SUSTAINING THE COASTAL FISHERY RESOURCES IN SAN VICENTE, PALAWAN

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ABSTRACT

This study is an inquiry on the "low fisheries productivity" of a potentially resource-rich coastal ecosystem of 1,408 km^2 in San Vicente, Palawan, Philippines. Three main coastal habitats, namely: mangroves, coral reefs, and seagrass beds located in four fishing grounds were investigated. Field observations and rapid appraisal methodology using key informant interviews and focused group discussions were involved in the process. A municipal level stakeholders' validation was done to confirm initial findings. Results showed 8 major fishing gears are operating in 4 bays, of which 5 are passive and 3 are active gears. A total of 103 fish species from 48 families and a major species of squid comprised the catch, of which 60% is reef-associated species. San Vicente's present fisheries productivity of 1,557.68 metric tons (mt) per year or an extraction rate equivalent to only 1.1 mt/km^2/year is far behind its estimated potential yield of 7,040.40 mt per year. In general, the municipal fishing grounds are not overfished. Although commercial and high value species remain abundant, the catches have been declining for most species across gears. Thus, sustainable fisheries management regime is necessary to increase fishery production and maintain ecosystem balance.

KEY WORDS: Sustaining Coastal Fishery Resources, San Vicente, Palawan

1.0 INTRODUCTION

The WorldFish Center and Palawan State University (2011) reported that human factors such as excessive fishing pressure, destructive methods of fishing, and marine pollution are the main causes of coastal and marine habitats degradation. These practices are common in most fishing communities in Palawan as open access regime still exists, despite national and local fisheries legislations. In a developing country like the Philippines, population growth and lack of alternative or supplemental livelihoods are main drivers that increase fishing pressure. These social problems coupled with the open-access regime that prevails in marine capture fisheries contribute significantly to overfishing and the subsequent decline in fish stocks (Dequit et al. 2004).

The Municipality of San Vicente is a local government unit located in the northwestern coast of Palawan Province, Republic of the Philippines. It is part of Palawan's Environmentally Critical Areas Network (ECAN) Coastal Zone identified under Republic Act (RA) No. 7611 or the Strategic Environmental Plan (SEP) for Palawan Act. It has a total fishing ground zone of about 140,805 ha (1,408 km^2), which is equivalent to 46% of its total area of municipal jurisdiction.

San Vicente adopts the concept and policy of sustainable development. Among the municipalities in Palawan, it manifested the highest forest cover at 75% relative to its total land area (Palawan Council for Sustainable Development 2010). The place is endowed with outstanding natural beauty with a lush forest cover, waterfalls, mangroves, seagrass beds, coral reefs, high marine biodiversity, and white sand

beaches, particularly the 14-kilometer long beach from the town proper (Poblacion) to the northeastern barangay of Alimanguan.

Based on the 2010 National Statistics Office Census, its population was 30,565 with a growth rate of 6 percent (Municipal Government of San Vicente 2010). Fishing and farming are the major economic activities in the municipality. Fishers and farmers comprise 29.50% and 25.77% of the total population, respectively. However, occupations associated with coastal tourism are emerging in San Vicente.
As reported by Silliman University Marine Laboratory (1997) and Arquiza (1999), the important marine resources of San Vicente include 160 species of finfishes, squids and octopi; 163 species of corals and thousands of species of other invertebrates; 96 species of algae; a diverse collection of seagrasses; and 22 species of mangroves.
The fishery resources of San Vicente remain crucial for the Philippine's food security program. San Vicente supplies part of the food fish requirements in other northern municipalities in Palawan, Puerto Princesa City, and Metro Manila. In addition, it supplies part of the live reef fish for food (LRFF) demand in China.

1.1 Objectives of the Study

This study investigates ways to sustain the coastal fishery resources in San Vicente, Palawan, Philippines. Specifically it aimed to:

1. assess the conditions of coastal habitats in San Vicente, Palawan;
2. describe the physical characteristics such as sea surface temperature variation and tidal circulation pattern;
3. calculate the catch per unit effort (CPUE) of the fishing gears and methods used;
4. describe the fishing ground and seasonality of fishing gears;
5. identify the dominant species caught by gear type and associated habitats;
6. discuss resource use conflicts in the coastal zone; and
7. calculate the fisheries productivity potential of the fishing grounds.

1.2 Significance of the Study

This study is an offshoot of the coastal resource management (CRM) interventions implemented in 1997 and 1999 in San Vicente, Palawan, Philippines. The findings of this research would be essential in monitoring and evaluation of the local government's CRM project, the goal of which is to promote and maintain sustainable development of coastal communities in this municipality, particularly its coastal fisheries.

