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**Rodulf Anthony T Balisco**

College of Fisheries and Aquatic  
Sciences, Western Philippines  
University, Puerto Princesa  
Campus, Sta. Monica, Puerto  
Princesa City, Palawan,  
Philippines

**Cristine Joy D Tahajudjin**

College of Fisheries and Aquatic  
Sciences, Western Philippines  
University, Puerto Princesa  
Campus, Sta. Monica, Puerto  
Princesa City, Palawan,  
Philippines

**Angeli Claire M Vigonte**

College of Fisheries and Aquatic  
Sciences, Western Philippines  
University, Puerto Princesa  
Campus, Sta. Monica, Puerto  
Princesa City, Palawan,  
Philippines

**Correspondence**

**Rodulf Anthony T Balisco**

College of Fisheries and Aquatic  
Sciences, Western Philippines  
University, Puerto Princesa  
Campus, Sta. Monica, Puerto  
Princesa City, Palawan,  
Philippines

## Fishing gears and their common catch in two coastal areas of Palawan, Philippines: Implications to fisheries management

**Rodulf Anthony T Balisco, Cristine Joy D Tahajudjin and Angeli Claire M Vigonte**

### Abstract

Fishing gears are important tools in catching aquatic species that is consumed by local communities. The design and methods employed describe the characteristics of species caught by these gears. This study was conducted to document the fishing gears and their common catch in SIMBANA (Simpocan, Bagong Bayan, Napsan), Puerto Princesa City, and Rasa Island, Narra, Palawan, Philippines. Fishing gears used were photo-documented, and their common catches were identified using one-on-one interviews with fishermen. Sixteen fishing gears were documented, with six “nets”, four “lines”, four “barriers and traps”, and two “hand instruments”. Six gears were further classified as active gears, while 10 were Passive gears. More gears operate in Rasa Island than in SIMBANA. Most of the species caught are fish, pelagic species and reef-associated. Information gathered can be used for the characterization of the multi-gear fisheries which are important in making fisheries policies and management decisions for the mentioned coastal areas.

**Keywords:** Catch composition, coral reefs, fishing gears, Palawan, Philippines

### 1. Introduction

The Philippines is one of the top fish producing countries in the world, ranking 9<sup>th</sup> in 2015. The capture fisheries (i.e. municipal, commercial) sectors of the country accounted to 2,154,879.08 MT or 49.5% of total fish produced from Philippine waters <sup>[1]</sup>. Fishery exports totalled 257, 219 MT or 5.9% of total fish production, with tuna, seaweeds and shrimp/prawn as the top export commodities. Fish is the cheapest source of animal protein for many coastal villagers in the world, and Filipinos consume 36.5 kg per capita per year of fish and fishery products <sup>[1]</sup>.

Municipal fisheries refer to all fisheries activities conducted within municipal waters (15 km from shoreline). This includes subsistence fishing of which the fisherfolk gather fishery resources for local consumption only, without or with the use of fishing vessel (less than 3 gross tonnage). Activities of marginal fishermen are under this sector which primarily uses passive gears in catching fishery resources. On the other hand, commercial fisheries activities are conducted beyond the municipal waters and use both passive and active gears in fishing. The purpose of this sector is for business and profit and uses fishing vessel more than 3 gross tonnage <sup>[2]</sup>.

Fishing gears are tools used in gathering or capturing fishery resources, which can be categorized into active gears (presence of gear movement, and/or pursuit of target species) and passive gears (absence of gear movement, and/or pursuit of target species) <sup>[3]</sup>. These gears are primarily used to capture fishery resources of commercial value and tend to eliminate larger individuals in a fish stock <sup>[4]</sup>. Most of the fishing gears employed in municipal waters are generated using human effort, while fishing gears in commercial fisheries are powered using machines, a characteristic of tropical reef fisheries <sup>[5]</sup>.

