



# Monterey Bay Aquarium Seafood Watch®

## Blue Swimmer Crab

*Portunus pelagicus*



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## Philippines

Bottom gillnet, Pot

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### Disclaimer

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## Final Seafood Recommendation

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Blue swimmer crab: Tawi-Tawi Philippines Pacific - Gillnet, Bottom	Yellow (2.64)	Critical (0.00)	Critical (1.00)	Yellow (2.45)	Avoid (0.000)
Blue swimmer crab: Visayan Sea Philippines Pacific - Gillnet, Bottom	Red (1.73)	Critical (0.00)	Critical (1.00)	Yellow (2.45)	Avoid (0.000)
Blue swimmer crab: Tawi-Tawi Philippines Pacific - Pot	Yellow (2.64)	Critical (0.00)	Critical (1.00)	Yellow (2.45)	Avoid (0.000)
Blue swimmer crab: Visayan Sea Philippines Pacific - Pot	Red (1.73)	Critical (0.00)	Critical (1.00)	Yellow (2.45)	Avoid (0.000)

**Scoring note** – 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** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores
- **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores.

## **Executive Summary**

The blue swimmer crab (*Portunus pelagicus*) is found in the Philippines and is commonly caught using the pot and bottom gillnet. The two blue swimmer crab stocks are ranked as **AVOID** for all gear-types in the Philippines.

Blue swimmer crabs (BSC) mature quickly (about 1 year), have short lifespans (about 3 years), and are partial brooders. The stock status is unknown because there have not been any regular stock assessments or research conducted. Fishing mortality for the Tawi-Tawi stock is unknown because of a lack of information; however, the Visayan Sea and surrounding areas stock has a high fishing mortality concern based on recent studies.

There are two primary gear-types used in the Philippines BSC fishery: bottom gillnets and pots. The bycatch and retained species caught by these gear-types are generally unknown; however, two studies looked at gear effectiveness in the BSC fishery and supply general taxa information. Scoring for bycatch is based on a study in the Visayan Sea, along with gear type, geographic region, peer reviewed literature, expert opinion in the region, and the Seafood Watch® criteria for use when bycatch is unknown. The taxa that are most likely to interact with the BSC fishery include: finfish, sharks, benthic invertebrates, Irrawaddy dolphins, turtles, and seabirds (outside albatross range). Some common bycatch consists of juvenile sharks, other crab species, molluscs, and fish. They are usually discarded in a manner that has a low survival rate (e.g., nets are brought onshore to the landing site and/or unwanted crabs are left onshore to ensure they are not caught again). The Irrawaddy dolphin is the species that limits the fishery the most due to its international listing as "critically endangered" and the lack of effective management to protect the species.

For both methods, there is a general lack of management, research and enforcement. There is insufficient management precaution to maintain the BSC populations; however, given the finalization of the blue swimming crab management plan released by BFAR and the current FIP, stakeholder inclusion is moderately effective. Ultimately, though, not enough time has passed to determine how the FIP is helping and the BSC management plan has yet to be implemented. Of particular concern for the species, though, are the harvest and sale of juvenile crabs, the declining trend in crab size and catch--per-unit-effort, and the lack of fishing limits to protect stocks. This coupled with the lack of enforcement means management is not effective. For bycatch, the incidental catch of the Irrawaddy dolphin and the lack of effective management severely impact the fishery and makes management ineffective.

Pots and bottom gillnets are used on sandy/muddy seafloor where BSC crabs typically reside. To help mitigate the impacts of fishing, there are marine protected areas throughout the country; however, these areas are not always effectively enforced and do not control the spatial extent of fishing; as a result, there is no effective mitigation. Consideration of the ecosystem and food webs are ranked a high concern as Irrawaddy dolphins, juvenile sharks, and protected univalve mollusks are caught as by-catch. Irrawaddy dolphins and juvenile sharks are

top predators and play an important role in the ecosystem and there are no efforts to assess and manage ecosystem impacts.

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## Introduction

### Scope of the analysis and ensuing recommendation

The blue swimmer crab (*Portunus pelagicus*) is found in the Philippines and is commonly caught using the pot and bottom gillnet.



Figure 1. Distribution map of the blue swimmer crab (figure from {FAO 2013}).

### Overview of the species and management bodies

The blue swimmer crab (BSC) is a part of a family of crabs called the *Portunidae*. There are several different species within this family. In 2010, {Lai et al. 2010} revised the BSC (*P. pelagicus*) species complex into four distinct species found throughout the Indo-West Pacific. These distinct species are found in different regions, which have compounded the issues with managing the overall fishery {Lai 2012}. Despite the commercial value of BSC, there is very little information about the sustainability and environmental impacts of the fisheries {Lai 2012}.

The BSC was first caught as a bycatch species in prawn and marine fish fisheries {Svane and Hooper 2004}. Now, many regions have a targeted fishery in place {Josileen and Menon 2007}. The BSC in the Philippines is known locally as "*alimasag*" and is considered one of the

most important crab species {Ingles 1996} {Ingles and Flores 2000}. The main area the BSC is fished is in Western Visayas (specifically, the Guimaras Strait and the Visayan Sea) and the first BSC processor, Phillips Seafood Corporation, opened in 1990 {Ingles and Flores 2000} {Romero 2009}.

The BSC has seen a decline in fishing trends over the last few decades {FishSource 2013} {Ingles 1996} {Ingles and Flores 2000}, which follows a general trend for target species in the Philippines {Ingles 2004}. Prior to 1970, only artisanal gears were used; however, the introduction and popularity of bottom trawls in the mid-1970 and mid-1980 meant there was a significant increase in exploitation {Ingles 2004}. This increased exploitation caused a decline in catch {Ingles 2004}. In 1982, trawls were banned and gave the BSC a chance to recover until 1990, when the export demand for the BSC increased with the collapse of the Chesapeake Bay crab fishery in the US {Ingles 2004}. Now, most production is through artisanal fleets using gillnets and pots {Ingles 2004}. The increase in export demand and artisanal fleets, though, has caused a boom and bust trend in various areas in the Philippines {Ingles 2004}. When export demands increased, artisanal fishing rose and crab meat processing plants were created {Ingles 2004}. Due to high prices, fishers entered the fishery without any management restrictions and stayed until fishing was no longer profitable {Ingles 2004}. Once this occurs, the processing plant closes and moves to another location {Ingles 2004}.

