gulf of Thailand), the diversity and abundance of marine crabs were observed using 10 sampling stations. The results showed that there were seven families, 11 genera and 17 species (two anomuran and 15 brachyuran crabs). For brachyuran crabs, Portunidae was the most common family (10 species); the dominant species included Mangrove swimming crab (*Thalamita crenata*), BSC (*Portunus pelagicus*), Smooth-shelled swimming crab (*Charybdis affinis*), *Scylla* sp. (201 individuals), and Two-spined arm swimming crab (*Charybdis anisodon*) {Kunsook and Dumrongrojwattana 2017}. There are no stock assessments for these species in Thai waters.

Factor 2.2 - Fishing Mortality

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Low Concern

Using the SFW Unknown Bycatch Matrices, benthic invertebrates receive a fishing mortality score of 3.5 out of 5, or "low" concern, for traps.

Factor 2.3 - Discard Rate/Landings

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

< 100%

Some low-value species, such as *Murex trapa* and *Telescopium telescopium*, caught as bycatch in crab gillnets are discarded (pers. comm., C. Kunsook, 3 September 2017), which may or may not survive, and the majority of catch is landed (dead or alive). Since there is no bait use in bottom-set gillnets, and most bycatch species are retained, a modifying factor of 1 is used.

**Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand
Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots**

< 100%

Some low-value species, such as mollusks, undersized fish, and hermit crabs, caught as bycatch in crab traps are discarded (pers. comm., C. Kunsook, 3 September 2017), which may or may not survive, and the majority of catch is landed (dead or alive). Therefore, there is likely less than 100% discard rate, so a modifying factor of 1 is used.

Justification:

Fishing vessel owners and small scale fishers stated that Indian mackerels and small pelagic species are used as baitfish in traps, but amount of bait/trap has not been quantified.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- 5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.
- 4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.
- 3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.
- 2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'
- 1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'
- 0 (Critical) — Management Strategy and Implementation is 'critical'.

The Criterion 3 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Andaman Sea or Burma Sea Indian Ocean, Eastern Gillnets and entangling nets Thailand	Ineffective	Ineffective	Ineffective	Moderately Effective	Highly effective	Red (1.000)
Andaman Sea or Burma Sea Indian Ocean, Eastern Pots Thailand	Ineffective	Ineffective	Ineffective	Moderately Effective	Highly effective	Red (1.000)

Gulf of Siam (Gulf of Thailand) Pacific, Western Central Gillnets and entangling nets	Ineffective	Ineffective	Moderately Effective	Moderately Effective	Highly effective	Red (1.000)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Pots	Ineffective	Ineffective	Moderately Effective	Moderately Effective	Highly effective	Red (1.000)

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do managers follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Ineffective

A draft FMP was presented at the 2018 FIP review meeting, which included a precautionary approach and clearly defined long-term objectives for the fisheries sector (MRAG 2018). Following this development in 2018, a series of consultations with fishers were held, to obtain their inputs (STBSCFIP 2021b); thereafter the Department of Fisheries gathered feedback from their experts, and the next steps were outlined in May 2021 (ibid). The second National Marine Fishery Management Plan 2020-2022 was developed after the first one; currently the Department of Fisheries is considering making the BSC FMP part of the National Marine FMP, pending approval by the Cabinet (ibid).

The Thai BSC fishery is open access (both commercial and coastal fisheries), and has had an expansion in effort, both with respect to boat numbers and gear (Banks and Trumble 2012). Limit and target reference points have not been set, nor incorporated into management and there are not many widespread fishery-specific harvest strategies, nor rules, in place. There is a closed season to protect spawning crabs (October to December), which has not been enforced, and some localized management measures in place, with evidence to suggest that initiatives are being encouraged, including crab banks, voluntary no-take zones (zero to 1 km from the shore) and the preservation of crab habitat (seagrass beds), but they are not pervasive throughout the coastal communities (ibid). There are also various Marine Protected Areas (MPAs) that exclude access to all fishers. These management measures are issued as Notifications. Commercial vessels are required to complete logbooks, but this does not specifically pertain to the crab fleet.