Increasing fishing effort and limited fishery resources has opted fishermen to modify their gears including employing fishing accessories to increase the capture efficiency of their gears. The fishermen's indigenous fishing knowledge and skills, environmental conditions, fishing season and gears used are mostly the factors which are attributed to the fishing success <sup>[6]</sup>.

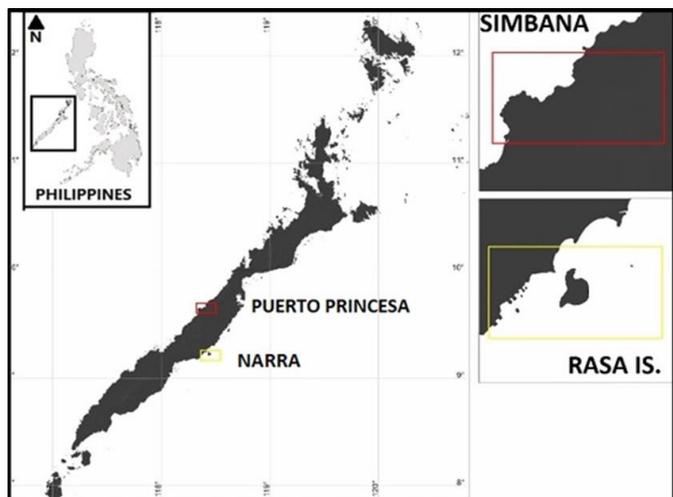
These gears are used to catch target species which are of high commercial value, however, by-catch species are nowadays retained for consumption (i.e. human and animal). The characteristics of fisheries in a fishing ground are described by the catch of fishing gears. There may be a high marine biodiversity in the waters surrounding Palawan, but these are yet to be proved since only few studies were published to affirm this claim. The Philippines being located at the Coral Triangle where the most diverse ecosystems are found in the planet, is considered as the “Center of center of marine shore fish biodiversity” [7].

This study aimed to make an inventory and classification of fishing gears operated and its catch composition in SIMBANA, Puerto Princesa City, and Rasa Island, Narra, Palawan, Philippines. Information collected can be used for the characterization of the fishery in the area, and in making fisheries policies and management decisions for the local fisheries.

**2. Materials and Methods**

**2.1 Study site**

The study was conducted in coastal waters surrounding three west coast barangays of Puerto Princesa City (Simpocan, Bagong Bayan and Napsan or SIMBANA), and Rasa Island, Narra both in Palawan, Philippines. The SIMBANA is located in the western side of the province of Palawan, facing the West Philippine Sea (South China Sea), while the Rasa Island is located in the eastern side of the province facing Sulu Sea. Fishing is one of the main sources of livelihood of coastal villagers (Figure 1).



**Fig 1:** The locations of SIMBANA in west coast Puerto Princesa City, and Rasa Island in Narra, Palawan, Philippines.

**2.2 Sampling procedure**

Data were gathered on one-on-one interviews with the fishermen using structured questionnaire. The different fishing gears used by fishermen were photographed using a digital camera for documentation. Gears were categorized as nets, lines, hand instruments, and barriers and traps. The common catch of each fishing gear were also identified with the help of the fishermen using the species group/family and local names. Local names were then translated to English names for easy identification. During the interview, most of the resident fishermen in SIMBANA operate within the vicinity of the barangay, while fishermen from neighbouring barangays operate in Rasa Island. A total of 90 respondents were interviewed, with 30 respondents from SIMBANA and

60 respondents from Rasa Island (Figure 2). The study was conducted on November 2015 - January 2016 in SIMBANA, and December 2017 - January 2018 in Rasa Island.



**Fig 2:** One-on-one interview with the fishermen at SIMBANA, Puerto Princesa City (left) and Rasa Island, Narra (right), Palawan, Philippines.

**3. Results**

**3.1 Inventory and classification of fishing gears**

There are 16 fishing gear types used in municipal waters of SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines. Of these gears, eight are used in SIMBANA and 13 in Rasa Island.