There is no unified worldwide body that manages fisheries for the BSC. Instead, each country has its own individual management system. In the Philippines, the fishery is managed by the central government through municipal fisheries sectors; however, local governments are also in charge of managing the fishery to help better meet the needs of the local community {FishSource 2013}. In early 2013, the Bureau of Fisheries and Aquatic Resources (BFAR) finalized the Philippines Management Plan of the Blue Swimming Crab {BFAR 2013} {FishSource 2013}. Despite this national framework, the lack of management resources, training, and enforcement has caused the fishery to continue to see decreasing trends {FishSource 2013}.

### **Production Statistics**

The increasing global demand for the BSC and its wide distribution throughout the Indo-West Pacific makes it an important species to a number of countries {Lai et al. 2010}{FAO 2013}, and there has been a steady increase in global supply since the 1950's (Figure 2). About 77% of production of the BSC from the Philippines is exported {Ingles 2004}.

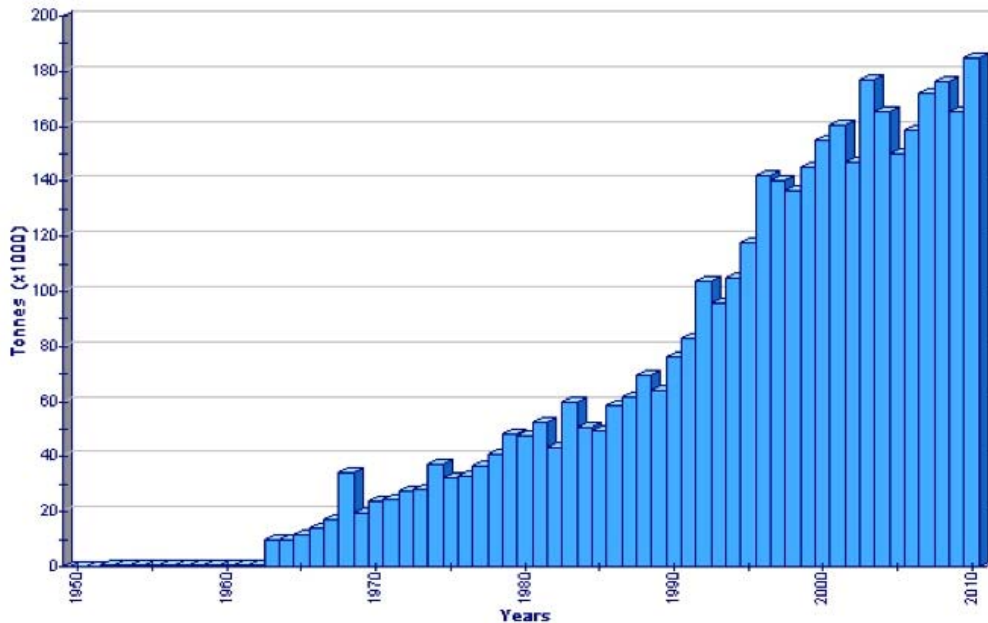
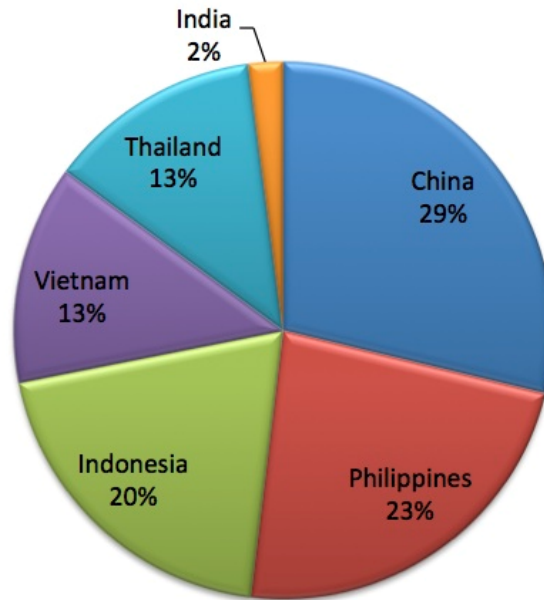


Figure 2. Global catch for the BSC. Figure from {FAO 2013}.

### Importance to the US/North American market

The supply of crabmeat from BSC is considerably larger than the amount of crabmeat available from the domestic blue crab fishery (*Callinectes sapidus*); therefore, an important source of crabmeat into the United States {Sea Fare Group 2011}. In 2010, the United States imported approximately 21,000 metric tons of swimmer crabmeat. Indonesia was the largest supplier, accounting for almost 50% of the imports, followed by China (23%); Thailand (13%); the Philippines (9%) and India (6%) {Sea Fare Group 2011}.

In 2011, approximately 16,000 metric tons of the *Portunidae* crab family was imported to the US from China, the Philippines, Indonesia, Vietnam, Thailand, and India (Figure 3). It should be noted that the *Portunidae* crab family are sold interchangeably and these species can include the BSC and others like *P. haanii*, *P. sanguinolentus*, and *P. trituberculatus* {Lai et al. 2010} {Sea Fare Group 2011}; the NMFS database does not distinguish between species in the family.