1.3 Conceptual Framework

In the effort to analyze the sustainability of coastal fishery resources in San Vicente, Palawan, the present researchers propose that conditions of coastal habitats, physical characteristics, catch per unit effort (CPUE), fishing ground characteristics and seasonality of fishing gears, dominant species and associated habitats, resource use conflicts, and fisheries potential be its inputs (Figure 1).

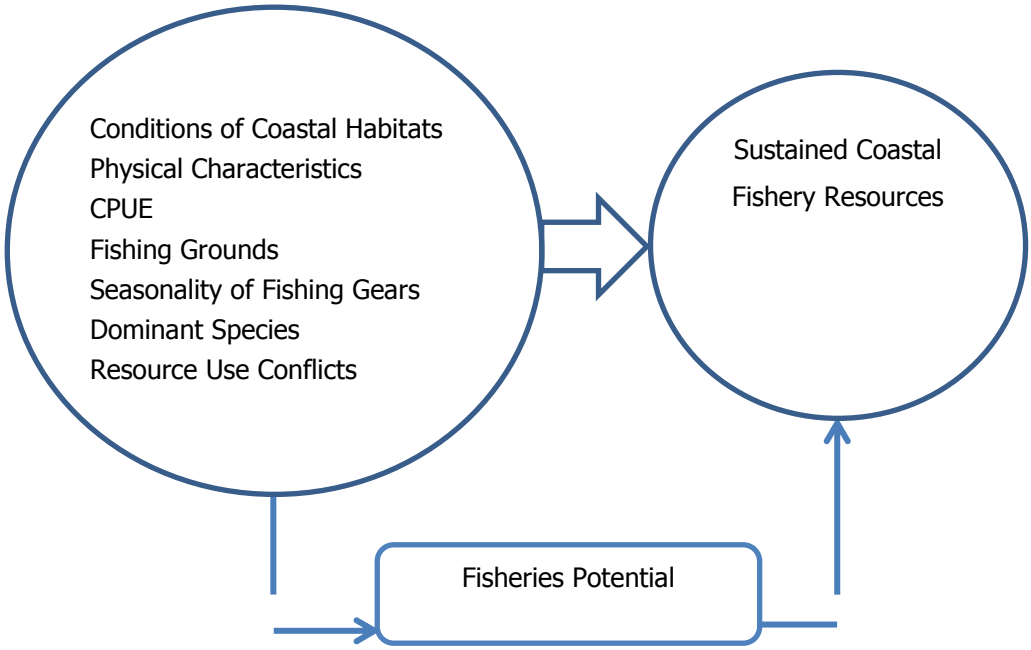


FIGURE 1. Conceptual model towards sustained coastal fishery resources in San Vicente, Palawan, Philippines

2.0 METHODOLOGY

In assessing the status of coastal fishery resources in San Vicente, Palawan, Philippines, the researchers followed the rapid rural appraisal (RRA) method as described by Pido et al. (1996) and the WorldFish Center (2010). This RRA has four interactive steps, namely: secondary data analysis, reconnaissance, field data gathering and community validation.

2.1 Site Profile

The Municipality of San Vicente is composed of 10 coastal *barangays* (villages) with a total land area of about 165,797.65 ha (1,658 km^2) and a fishing zone of 140,805 ha (1,408 km^2). It has 22 smaller islands and four productive bays, namely: Imuruan, Pagdanan, Mayday and Jibboom. Geographically, this coastal town is found between coordinates 10º15' - 10º47' north latitude and 118º58' - 119º20' east longitude (Figure 2).