There are six gears under the “nets”, four gears are “lines”, four gears are “barriers and traps”, and two gears under “hand instruments” categories. Fishing gears that are mostly made of net include bag net, beach seine, bottom set gill net, drift gill net, ring net, and trammel net. “Line” gears include bottom set longline, multiple and simple handlines, and troll lines. Hand instruments include squid/octopus lures and spear gun, while barriers and traps include fish pot, crab pot, squid pot, and fish corral (figures 3-7).

Six gears were classified as active gears, and 10 were passive gears. Active gears include bag net, beach seine, drift gill net, ring net, troll line and spear gun. The rest of the gears are considered as passive gears. Of these active gears, two were operated in SIMBANA, while all of the listed active gears were noted being used in Rasa Island (Table 1, Figure 8).



**Fig 3:** Fishing gears (nets) used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines: beach seine (A), bottom-set gill net (B), drift gill net - nylon (C), drift gill net - pamo (D), and ring net (E).



**Fig 4:** Fishing gears (lines) used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines: bottom-set long line (A), multiple hand line (B), simple handline (C), and troll line (D).



**Fig 6:** Fishing gears (hand instruments) used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines: spear gun (A), mask and flippers as spear gun accessories (B and C), bundak as another form of lure (D), and cage used during bundak operation (E).



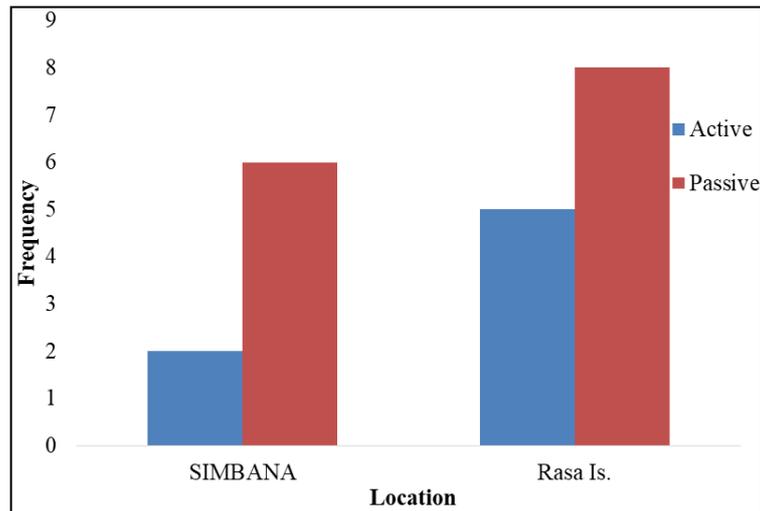
**Fig 5:** Fishing gears (hand instruments) used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines: variations of squid lures (A and B), and variations of octopus lures (C and D).



**Fig 7:** Fishing gears (pots) used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines: variations of fish pot (A and B), crab pot (C), and squid pot (D).

**Table 1:** English and local names, and classification of fishing gears used by fishermen in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines. Note: Check (✓) sign means “presence” of such fishing; negative (-) sign means “absence” of such fishing gear.

English name	Local name	Gear classification	SIMBANA, PPC	Rasa Is., Narra
A. Nets				
1. Bag net	Basnig	Active	-	✓
2. Beach seine	Sahid, sinsoro, baling	Active	-	✓
3. Bottom set gill net	Pamanti, panting palunod, rabnot	Passive	✓	✓
4. Drift gill net	Pamanti, panting palutang, kurantay, pamo	Active	✓	✓
5. Ring net	Baby Kulong, Basnig	Active	-	✓
6. Trammel net	Pukot, 3-ply, pamalu	Passive	-	✓
B. Lines				
7. Bottom set long line	Kitang	Passive	-	✓
8. Multiple handline	Bira-bira, kawil-moderno	Passive	✓	-
9. Simple handline	Kawil, pasol	Passive	✓	✓
10. Troll line	Sibid-sibid	Active	✓	-
C. Hand instruments				
11. Squid/octopus lure	Bundak	Passive	✓	-
12. Spear gun	Pana	Active	✓	✓
D. Barriers and traps				
13. Fish pot	Bubo	Passive	-	✓
14. Crab pot	Bubo, panggal	Passive	-	✓
15. Squid pot	Bubo-pusit	Passive	-	✓
16. Fish corral	Baklad	Passive	✓	✓
Total			8	13