**Figure 3. Major sources of swimmer crab into the United States in 2011. Data from {NMFS 2012}.**

### **Common and market names**

Common market names for the BSC are swimming crab, swimmer crab, canned crabmeat (with origin name, i.e., ‘product of the Philippines’, etc.), Colossal, Jumbo Lump, Super Lump, Lump, Backfin Lump, Special and Claw meat. Swimming crab products may also have the country of origin’s name in front (e.g., Filipino blue swimming crab; Figure 4). The U.S. (*Callinectes sapidus*) and blue swimmer crab have similar common market names, but origin of the item indicates if it is from the U.S. or Asian waters.

### **Primary product forms**

The primary product forms are pasteurized lump meat, special meat and claw meat, which can be canned, in pouches, or frozen. In addition, there can be different grades of the meat ranging from “jumbo lumps” to “shredded” crab meat ({Lai 2012}; Figure 4). There is a general concern that shredded crabmeat may be from sub-adult crabs {Lai 2012}.



Figure 4. Example of blue swimmer crab product sold in the US market. Photos from: [https://www.facebook.com/TwinTailsSeafood/photos\\_stream](https://www.facebook.com/TwinTailsSeafood/photos_stream)

## Analysis

### Scoring Guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at <http://www.seafoodwatch.org>.

### **Criterion 1: Stock for which you want a recommendation**

*This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown. The final Criterion 1 Score is determined by taking the geometric mean of the abundance and fishing mortality scores.*

<b>BLUE SWIMMER CRAB: TAWI-TAWI</b>				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Philippines Pacific Gillnet, Bottom	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
Philippines Pacific Pot	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>

<b>BLUE SWIMMER CRAB: VISAYAN SEA</b>				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Philippines Pacific Gillnet, Bottom	3.00:Low	3.00:Moderate Concern	1.00:High Concern	<b>Red (1.732)</b>
Philippines Pacific Pot	3.00:Low	3.00:Moderate Concern	1.00:High Concern	<b>Red (1.732)</b>

Blue swimmer crabs (BSC) have a low inherent vulnerability. They mature quickly (about 1 year), have short lifespans (about 3 years), and are, partially, brooders. The stock status and fishing mortality for all stocks is generally unknown because there have not been any regular assessments or research conducted on fishing mortality. However, the Visayan Sea stock was given a high concern for fishing mortality based on declining trends and a high fishing exploitation.

## Justification of Ranking

### Factor 1.1 - Inherent Vulnerability to Fishing

- Low = FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.
- Medium = FishBase vulnerability score for species 36-55 OR life history characteristics that make it neither particularly vulnerable or resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.
- High = FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.

*Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g. schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

### Factor 1.2 - Abundance

- 5 (Very Low Concern) = Strong evidence that population is above target abundance level (e.g. biomass at maximum sustainable yield, BMSY) or near virgin biomass
- 4 (Low Concern) = Population may be below target abundance level, but it is considered not overfished.
- 3 (Moderate Concern) = Abundance level is unknown and species has a low or medium inherent vulnerability to fishing
- 2 (High Concern) = Population is overfished, depleted, or a species of concern OR Abundance is unknown and species has a high inherent vulnerability to fishing.
- 1 (Very High Concern) = Population is listed as threatened or endangered.

### Factor 1.3 - Fishing Mortality

- 5 (Very Low Concern) = Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY) OR fishery does not target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality)
- 3.67 (Low Concern) = Probable (>50% chance) that fishing mortality is at or below a sustainable level, but some uncertainty OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible OR fishing

mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught)

- 2.33 (Moderate Concern) = Fishing mortality is fluctuating around sustainable levels OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery, and if species is depleted, reasonable management is in place.
- 1 (High Concern) = Overfishing is occurring, but management is in place to curtail overfishing OR fishing mortality is unknown, species is depleted and no management is in place
- 0 (Critical) = Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.

## Blue Swimmer Crab: Tawi-Tawi

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### 1.1 - Inherent Vulnerability

Philippines/Pacific, Gillnet, Bottom

Philippines/Pacific, Pot

3.00

Low

The inherent vulnerability for the BSC is low.

#### Rationale:

Life History Attribute	BSC	Score	Source
Average age at maturity	Approximately 1 year	3	{Josileen and Menon 2007}{Kangas 2000}
Average maximum age	Approximately 3 years	3	{Josileen and Menon 2007}{Kangas 2000}
Reproductive strategy	Brooding (conservative)	2	{Kangas 2000}
Density dependence	No dependant or compensatory dynamics demonstrated or likely	2	{Kangas 2000}
Score (mean of individual scores)		2.5	

## 1.2 - Stock Status

Philippines/Pacific, Gillnet, Bottom

Philippines/Pacific, Pot

3.00

**Moderate Concern**

There are no biological reference points for the BSC in the Tawi-Tawi area; therefore, it is unknown whether the population is above or below reference points {BFAR 2013} {FishSource 2013}. Due to its low inherent vulnerability, the stock was ranked as a 'moderate concern.'

## 1.3 - Fishing Mortality

Philippines/Pacific, Gillnet, Bottom

Philippines/Pacific, Pot

2.33

**Moderate Concern**

There is a lack of history and current stock status information and the lack of information on the impact of fishing mortality on stocks for Tawi-Tawi {FishSource 2013}; therefore, fishing mortality is unknown.

## Blue Swimmer Crab: Visayan Sea

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### 1.1 - Inherent Vulnerability

Philippines/Pacific, Gillnet, Bottom

Philippines/Pacific, Pot

3.00

**Low**

The inherent vulnerability for the BSC is low.