Existing regulations for collapsible crab traps that operate within the coastal zone in vessels lower than 9.9 GT include a prohibition on the mesh size being less than 2.5 inches on all sides and the maximum number of traps is 300 units/vessel (FishChoice 2021)(STBSCFIP 2021b). For collapsible traps that operate in offshore regions and in vessels of 10 GT and over the mesh size needs to be greater than 2.5 inches from the bottom side only, the maximum number of units per vessel up to 29.9 GT is 3,500 units/vessel, and for vessels that are 30 GT and over, the maximum number is 4,500 units/vessel (ibid). In the case of gillnets, for vessels operating in the coastal zone that are lower than 9.9 GT, the maximum length is 3000 meter/vessel (ibid). For gillnets set in offshore waters in vessels from 10 GT up to 29.9 GT, the maximum length is 20,000 meters/vessel, and for gillnets set in offshore waters that are 30 GT and greater, the maximum length is 30,000 meters/vessel (ibid). A complete ban on trawling in coastal zones is being maintained; for offshore trawlers greater than 10 GT, the cod end mesh size needs to be 4 cm, the ground rope in a pair trawl cannot be over 100m, and the ground rope in an otter trawl cannot be over 60 m (The Government Gazette 2017). As per an official notification by the Ministry of Agriculture and

Cooperatives, there is also a prohibition on fishing berried female crabs, from October to December every year (FishChoice 2021); however, this regulation is not implemented and enforced (ibid).

Based on regulations implemented since mid-November 2015, in each province, provincial fisheries committees are encouraged to organize consultations to regulate fisheries with management measures (including gear limitations) within their provinces. There is also no Minimum Landing Size or Total Allowable Catch in place. Nevertheless, some communities have implemented their own regulations to address the same (FishChoice 2021)(STBSCFIP 2021b).

Efforts to develop the FMP have been initiated and progressed, but there is no law in place at present (STBSCFIP 2021b). Processors have implemented a voluntary minimum size for BSC for buying and processing. Issues that should be addressed when establishing the FMP are: 1) the need for limited licensing; 2) a minimum landing size; 3) enforcing the prohibition on taking berried females; 4) implementing trap escape vents. Although there is a clear need to develop a national management strategy for BSC fisheries in Thailand, it is important that the plan is flexible to support the differing needs of communities reliant on these fisheries (pers. comm., C. Kunsook, 23 September 2017).

Because there are very few management measures in place, and those that are in place are not well enforced, management is scored as "ineffective."

Factor 3.2 - Bycatch Strategy

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Ineffective

There are general BSC regulations that indirectly apply to bycatch (such as crab trap mesh size specifications and closed seasons/areas), but at this time, there are no bycatch-specific management measures in place for the Thai BSC fishery. In terms of ETP species, there are numerous community conservation groups (especially sea turtle and seagrass conservation groups) in many of the coastal fishing villages. Government organizations are also involved in sea turtle protection and conservation, including the Thai Navy, some NGO groups, and DMCR through informational brochures and workshops on ETP awareness and establishment of reporting systems (Banks and Trumble 2012). All seagrass beds, where dugongs reside, are mapped and protected by law under the Enhancement and Conservation of the National Environmental Quality Act B.E. 1992 (DMCR 2011); fishing in these areas is rare (ibid). During the 2020 BSC FIP review meeting, local stakeholder consultations revealed that stranding of turtles and cetaceans were in fact an issue (FishChoice 2021).

Recent research indicates that ghost gear from the BSC fishery is in fact an issue, but no mitigation measures are in place to address it (Koolkalya et al. 2022), and the extent to which sea turtles and marine mammals, which are ETP species, are entangled in both traps and gillnets is unknown. For these reasons, this factor is scored "ineffective."

Justification:

In Kung Krabaen Bay, specifically, a 20% harvest reduction of BSC has been proposed for collapsible crab traps (pers. comm., C. Kunsook, 3 September 2017).

Factor 3.3 - Scientific Research And Monitoring

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Ineffective

In Trang province on the Andaman coast of Thailand, although catch composition data are collected for all species on a monthly basis by the Department of Fisheries, there appears to be no regular monitoring of the BSC stock or of the bycatch in the BSC fisheries. For this reason, a score of "ineffective" is suggested (DoF 2022).