**Fig 8:** Frequency of active and passive gears used by fishermen in SIMBANA and Rasa Island, Palawan, Philippines.

### 3.2 Catch composition of fishing gears

There were 58 marine organisms scattered in 44 families/groups caught by different fishing gears in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan. Of these, 32 were noted in SIMBANA, while 56 in Rasa Island. Majority of the species caught were fish, with

some crustaceans and cephalopods (Table 2). Most of the fish caught are of high economic importance, while only a few were of low value. The different fishing gears catch different marine species. Table 3 shows the different species commonly caught by each fishing gear in SIMBANA and Rasa Island based on the interview.

**Table 2:** English names and local names of marine organisms caught by different fishing gears in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines. Note: Check (✓) sign means “presence” of the organisms; negative (-) sign means “absence” of such organisms.

Family name	English name	Local name	Simbanappc	Rasa Is., Narra
<b>A. Fishes</b>				
1. Acanthuridae	1. Unicornfishes	Surahan	✓	✓
	2. Surgeonfishes	Labahita	-	✓
2. Atherinidae	3. Hardyheads	Malaguno, guno	-	✓
3. Balistidae	4. Triggerfishes	Pakol, Pugot	-	✓
4. Belonidae	5. Needlefishes	Balo, kambabalo	-	✓
5. Caesionidae	6. Fusiliers	Sulid, dalagang bukid	✓	✓
6. Carangidae	7. Trevallies	Talakitok, mamsa	✓	✓
	8. Big-eyed scads	Matang-baka	✓	✓
	9. Hard-tail scads	Pak-an	-	✓
	10. Yellow scads	Salay-Ginto, Salay-Salay, Hasa-Hasa	✓	✓
	11. Caranx	Putian	-	✓
	12. Needlekin	Lapis	✓	✓
7. Carcharhinidae	13. Scads	Galonggong	-	✓
	14. Sharks	Pating	✓	✓
8. Clupeidae	15. Sardines	Tabagak, tamban, tulis, tunsoy, tuloy	-	✓
9. Chanidae	16. Milkfish	Bangus	-	✓
10. Dasyatidae	17. Sting rays	Pagi	-	✓
11. Diodontidae	18. Porcupine fish	Karatungan	✓	✓
12. Engraulidae	19. Anchovies	Dilis	-	✓
13. Ehippidae	20. Batfish	Bayang	✓	✓
14. Exocoetidae	21. Flying fish	Bangsi,	✓	✓
15. Haemulidae	22. Sweetlips	Lepte, lambian	✓	✓
16. Hemiramphidae	23. Halfbeaks	Baritus, tursilyo	-	✓
17. Holocentridae	24. Soldierfishes	Baga-baga, siga	✓	✓
18. Gerreidae	25. Mojarras	Amorok	-	✓
19. Labridae	26. Wrasses	Mul-mol, surip	✓	✓
20. Leiognathidae	27. Ponyfishes	Sapsap, damol- damol, lawayan	-	✓
21. Lethrinidae	28. Emperors	Isnayper, kanuping, isdang-bato, dugso	✓	✓
	29. Snappers	Sagisi, malatigi, mangagat, kilawan	✓	✓
22. Lutjanidae	30. Red snappers	Maya-maya	-	✓
	31. Russell’s snappers	Kalamuhoy	-	✓
	32. Striped snappers	Saging-saging	✓	✓
	33. Blue false whittings	Asohos	-	✓
23. Malacanthidae	34. Mulletts	Banak, balanak	✓	✓
24. Mugilidae	35. Goatfishes	Salmonete, saramulyete	✓	✓