**Rationale:**

Life History Attribute	BSC	Score	Source
Average age at maturity	Approximately 1 year	3	{Josileen and Menon 2007}{Kangas 2000}
Average maximum age	Approximately 3 years	3	{Josileen and Menon 2007}{Kangas 2000}
Reproductive strategy	Brooding (conservative)	2	{Kangas 2000}
Density dependence	No depensatory or compensatory dynamics demonstrated or likely	2	{Kangas 2000}
Score (mean of individual scores)		2.5	

**1.2 - Stock Status****Philippines/Pacific, Gillnet, Bottom****Philippines/Pacific, Pot****3.00****Moderate Concern**

There are no biological reference points for the BSC in the Visayan Sea and surrounding area; therefore, it is unknown whether the population is above or below reference points {BFAR 2013} {FishSource 2013}. Due to its low inherent vulnerability, the stock was ranked as a 'moderate concern.'

**1.3 - Fishing Mortality****Philippines/Pacific, Gillnet, Bottom****Philippines/Pacific, Pot****2.33****Moderate Concern**

In the Visayan Sea and surrounding waters, the BSC has a high concern for fishing mortality based on an exploitation status of 0.96 {Romero 2009}.

**Rationale:**

Though {Romero 2009} found an exploitation rate of 0.49 (about half the total mortality was due to fishing) and an exploitation status of 0.96, Ingles and Flores ({Ingles and Flores 2000}) found that the

fishery is in overcapacity and is over the MSY suggested in Ingles (Ingles 1996). In addition, CPUE for pots and gillnets have a decreasing trend (FishSource 2013), which suggests fishing pressure is too high to maintain stock levels. Though an official MSY has not been set, the recently finalized BSC management plan (BFAR 2013) will set a MSY and TAC.

## **Criterion 2: Impacts on other retained and bycatch stocks**

All retained and primary bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch.

### **Blue swimmer crab: Tawi-Tawi: Philippines Pacific, Gillnet, Bottom**

Subscore:: **0.000**      Discard Rate: **0.90**      C2 Rate: **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
IRRAWADDY DOLPHIN	1.00: High	1.00: Very High Concern	0.00: Critical	<b>0.000</b>
BLUE SWIMMER CRAB: VISAYAN SEA	3.00: Low	3.00: Moderate Concern	1.00: High Concern	<b>1.732</b>
SHARKS	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
TURTLES	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
BENTHIC INVERTS	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
BLUE SWIMMER CRAB: TAWI-TAWI	3.00: Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
FINFISH	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
SEABIRDS	1.00: High	2.00: High Concern	3.67: Low Concern	<b>2.709</b>

### **Blue swimmer crab: Tawi-Tawi: Philippines Pacific, Pot**

Subscore:: **0.000**      Discard Rate: **0.80**      C2 Rate: **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
IRRAWADDY DOLPHIN	1.00: High	1.00: Very High Concern	0.00: Critical	<b>0.000</b>

<b>BLUE SWIMMER CRAB: VISAYAN SEA</b>	3.00: Low	3.00: Moderate Concern	1.00: High Concern	<b>1.732</b>
<b>BLUE SWIMMER CRAB: TAWI-TAWI</b>	3.00: Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>BENTHIC INVERTS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>
<b>FINFISH</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

**Blue swimmer crab: Visayan Sea: Philippines Pacific, Gillnet, Bottom**

Subscore:: **0.000**      Discard Rate: **0.90**      C2 Rate: **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>IRRAWADDY DOLPHIN</b>	1.00: High	1.00: Very High Concern	0.00: Critical	<b>0.000</b>
<b>BLUE SWIMMER CRAB: VISAYAN SEA</b>	3.00: Low	3.00: Moderate Concern	1.00: High Concern	<b>1.732</b>
<b>SHARKS</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>TURTLES</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>BENTHIC INVERTS</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>BLUE SWIMMER CRAB: TAWI-TAWI</b>	3.00: Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>FINFISH</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>SEABIRDS</b>	1.00: High	2.00: High Concern	3.67: Low Concern	<b>2.709</b>

**Blue swimmer crab: Visayan Sea: Philippines Pacific, Pot**

Subscore:: **0.000**      Discard Rate: **0.80**      C2 Rate: **0.000**

Species	Inherent	Stock Status	Fishing	Subscore
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	Vulnerability		Mortality	
<b>IRRAWADDY DOLPHIN</b>	1.00: High	1.00: Very High Concern	0.00: Critical	<b>0.000</b>
<b>BLUE SWIMMER CRAB: VISAYAN SEA</b>	3.00: Low	3.00: Moderate Concern	1.00: High Concern	<b>1.732</b>
<b>BLUE SWIMMER CRAB: TAWI-TAWI</b>	3.00: Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>BENTHIC INVERTS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>
<b>FINFISH</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

### Justification of Ranking

*Only species that scored 'red' are included here. All other species evaluations are in Appendix 1. See criterion 1 for scoring definitions.*

There are two primary gear-types used in the Philippines BSC fishery: bottom gillnets and pots. The bycatch and retained species caught by these gear-types are generally unknown; however, two studies (Ingles and Flores 2000; Romero 2009) looked at gear effectiveness in the BSC fishery and supply general taxa information. Scoring for bycatch is based on Romero (2009), along with gear type, geographic region, peer reviewed literature, expert opinion in the region, and the Seafood Watch® criteria for use when bycatch is unknown. The taxa that are most likely to interact with the BSC fishery include: finfish, sharks, benthic invertebrates, Irrawaddy dolphins, turtles, and seabirds (outside albatross range). Some common bycatch consists of juvenile sharks, other crab species, mollusks, and fish (Ingles and Flores 2000; Romero 2009). They are usually discarded in a manner that has a low survival rate (e.g., nets are brought onshore to the landing site and/or unwanted crabs are left onshore to ensure they are not caught again) (Ingles and Flores 2000; Romero 2009). However, the Irrawaddy dolphin bycatch limit the score for Criterion 2 due to their conservation status. Though it is unknown how many species of concern interact with the BSC fishery; turtles, Irrawaddy dolphins, and sharks are included in this assessment since they are a high conservation concern, have low inherent resilience, lack regional information on stock health and have the potential to be caught in swimming crab fisheries. Coral and sponge are not assessed because the BSC are found in muddy/sandy habitats and, therefore, not expected to have a great overlap with these species.