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderately Effective

In the Surat Thani province in the Gulf of Thailand, data limited stock assessments are conducted (STBSCFIP 2020)(STBSCFIP 2021)(STBSCFIP 2022)(FishChoice 2021), to maintain and monitor the BSC stock. Qualitative bycatch data are also collected, along with proportions of various categories of species found in the catch (Sawusdee 2021), so bycatch is monitored, but data are incomplete. As some data are collected, but there are gaps in the collected data and the stock assessment is data limited, a score of "moderately effective" is suggested.

Factor 3.4 - Enforcement Of Management Regulations

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderately Effective

In the 2020 Three-Year FIP Review of the BSC fishery in Surat Thani province in the Gulf of

Thailand, information was provided on the number of allegations, prosecutions and results of illegal activity in the BSC fishery in 2019 and 2020 (FishChoice 2021). During this time, the most common offense appeared to be the use of inappropriate gear (with a mesh size less than 2.5 inches), and fishing in prohibited zones (ibid). Data on vessel size category were missing in the 2020 dataset (ibid). There is also evidence that fines were charged for offences, but there is no information on whether the fines were enough to ensure adequate compliance (ibid). In 2020 only two incidences of non-compliance were reported, but this could also be due to the Corona virus pandemic (ibid).

Although small inshore vessels require to be registered, they do not yet need to have a license. Smaller vessels may have paper based log books, but this is currently voluntary (ibid). Larger offshore vessels need to be registered and have a license, are required to have e-log books, and need to have VMS on board (ibid). Patrolling takes place 4 times a month, for 5 days at a stretch (ibid). Local fishing volunteers have also been trained to monitor illegal fishing activity and good practice within the fishery (ibid). Despite there being enforcement in place, the effectiveness of this enforcement is unknown, as catching of juveniles is known to occur, suggesting that systematic non-compliance exists.

With regards to the BSC fishery in Trang province on the Andaman coast of Thailand, enforcement does exist, and penalties are charged for fishing infractions (DoF 2022). However, the list of infractions provided was very low, suggesting that compliance could be weak.

As enforcement of fisheries regulations exists, but the effectiveness of this enforcement and extent of compliance is unknown along both coasts of Thailand, this factor has been scored as “moderately effective”.

Factor 3.5 - Stakeholder Inclusion

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Highly effective

At the National level, management of marine systems is the responsibility of the Department of Marine and Coastal Resources (FishChoice 2021)(Anonymous 2022b). Fisheries are also managed at the provincial and local levels (ibid). The provincial fisheries committee is appointed by the National Government, and comprise representatives from local fishing communities; these committees have the authority to compile and propose policy recommendations on the management and conservation of marine resources (ibid). During emergencies, these committees have the authority to issue notifications which may be implemented immediately (ibid). The draft BSC FMP clearly defines the responsibilities of stakeholders involved in the management of BSC in

Surat Thani, along the Gulf of Thailand (ibid). When there is new fisheries legislation, fishers are invited for consultations (ibid). The Management Advisory Committee comprising members of the BSC fishing community was formulated to ensure that appropriate consultation takes place among all relevant stakeholders at the National level, for all BSC fisheries (ibid). Local universities have also been coopted to provide academic support and advice on the BSC fishery (ibid).

Along the Andaman coast, the Department of Fisheries has encouraged inclusion of 60 fisher communities through the establishment of locally managed BSC crab banks. Local fishers have set up committees to manage the crab bank activities and associated BSC nursery grounds, with a clear division of responsibilities (DoF 2022). The DoF has also generated awareness on the conservation of BSC (ibid). Fishers are also coopted to collect catch data on BSC (ibid).

As there is a high degree of transparency, participation and inclusion in the BSC fisheries along the Gulf of Thailand and the Andaman coast, this factor has been scored as "highly effective".