26. Muraenidae	36. Moray eels	Indong	✓	✓
27. Nemipteridae	37. Breams	Upos-upos	✓	✓
	38. Threadfin breams	Bisugo, silay	✓	✓
28. Paralichthyidae	39. Flounders	Palad, tampal-puki	-	✓
29. Scaridae	40. Parrotfishes	Mul-mol	-	✓
30. Scorpionidae	41. Lionfishes	Manumpurok	✓	-
31. Scombridae	42. Indian mackerels	Salimburaw, buraw, alumahan	✓	✓
	43. Mackerels	Tanguigi	-	✓
	44. Skip jack tuna	Tulingan	✓	✓
32. Serranidae	45. Coral groupers	Suno, lawihan	✓	✓
	46. Groupers	Lapu-lapu, lapu, luba, kugtong	✓	✓
33. Siganidae	47. Rabbitfishes, Spinefoots	Samaral, bararawan, danggit, mandalada	✓	✓
34. Sphyrnidae	48. Barracudas	Rumpi, torsilyo, balu	✓	✓
35. Sparidae	49. King soldier breams	Chinese bisugo, Karaho/ Pugot	-	✓
36. Synodontidae	50. Lizardfishes	Ngirit-ngirit	-	✓
37. Teraponidae	51. Four-lined tigerfishes	Bugaong	-	✓
38. Triacanthidae	52. Blotch-backed	Sulay-bagyo	-	✓
39. Trichiuridae	53. Cutlass fish, Large-head hair-tails	Ispada	-	✓
<b>B. Crustaceans</b>				
40. Portunidae	54. Blue-swimming crabs	Alimasag	✓	✓
41. Pennidae	55. Tiger shrimp	Hipon, sugpo	-	✓
<b>C. Cephalopods</b>				
42. Loligilidae	56. Squids	Pusit	✓	✓
43. Octopidae	57. Octopus	Pogita, gipo-gipo	✓	✓
44. Unidentified	58. Cuttlefishes	Tauban	✓	-
<b>Total</b>			<b>32</b>	<b>56</b>

**Table 3:** Common catch of different fishing gears used in SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan, Philippines.

Fishing gear	Common catch
<b>A. Nets</b>	
1. Bag net	sardines, Round scads, frigate tuna, Indian mackerel, squid, big-eyed Scad, Slipmouth, hard-tail Scad, needleskin, jacks
2. Beach seine	anchovy, sardines, Slip mouth, coral bream, halfbeaks, jacks, hardtail Scad, yellow scads
3. Bottom set gill net	rabbitfish, emperor, flatfish, parrotfish, Indian mackerel, big-eyed Scad
4. Drift gill net	Flying fish, barracuda, halfbeak, Indian mackerel, needle skin, frigate tuna
5. Ring net	anchovy, jack, Slipmouth, sardines, grunther, bream, goatfish
6. Trammel net	Parrotfish, Indian mackerel, big-eyed Scad, Rabbitfish, emperor, flatfish
<b>B. Lines</b>	
7. Bottom set long line	Frigate tuna, barracuda, mackerel, sweetlips
8. Multiple hand line	Bream, jack/trevally, frigate tuna, grouper, snapper
9. Simple hand line	Bream, jack/trevally, grouper, sweetlips, frigate tuna, grouper, snapper, sharks, emperor
10. Troll line	Indian mackerel, frigate tuna, eastern little tuna
<b>C. Hand instruments</b>	
11. Squid/octopus lure	Squid, cuttlefish, octopus
12. Spear gun	emperor, parrotfish, wrasses, surgeon/unicornfish, grouper
<b>D. Barriers and traps</b>	
13. Fish pot	Bream, chinese bisugo, lapu-lapu, snapper, swimming crab
14. Crab pot	Swimming crab
15. Squid pot	Squid, cuttlefish
16. Fish corral	Cardinal fish, rays, rabbitfish, slipmouth, surgeon/unicorn fish, jacks