## Taxa Assessed and Rationale

**Sea Turtles** – Two of the seven worldwide sea turtle species are found in the Philippines (State of the World’s Sea Turtles 2011). A review by Wallace et al. (2010) found that sea turtles are caught as bycatch in gillnets in the BSC fishing region. It is unknown how many sea turtles are actually caught as bycatch in the gillnet BSC fishery, but their vulnerability and potential to be caught includes them in this analysis. For example, the BSC fishery takes place close to Green and hawksbill turtle nesting sites in Taw-Tawi (FishSource 2013). Hawksbill turtles are known to feed on BSC (Kailola et al. 1993; Poseidon 2010), which suggests that there are some risks of entanglement.

**Irrawaddy dolphin** – Irrawaddy dolphins (*Orcaella brevirostris*) in the Malampaya Sound subpopulation are listed as ‘critically endangered’ according to the IUCN (2013) and have been documented as bycatch in BSC gillnets (FishSource 2013; Gonzales and Matillano 2008; WWF n.d.).

**Finfish** – Both Ingles and Flores (2000) and Romero (2009) list ‘fish’ as one of the taxon that is caught as bycatch in the BSC fishery; however, specifically which species is unknown.

**Sharks** – Juvenile sharks are known to interact with bottom gillnets in the BSC fishery (FishSource 2013; Romero 2009), especially juvenile pelagic sharks where fishing is near coral reefs (J. Flores, pers. comm.), and were included as a taxon that is likely to interact substantially with bottom gillnets; however, specifically which species is unknown.

**Benthic invertebrates** -- Mollusks and other crabs are a known bycatch in the BSC fishery; the primary taxa for benthic invertebrates caught in the BSC fishery are brachyurans and univalve mollusks. (FishSource 2013; Ingles and Flores 2000; Romero 2009).

**Seabirds (outside albatross range)** -- The worldwide distribution of albatross and petrels from BirdLife International (2004) shows that they are not found within the Philippines; therefore, albatross are not considered. However, there are some threatened seabird species found within the Philippines (BirdLife International 2010); therefore, seabirds were included as a taxon that is likely to interact with the BSC fishery.

## BENTHIC INVERTS

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### 2.1 - Inherent Vulnerability

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

**2.00**      **Medium**

Using the SFW's unknown species criteria {Seafood Watch 2013}, benthic invertebrates have a medium inherent vulnerability.

### 2.2 - Stock Status

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

**3.00**      **Moderate Concern**

Using the SFW's criteria for unknown species {Seafood Watch 2013}, benthic invertebrates have a moderate stock status concern.

#### Rationale:

It should be noted that the primary taxa for benthic invertebrates caught in the BSC fishery are brachyurans and univalve mollusks. There is no reliable data to assess the status of the stocks of either taxa, therefore they have been scored according to the unknown bycatch matrix {Seafood Watch 2013}

### 2.3 - Fishing Mortality

Philippines Pacific, Gillnet, Bottom

**2.33**      **Moderate Concern**

Using the SFW's criteria for unknown species {Seafood Watch 2013}, benthic invertebrates have a low fishing mortality concern for bottom gillnet fisheries; however, because of the practice of killing all crab by-catch to ensure "unwanted species" will not be caught again and the high rate of by-catch {Ingles and Flores 2000}, benthic invertebrates have a moderate fishing mortality concern.

Philippines Pacific, Pot

3.67

**Low Concern**

Using the SFW's criteria for unknown species, benthic invertebrates have a low fishing mortality concern in pot fisheries.

## 2.4 - Discard Rate

### Philippines Pacific, Gillnet, Bottom

0.90

**40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

### Philippines Pacific, Pot

0.80

**80-100%**

Little information is available on discard rate/landings for the BSC and pot; however, {Romero 2009} found that the pot was highly selective and only 5% of the catch was unwanted. Unfortunately, little information is known about the amount of bait is used and, to err on the side of caution, is deemed to be 100% of the landed catch.

## FINFISH

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### 2.1 - Inherent Vulnerability

#### Philippines Pacific, Gillnet, Bottom

#### Philippines Pacific, Pot

2.00

**Medium**

Using the SFW unknown species criteria {Seafood Watch 2013}, finfish have a medium inherent vulnerability.

### 2.2 - Stock Status

#### Philippines Pacific, Gillnet, Bottom

**Philippines Pacific, Pot****3.00 Moderate Concern**

Using the SFW unknown species criteria {Seafood Watch 2013}, finfish have a moderate stock status concern.

**2.3 - Fishing Mortality****Philippines Pacific, Gillnet, Bottom****2.33 Moderate Concern**

Based on the SFW's unknown species criteria {Seafood Watch 2013}, finfish have a moderate fishing mortality concern for bottom gillnet fisheries.

**Philippines Pacific, Pot****3.67 Low Concern**

Using the SFW's unknown species criteria, finfish have a low fishing mortality concern in pot fisheries.

**2.4 - Discard Rate****Philippines Pacific, Gillnet, Bottom****0.90 40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

**Philippines Pacific, Pot****0.80 80-100%**

Little information is available on discard rate/landings for the BSC and pot; however, {Romero 2009} found that the pot was highly selective and only 5% of the catch was unwanted. Unfortunately, little information is known about the amount of bait is used and, to err on the side of caution, is deemed to be 100% of the landed catch.

## IRRAWADDY DOLPHIN

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### 2.1 - Inherent Vulnerability

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

**1.00**     **High**

Irrawaddy dolphins have a high inherent vulnerability.

#### Rationale:

Little information is known about the Irrawaddy dolphin; however, it is believed they reach sexual maturity between 4 and 9 years; the gestation period is 14 months; and they produce one offspring every 2 to 3 years {WhaleFacts.org 2013}. Given their life history and low numbers in this subpopulation, inherent vulnerability is ranked high.