Draft for Review

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Guiding principles

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Andaman Sea or Burma Sea Indian Ocean, Eastern Gillnets and entangling nets Thailand	Score: 2	Score: 0	Moderate Concern	Yellow (2.449)
Andaman Sea or Burma Sea Indian Ocean, Eastern Pots Thailand	Score: 2	Score: 0	Moderate Concern	Yellow (2.449)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Gillnets and entangling nets	Score: 3	Score: 0	Moderate Concern	Yellow (3.000)
Gulf of Siam (Gulf of Thailand) Pacific, Western Central Pots	Score: 3	Score: 0	Moderate Concern	Yellow (3.000)

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or

associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management

Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*

- 4 — *Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- 3 — *Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- 2 — *Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- 1 — *Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

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Factor 4.1 - Impact of Fishing Gear on the Habitat/Substrate

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Score: 2

In some parts of the Andaman Sea (west coast), fishing was observed on mixed ground, rock and sand (ibid.) interacting with benthic assemblages such as corals, giant mussels, skate, and sponges. In other areas, such as Ban Nam Rab, Trang, fishing was on sand, with limited signs of benthic assemblages caught in the net. According to the SFW criteria, crab traps and bottom-set gillnets fished over sand/mud (not on rocky reef/boulder and corals) are scored a 3 out of 5, whereas fishing over rocky reef/boulders is scored 2. Hence, the more conservative score of 2 is given.

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Score: 3

Banks and Trumble (2012) reported that most fishing on the east coast of Thailand (in the Gulf of Thailand) is reported to be across soft sand/mud. According to the SFW criteria, crab traps and bottom-set gillnets fished over sand/mud (not on rocky reef/boulder and corals) are scored a 3 out of 5.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Score: 0

There are no gear-specific modifications to reduce impacts to the seafloor; however there are voluntary no-take zones (zero to 1 km from the shore) set up by some fishers and a prohibition on fishing in seagrass beds (Banks and Trumble 2012). In addition, there are various Marine Protected Areas, which exclude access to all fishers, and DMCR has established a network of moorings on all coral reefs, in order to reduce coral reef damage (ibid). Although some voluntary closures are in place, they are not widespread and it is uncertain whether there is a high level of compliance; therefore this factor is scored as "no mitigation."

Justification:

With the support of DoF, community monitoring, control and surveillance (MCS) groups have been set up in certain coastal villages in order to protect their fishing zones from commercial trawlers, as well as to monitor compliance by their own communities, thereby ensuring protection of sea grass beds and other no-take zones {Banks and Trumble 2012}. Participation in these activities is thought to be effective, but these measures are not yet widespread throughout the coastal communities (ibid).

Factor 4.3 - Ecosystem-based Fisheries Management

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Gillnets and entangling nets | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Gillnets and entangling nets

Andaman Sea or Burma Sea | Indian Ocean, Eastern | Pots | Thailand

Gulf of Siam (Gulf of Thailand) | Pacific, Western Central | Pots

Moderate Concern

BSC are often considered opportunistic, bottom-feeding carnivores and scavengers. They primarily consume various sessile and slow-moving prey such as worms, mollusks, and crustaceans {Batoy et al. 1987}, as well as smaller fish, but not much is known about the role of BSC as prey in Thai waters. In Australia, BSC are prey to turtles, sharks, rays, large fish, birds and other BSC (GWA DOF 2011). Intense fishing pressure on BSC could alter the trophic structure and species composition by reducing predation on crab prey, and/or by reducing food for higher-level predators.

The development of a new Fisheries Act is in progress, which will promote application of the precautionary principle and ecosystem approach to fisheries management (Banks and Trumble 2012). These have yet to be adopted in practice and therefore the full extent of the BSC fishery's impacts on the ecosystem is not well known. Effects of the fishery on the ecosystem are thought to include ghost fishing and traps without escape vents and biodegradable panels (which could allow small incidental species and juvenile crabs to escape). Crab traps catch a large amount of juvenile crabs, which could also impact ecosystem structure, reducing size composition and the rate of recovery for all crab species caught.

Bycatch from gillnets includes top predators (sharks and rays), which are considered highly vulnerable, and their capture could potentially cause trophic cascades. Along with the primary bycatch of other crab species in traps, there are no measures in place to maintain retained species at levels that are likely to be within biologically based limits. In addition, it is unclear whether ETP species such as sea turtles and dugongs are commonly caught in the gillnet fishery. There are numerous community conservation groups (especially sea turtle and seagrass conservation groups) in many of the coastal fishing villages; government organizations have also become involved in sea turtle protection and conservation, including the Thai Navy, some NGO groups, and DMCR through informational brochures and workshops on ETP awareness and establishment of reporting systems (Banks and Trumble 2012). All seagrass beds are mapped and protected by law under the Enhancement and Conservation of the National Environmental Quality Act B.E. 1992 (DMCR

2011); fishing in these areas is rare (ibid).