## 4. Discussion

### 4.1 Inventory and classification of fishing gears

Fishing gears can be categorized as active and passive gears. Active gears are characterized with movement which aim to pursue or capture the target species and used with combination of other fishing methods. On the other hand, passive gears are characterized by absence of movements (stationary) and the target species move towards the gear through different methods such as attracting and setting, among others <sup>[3]</sup>.

Most of the active gears noted during the study are composed of nets. Bag net or basnig operate through lifting motion and fish beyond the municipal waters (i.e. 15 km from the shoreline), and target small pelagic species, such as scads, anchovies and mackerels. The beach seine (Sinsoro) is

characterized by having a bag similar to a trawl net with two wings, its body and the cod-end. Majority of the beach seine's length are within 50-200 m with 2-10 m depth. Drift gill net or Kurantay is a type of gill net targeting pelagic/surface fishes which are usually attracted by light. This can be made of monofilament nylon or polyvinyl alcohol (Kuralon). It is usually operated during night time and catches fish when set in fishing grounds known to be abundant with pelagic fish. The municipal ring nets (Pangulong, Taksay), which net measures length of 250-400 m and depth of 30-50 m, is operated manually in a fishing Banca and are usually powered by 10-16 horsepower (HP) gasoline engine. Each operation includes scouting of fish schools and use of light attraction in Payaw with tuna and mackerels are the main target. Spear gun (Pana) is the only hand instrument documented in two areas.

This is usually made wood with rubber attached to that pushes a pointed metal stick when pulled. This aim to target large fishes and are highly selective. This is also operated using a mask and improvised fins made of either plywood or PVC<sup>[8]</sup> [9, 10, 11].

Passive gears such as simple and multiple handlines, troll lines, and squid and octopus lure are cheap to produce and simple to operate in municipal waters. They are usually made of nylon monofilament of 1.2-2.0 mm size. Simple handline (Kawil) is one of the most commonly used fishing gears by fishermen because it does not need complicated method, and can be used all-year round as long as the weather permits. It is highly selective and targets carnivorous species such as groupers, emperors, snappers, etc. Multiple handline (birabira) operates 4-10 hooks per line which are separated by a spreader, sometimes bobbed to attract the target species which are pelagic and demersal species. Squid/octopus lure (bundak) targets squids and octopus and operated with a sinker with hook at the end of the line. These are jigged to attract squids/octopus. Troll line (sibid-sibid) targets pelagic species and uses natural or synthetic baits. This gear use multiple hooks to increase the efficiency of catching school of fish, usually hauled in a outrigger boat. Bottom set longline (kitang) operates with multiple hooks attached to the branchlines and target demersal fishes. It is usually 500-1,000 m long, with hook interval every one meter. Bottom set gill net (pamanti) is one of the most commonly used and productive fishing gears in municipal waters. When set, it serves as a wall intercepting school of fish, only needs periodic attention, and are usually 100-300 m long and 50 meshes deep. This gear is simple in design, easy to construct and operate. This gear targets bottom dwelling species such as rabbitfishes, crabs, and emperor among others. The trammel net (3-ply), which target mackerels, scads, and rabbitfishes, is characterized by having length of 70-200 m and 50 meshes depth. Fish pots, squid pots and crab pots (bubo) are operated mostly in the mid water column, need periodic attention, and targets fish, squids and crabs. Fish corrals or baklad are found in shallow and deep portions of the municipal waters, and catch are usually harvested every week. They need relatively larger area than other fishing gear, except for gill nets which also needs larger area [9, 10, 11]. These gears are also noted being operated in Malampaya Sound in Taytay, Palawan, Philippines [13]. It is worth noting that passive gears are the most used fishing gears in municipal waters of SIMBANA and Rasa Island, but some active gears were also operated in the said areas. Although the use of active gears in municipal waters is prohibited in Section 95 of the RA 10654 (The Philippine Fisheries Code), it was noted that there are active gears that operate in the areas surveyed. The Fisheries Code may allow the operation of active gears in municipal waters provided that they operate 10.1-15 km from the shoreline, gears will not touch the sea bottom, prior consultation with the stakeholders, and the owner of the does not violate any fisheries laws (Section 95, RA 10654). The spear guns or pana, although an active gear, are allowed to operate in shallow waters since it is a sustainable and a highly selective fishing gear that does not overfish local resources.