### 2.2 - Stock Status

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

**1.00**     **Very High Concern**

There are considered to be less than 100 individuals in the Malampaya Sound subpopulation and the subpopulation is considered critically endangered on the IUCN Red List {IUCN 2013}.

### 2.3 - Fishing Mortality

Philippines Pacific, Gillnet, Bottom

**0.00**     **Critical**

Irrawaddy dolphins have been documented as bycatch in BSC gillnets ({FishSource 2013}{Gonzales and Matillano 2008}{WWF n.d.}). In two years in the late 1990's and early 2000's, three confirmed deaths due to BSC gillnets occurred {FishSource 2013}. Though it may seem a low number of deaths, considering the population is considered to number less than 100 individuals, three deaths is 3% of the population. It is also believed that deaths due to entangling in BSC gillnets has risen from 2.5% to 4.5% {WWF n.d.}. Though it is unknown the exact impact the fishery is having on the Irrawaddy dolphin, to err on the side of caution, the dolphin is given a critical status given its low numbers and lack of

management to reduce incidental catch.

#### Philippines Pacific, Pot

**0.00**      **Critical**

Irrawaddy dolphins have been documented as bycatch in the BSC pot by being entangled in the joining lines of the pots {Gonzales and Matillano 2008}. In 2006, four deaths due to the BSC pot occurred {Gonzales and Matillano 2008}. Though it may seem a low number of deaths, considering the population is considered to number less than 100 individuals, four deaths is 4% of the population. Though it is unknown the exact impact the fishery is having on the Irrawaddy dolphin, to err on the side of caution, the dolphin is given a critical status given its low numbers and lack of management to reduce incidental catch.

## 2.4 - Discard Rate

#### Philippines Pacific, Gillnet, Bottom

**0.90**      **40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

#### Philippines Pacific, Pot

**0.80**      **80-100%**

Little information is available on discard rate/landings for the BSC and pot; however, {Romero 2009} found that the pot was highly selective and only 5% of the catch was unwanted. Unfortunately, little information is known about the amount of bait is used and, to err on the side of caution, is deemed to be 100% of the landed catch.

## SEABIRDS

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### 2.1 - Inherent Vulnerability

#### Philippines Pacific, Gillnet, Bottom

**1.00**      **High**

Using the SFW's unknown species criteria {Seafood Watch 2013}, seabirds (outside albatross range) has a high inherent vulnerability to bottom gillnet fisheries.

## 2.2 - Stock Status

### Philippines Pacific, Gillnet, Bottom

**2.00**     **High Concern**

Using the SFW's unknown species criteria {Seafood Watch 2013}, seabirds (outside albatross range) have a high stock status concern for bottom gillnet fisheries.

## 2.3 - Fishing Mortality

### Philippines Pacific, Gillnet, Bottom

**3.67**     **Low Concern**

Based on the SFW's unknown species criteria {Seafood Watch 2013}, seabirds (outside albatross range) have a low fishing mortality concern for bottom gillnet fisheries.

## 2.4 - Discard Rate

### Philippines Pacific, Gillnet, Bottom

**0.90**     **40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

## SHARKS

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### 2.1 - Inherent Vulnerability

#### Philippines Pacific, Gillnet, Bottom

**1.00**     **High**

Using the SFW's known species criteria {Seafood Watch 2013}, sharks have a high inherent vulnerability

to bottom gillnet fisheries.

## 2.2 - Stock Status

### Philippines Pacific, Gillnet, Bottom

**2.00**      **High Concern**

Using the SFW's known species criteria {Seafood Watch 2013}, sharks have a high stock status concern for bottom gillnet fisheries.

## 2.3 - Fishing Mortality

### Philippines Pacific, Gillnet, Bottom

**2.33**      **Moderate Concern**

It should be noted that sharks have a good local market because they are considered a delicacy (J. Flores, pers. comm.); however, with little other information, the SFW's unknown species criteria {Seafood Watch 2013} is used and sharks have a moderate fishing mortality concern for bottom gillnet fisheries.

## 2.4 - Discard Rate

### Philippines Pacific, Gillnet, Bottom

**0.90**      **40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

## TURTLES

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### 2.1 - Inherent Vulnerability

#### Philippines Pacific, Gillnet, Bottom

**1.00**      **High**

Based on the SFW's criteria for unknown species {Seafood Watch 2013}, turtles have a high inherent

vulnerability to bottom gillnet fisheries.

## 2.2 - Stock Status

### Philippines Pacific, Gillnet, Bottom

**2.00**      **High Concern**

Using the SFW's criteria for unknown species {Seafood Watch 2013}, turtles have a high stock status concern for bottom gillnet fisheries.

## 2.3 - Fishing Mortality

### Philippines Pacific, Gillnet, Bottom

**2.33**      **Moderate Concern**

Based on the SFW's unknown species criteria {Seafood Watch 2013}, turtles have a moderate fishing mortality concern for bottom gillnet fisheries.

## 2.4 - Discard Rate

### Philippines Pacific, Gillnet, Bottom

**0.90**      **40-60%**

Little information is available on the discard rate/landings of the BSC in the Philippines; however, {Romero 2009} found about half the catch from gillnets comprised of unwanted species.

## **Criterion 3: Management effectiveness**

Management is separated into management of retained species and management of non-retained species/bycatch. The final score for this criterion is the geometric mean of the two scores.

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation				
Philippines Pacific Gillnet, Bottom	1.000	0.000	Critical(1.000)				
Philippines Pacific Pot	1.000	0.000	Critical(1.000)				
Factor 3.1: Management of fishing impacts on retained species							
Region / Method	Strategy	Recovery	Research	Advice	Enforce	Track	Inclusion
Philippines Pacific Gillnet, Bottom	Ineffective	N/A	Ineffective	Moderately Effective	Ineffective	Ineffective	Moderately Effective
Philippines Pacific Pot	Ineffective	N/A	Ineffective	Moderately Effective	Ineffective	Ineffective	Moderately Effective

### **Justification of Ranking**

#### **Factor 3.1: Management of Fishing Impacts on Retained Species**

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'.