EBFM is not in place at present, but trophic cascades — though possible — are not considered likely; therefore, we have deemed this factor as "moderate" concern.

Justification:

Some communities are looking at rehabilitating local habitats. For example, stakeholders in Kung Krabaen Bay and Chaoloa Beach are planting seagrass beds (*Halodule pinifolia*) to aid in the conservation of the megalopa (larval) and juvenile crab stages (pers. comm., C. Kunsook, 3 September 2017).

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Acknowledgements

Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch would like to thank the consulting researcher and author of this report, Rachel Simon, as well as several anonymous reviewers for graciously reviewing this report for scientific accuracy.

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Appendix A: Review Schedule

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Appendix B: 2023 update summary

Updates to the blue swimming crab report:

Updates to the December 19th, 2018 blue swimming crab report were made from March 24th, 2022 to February 28th 2023.. The report was updated in v3 of the Seafood Watch Fisheries Standard. **Overall recommendations for the blue swimming crab gillnet and pot fisheries in Thailand are still "Avoid"**. Additional updates, if any, are described below:

Criterion 1

Blue swimming crab remained "red" for Criterion 1; a new stock assessment was conducted on blue swimmer crab in the Gulf of Thailand, and hence abundance (Factor 1.1) of crabs in that region was upgraded from "high concern" to "moderate concern". However, no new stock assessment has been conducted along the Andaman coast, hence abundance of crabs along that coast remained "high concern". Contrastingly, fishing mortality (Factor 1.2) remained at "high concern" in both regions, indicating that overfishing is occurring.

Criterion 2

Although recent catch composition data were available, the new information has not been incorporated into the text of this assessment as it does not change the rating of Criterion 2, which remains "red".

Criterion 3

There was no improvement in the overall Criterion 3 score, which remained "red"; however new information was added to the text in Management strategy and implementation (Factor 3.1), and Bycatch strategy (Factor 3.2), an "ineffective" rating was assigned to research and monitoring (Factor 3.3), "moderately effective" was assigned to enforcement (Factor 3.4) and "highly effective" was assigned to stakeholder improvement (Factor 3.5).

Rating Review summary table:

Report:		
Blue swimming crab (Thailand)		
Criteria	Previous report (2018)	Current report (2022)

Who conducted the stock assessment? And when was it conducted?	<p>Andaman sea:</p> <p>Sawusdee and Songrak 2009</p> <p>Songrak and Chppunth 2011</p> <p>Gulf of Thailand:</p> <p>Jindalikit et al. 2008</p> <p>Kunsook et al. 2017</p> <p>Banks and Trumble 2012</p>	<p>Andaman sea:</p> <p>No updated stock assessment</p> <p>Gulf of Thailand:</p> <p>Surat Thani blue swimming crab fishery improvement project 2020, 2020b, 2021 & 2022.</p>
Where/ what are the catch composition data source(s)?	Banks and Trumble 2012	Sawusdee 2021
Who manages the fishery?	Department of Fisheries at the national level, provincial governors and district officers at the regional and local level	Department of Fisheries at the national level, provincial governors and district officers at the regional and local level.
What is the date of the published management plan?	NA	A draft FMP was presented in 2018. This was later incorporated into the Marine Fisheries Management Plan of Thailand 2020-2022, which is pending cabinet approval.

<p>Are there any updates or amendments?</p>	<p>NA</p>	<ul style="list-style-type: none"> • The Department of Fisheries is considering making the draft BSC FMP part of the National Marine FMP, pending cabinet approval. • Regulations on minimum mesh size, and maximum number of traps per vessel size category have been updated. • For gillnets, regulations on length of the net per vessel size category have been updated. • Trawling has been banned in coastal waters, and offshore trawl nets have restrictions on the cod end mesh size and ground rope length. • There is a prohibition on harvesting berried females from October to December.
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