Most of the resident fishermen in Simbana operated their fishing gears operated in nearby reef areas, while many gears operated in Rasa Island are from nearby barangays. Most of these gears are operated all year-round but depends on the local weather. For example, fishing operation in SIMBANA is

limited during southwest monsoon (habagat) since the area is exposed and the fishermen do not want to risk their lives in fishing. On the other hand, Rasa Island is exposed during northeast monsoon (Amihan), making fishing a very difficult task during these times. During bad weather, fishermen opt to find alternative source of livelihood to feed their family and send their kids to school.

#### 4.2 Catch composition of fishing gears

Majority of the species caught in the SIMBANA, Puerto Princesa City and Rasa Island, Narra, Palawan are of high commercial value (i.e. target species), and found in the reefs or in areas near the reefs. Some species in the common catch of fishing gears were noted in two sites and in other parts of Malampaya Sound and west Sulu Sea [13] [14]. The target species primarily are surgeonfishes (Acanthuridae), fusiliers (Caesionidae), jacks and trevallies (Carangidae), sweetlips (Haemulidae), emperors (Lethrinidae), snappers (Lutjanidae), goatfishes (Mullidae), parrotfishes (Serranidae), tunas and mackerels (Scombridae), groupers (Serranidae), rabbitfishes (Siganidae), barracudas (Sphyraenidae), swimming crabs, shrimps, octopus, squids and cuttlefishes. Most of the species caught are reef-associated since most of the gears are operated in reefs or near reef areas. However, because of overexploitation, fishery resources with no or low commercial value which are under-utilized before are also harvested nowadays. Some non-target species included in the catch of these gears were also utilized by fishermen as food since few target species were caught and very few are being discarded. If this trend continue to exist, overexploitation of underutilized may result to ecosystem overfishing.

It was also noted during the study that large gears and traps catches larger individuals than smaller gears which confirmed the study of McClanahan and Mangi [15]. Since most of the fishing gears have specific target of more than one species, some modifications of the gears may lead to exploitation of other species and the fishermen's ability to catch and consume other species caught as well [16]. Although generally aquatic biodiversity is relatively high in the sampling sites, it is important that a fisheries management plan must be crafted to sustain the fisheries productivity of those areas. The variety of organisms collected in the sampling areas only confirmed the title of the Philippines as the "Center of center of marine shore fish biodiversity" [7].

#### 5. Conclusion and Recommendations

Many fishing gears are operated in the coastal areas of SIMBANA and Rasa Island, an evidence that different gears are used to capture several marine species in the said localities. Some gears have different slight variations and modifications in the gears used which aimed to capture other species as well.

It is recommended that a study to determine variability of the catch composition of the fishing gears in different monsoon season (i.e. northeast monsoon, southwest monsoon) be conducted. It is also important that the fishing area of operation of each fishing gear in two coastal areas be studied which can be used on the proper zoning of fishing gear area of operation in their waters. Alternative source of livelihood must be provided to fishermen dependent on fishing especially during bad weather. And there must be proper information, education and communication (IEC) campaign on the status of fisheries resources in the said localities.

## 6. Acknowledgement

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