- 5 (Very Low Concern) = Rated as 'highly effective' for all seven subfactors considered
- 4 (Low Concern) = Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rated at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective'
- 0 (Critical) = No management exists when a clear need for management exists (i.e., fishery catches threatened, endangered, or high concern species) OR there is a high level of Illegal, Unregulated, and Unreported Fishing occurring.

**3.1.0 - Critical?**

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

0.00

No

The fishery is not deemed critical.

**Subfactor 3.1.1 - 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. To achieve a highly effective rating, there must be appropriate management goals and evidence that the measures in place have been successful at maintaining/rebuilding species.*

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

1.00

Ineffective

There is some management in the Philippines, such as the banning of active gear {RA 8550, ch. 6 § 90, 1998} and local government banning of the landing, trading, and possession of egg-bearing crabs or crabs with a carapace less than 11 cm wide {FishSource 2013}. In addition, the BSC management plan was finalized in early 2013, which highlights closed areas/seasons, protection of life stages, fishing gear/ground limitation, and fishing capacity {BFAR 2013}, but it has not been implemented. Because of the continued decline of the BSC fishing trends and lack of enforcement for the ban on active gear, current management strategies have been ineffective.

**Subfactor 3.1.2 - Recovery of Species of Concern**

*Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success. To achieve a rating of highly effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.*

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

**-1.00**    **N/A**

There are no species of concern targeted and, therefore, was ranked as not applicable (N/A).

### **Subfactor 3.1.3 - Scientific Research and Monitoring**

*Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species. To receive a highly effective score, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

**Philippines Pacific, Gillnet, Bottom**

**Philippines Pacific, Pot**

**1.00**    **Ineffective**

There is very little, if any, data collected; thus, scientific research and monitoring is scored as ineffective.

### **Subfactor 3.1.4 - Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels). A highly effective rating is given if managers nearly always follow scientific advice.*

**Philippines Pacific, Gillnet, Bottom**

**Philippines Pacific, Pot**

**2.00**    **Moderately Effective**

With the recent approval of the BSC management plan, the Philippines government is listening to some scientific advice. In addition, some local governments have implemented minimum legal size regulations {SFP 2013} and the Director of BFAR has encouraged a shift in fishing gears from gillnets to pots (J. Flores, pers. comm.). Therefore, the creation of the management plan and locals adopting some advice earns this subfactor a moderately effective as it appears management is willing to comply with scientific advice, but not enough time has passed to determine how the advice is followed through or enforced.

### Subfactor 3.1.5 - Enforcement of Management Regulations

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.*

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

1.00

**Ineffective**

Despite the fact that Republic Act No. 8550, section 90, prohibits the use of active gear (e.g., trawls, Danish seines) since 1998, active gear is still utilized throughout the country. While only a small percentage of the BSC landings are caught with Danish seines and trawls (less than 5% of landed catch {Ingles 1996}{Ingles and Flores 2000}), it is still being utilized because enforcement is lacking due to shortages in staff and surveillance {Dickson 2000}. In addition, regulating commercial vessels outside municipal waters and protecting current marine protected areas are not enforced {FishSource 2013}.

### Subfactor 3.1.6 – Management Track Record

*Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels. A highly effective rating will be given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

1.00

**Ineffective**

The BSC fishery has seen boom and bust periods when processing plants are created and fishers allowed to enter the fishery without any management restrictions {Ingles 2004}. When the natural resources are depleted, the processing plant moves on to another area to repeat the pattern {Ingles 2004}. Because of the boom and bust trend, declining landings, CPUE, and size distribution {FishSource 2013}, the track record is considered ineffective.

### Subfactor 3.1.7 - 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 will be given if the management process is transparent and includes stakeholder input.

#### Philippines Pacific, Gillnet, Bottom

#### Philippines Pacific, Pot

**2.00**      **Moderately Effective**

The Fishery Improvement Project and the BSC management plan both allow for stakeholder inclusion to create a sustainable BSC fishery {BFAR 2013}{FishSource 2013}, but they have limited transparency. Therefore, stakeholder inclusion was ranked as moderately effective.

Factor 3.2: Management of fishing impacts on bycatch species				
Region / Method	Strategy	Research	Advice	Enforce
Philippines Pacific Gillnet, Bottom	Yes			
Philippines Pacific Pot	Yes			

### Justification of Ranking

#### **Factor 3.2: Management of Fishing Impacts on Bycatch Species**

*Four subfactors are evaluated: Management Strategy, Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'. Unless reason exists to rank Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations differently, these ranks are the same as in 3.1.*

- 5 (Very Low Concern) = Rated as 'highly effective' for all four subfactors considered
- 4 (Low Concern) = Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rates at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy rated 'ineffective'
- 0 (Critical) = No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substantially impacted by the fishery.

### 3.2.0 - All Species Retained?

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

0.00 No

Not all species are retained.

### 3.2.0 - Critical?

Philippines Pacific, Gillnet, Bottom

Philippines Pacific, Pot

1.00 Yes

Irrawaddy dolphins have been documented as bycatch in BSC gillnets ({FishSource 2013}{Gonzales and Matillano 2008}{WWF n.d.}). In two years in the late 1990's and early 2000's, three confirmed deaths due to BSC gillnets occurred {FishSource 2013}. Though it may seem a low number of deaths, considering the population is considered to number less than 100 individuals, three deaths is 3% of the population. It is also believed that deaths due to entangling in BSC gillnets has risen from 2.5% to 4.5% {WWF n.d.}. In addition, the BSC management plan minimally mentions bycatch or how to reduce its impacts and current management does not manage bycatch. Though it is unknown the exact impact the fishery is having on the Irrawaddy dolphin, to err on the side of caution, the dolphin is given a critical status given its low numbers and lack of management to reduce incidental catch.

In addition, there are some univalve mollusks caught that are protected by the Philippines (e.g., *Murex tribulus* ({Ingles and Flores 2000})) ({FAO 168, s. 1990}) and juvenile sharks are often caught as by-catch where fishing occurs near coral reefs (J. Flores, person. comm., {SFP 2013}). Though these may not cause a critical score, they are also significant by-catch concerns for the fishery.

## **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 (plus the mitigation of gear impacts score) and the EBFM score.*

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Overall Recomm.
Philippines Pacific Gillnet, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	2.00:High Concern	<b>Yellow (2.450)</b>
Philippines Pacific Pot	3.00:Low Concern	0.00:No Effective Mitigation	2.00:High Concern	<b>Yellow (2.450)</b>

Pots and bottom gillnets are used on sandy/muddy seafloor where BSC crabs typically reside. To help mitigate the impacts of fishing, there are marine protected areas throughout the country; however, these areas are not always effectively enforced and do not control the spatial extent of fishing. As a result, there is no effective mitigation. Consideration of the ecosystem and food webs are ranked a high concern as Irrawaddy dolphins, juvenile sharks, and protected univalve mollusks are caught as by-catch. Irrawaddy dolphins and juvenile sharks are top predators and play an important role in the ecosystem and there are no efforts to assess and manage ecosystem impacts.

### **Justification of Ranking**

#### **Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate**

- 5 (None) = Fishing gear does not contact the bottom
- 4 (Very Low) = Vertical Line Gear
- 3 (Low) = 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. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom *occasionally* (<25% of the time) or purse seine known to commonly contact bottom
- 2 (Moderate) = Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand;
- 1 (High) = Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g. cobble or boulder).

- 0 (Very High) = 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*

#### Philippines Pacific, Gillnet, Bottom

**3.00**

**Low Concern**

The bottom gillnet fishery is of low concern because the BSC is found in shallow areas with sandy substrates {Ingles 1996} {Ingles and Flores 2000}.

#### Philippines Pacific, Pot

**3.00**

**Low Concern**

The pot fishery is of low concern because the BSC is found in shallow areas with sandy substrates {Ingles 1996} {Ingles and Flores 2000}.

#### Factor 4.2 - Mitigation of Gear Impacts

- +1 (Strong Mitigation) = Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.
- +0.5 (Moderate Mitigation) = 20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.
- +0.25 (Low Mitigation) = A few measures in place, e.g., vulnerable habitats protected but other habitats not protected; some limits on fishing effort/intensity, but not actively being reduced.
- 0 (No Mitigation) = No effective measures are in place to limit gear impacts on habitats.

#### Philippines Pacific, Gillnet, Bottom

**0.00**

**No Effective Mitigation**

Based on available information, there is little to no effective mitigation in place to help reduce fishing gear impacts on the seafloor.

**Rationale:**

There are fishery reserves that function as a marine protected area to help protect biodiversity, productivity, and habitat (FishSource 2013). In fact, since the 1970's, over 600 have been established and the Philippine fisheries code (RA 8550) mandated that at least 15% of municipal waters be declared a MPA, but enforcement has been minimal (FishSource 2013). The lack of enforcement leads to a ranking of no effective mitigation in place.

**Philippines Pacific, Pot****0.00****No Effective Mitigation**

Based on available information, there is little to no effective mitigation in place to help reduce fishing gear impacts on the seafloor.

**Rationale:**

There are fishery reserves that function as a sort of marine protected area to help protect biodiversity, productivity, and habitat (FishSource 2013). In fact, since the 1970's, over 600 have been established and the Philippine fisheries code (RA 8550) mandated that at least 15% of municipal waters be declared a MPA, but enforcement has been minimal (FishSource 2013). The lack of enforcement leads to a ranking of no effective mitigation in place.

**Factor 4.3 – Ecosystem-Based Fisheries Management**

- 5 (Very Low Concern) = Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g. large proportion of fishery area protected with marine reserves, abundance is maintained at sufficient levels to provide food to predators).
- 4 (Low Concern) = Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. If hatchery supplementation or fish aggregating devices (FADs) are used, measures are in place to minimize potential negative ecological effects.
- 3 (Moderate Concern) = Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species. OR negative ecological effects from hatchery supplementation or FADs are possible and management is not in place to mitigate these impacts.

- 2 (High Concern) = The fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.
- 1 (Very High Concern) = The use of hatchery supplementation or Fish Aggregating Devices (FADs) in the fishery is having serious negative ecological or genetic consequences. OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.

#### Philippines Pacific, Gillnet, Bottom

2.00

#### High Concern

There are species of exceptional importance being caught due to the by-catch of Irrawaddy dolphins, juvenile sharks, and protected univalve mollusks. Irrawaddy dolphins and sharks are top predators and play an important role in the ecosystem. Since there are no current efforts to assess and manage ecosystem impacts, ecosystem and food web considerations are considered a high concern.

#### Philippines Pacific, Pot

2.00

#### High Concern

There are species of exceptional importance being caught due to the by-catch of Irrawaddy dolphins. Irrawaddy dolphins are a top predator and play an important role in the ecosystem. As a result, ecosystem and food web considerations are considered a high concern.

## **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.*

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## **About Seafood Watch®**

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological 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. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from [www.seafoodwatch.org](http://www.seafoodwatch.org). 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.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

## **Guiding Principles**

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished<sup>1</sup> 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 capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

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<sup>1</sup> “Fish” is used throughout this document to refer to finfish, shellfish and other invertebrates.

**Best Choices/Green:** Are well managed and caught or farmed in environmentally friendly ways.

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

**Avoid/Red:** Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.