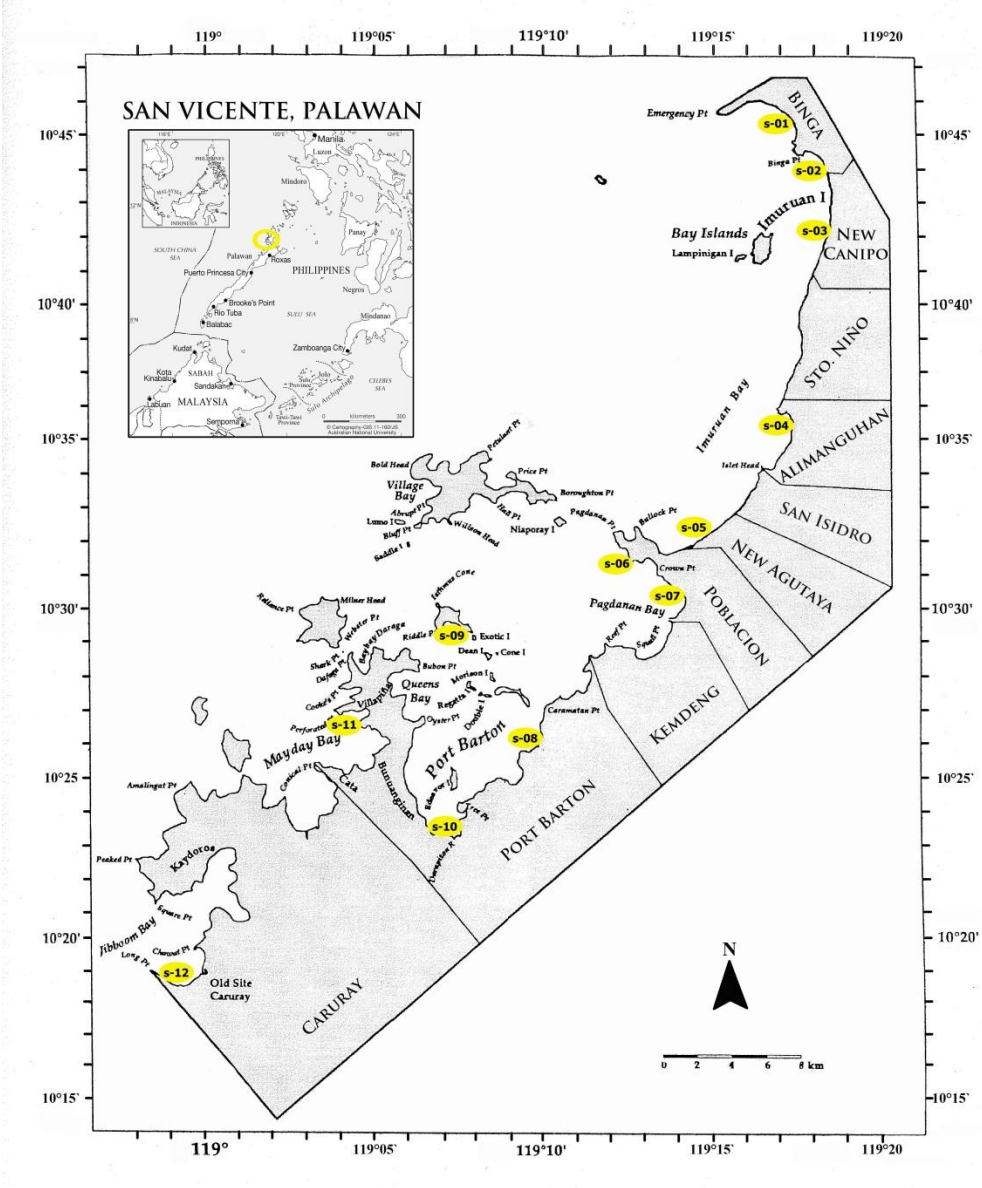


FIGURE 2. Map of East Asia (inset, Source: Australian National University as cited by Fabinyi et al. 2012) **and San Vicente, Palawan, Philippines indicating the 12 survey sites.**

Twelve survey sites in San Vicente were strategically selected: s-01 to s-03 are located in the northeastern part of Imuruan Bay where fishing is the main source of livelihood; s-04 is in the eastern part of Imuruan Bay, where fish traders and fisheries support facilities to include fish storage and solar driers are present; s-05 and s-06 are the fish landing centers and famous for the LRFF industry; s-07 is the center of local government where the public market is built; s-08 is the center of tourism; s-09 is an island fishing village where LRFF fishers are living; s-10 is known for lush mangrove forest and seaweeds culture; s-11 is a fishing village where fishers used passive gears such as hook-and-line and bottom set gillnet; and s-12 is the southernmost village, near to Puerto Princesa Underground River (one of the 7 new wonders of nature in 2012) where fish corral is the dominant fishing gear.

Based on the concept of ECAN coastal zone, the municipality has developed its Comprehensive Land, Water and Forest Use Plan (CLWFUP), which demarcates geographically the various uses of its resources.

2.2 Respondents of the Study

The respondents of this study were key officials from the *barangay* (village), municipal, provincial, and national government agencies; private sector representatives; fishers; fishers' associations; local community leaders; and research/ academic institutions. Some 46 key informants (KIs) were interviewed for the biophysical and socio-economic components. The socioeconomic component administered interviews to 36 fishers; 10 traders, and conducted 7 focused group discussions.

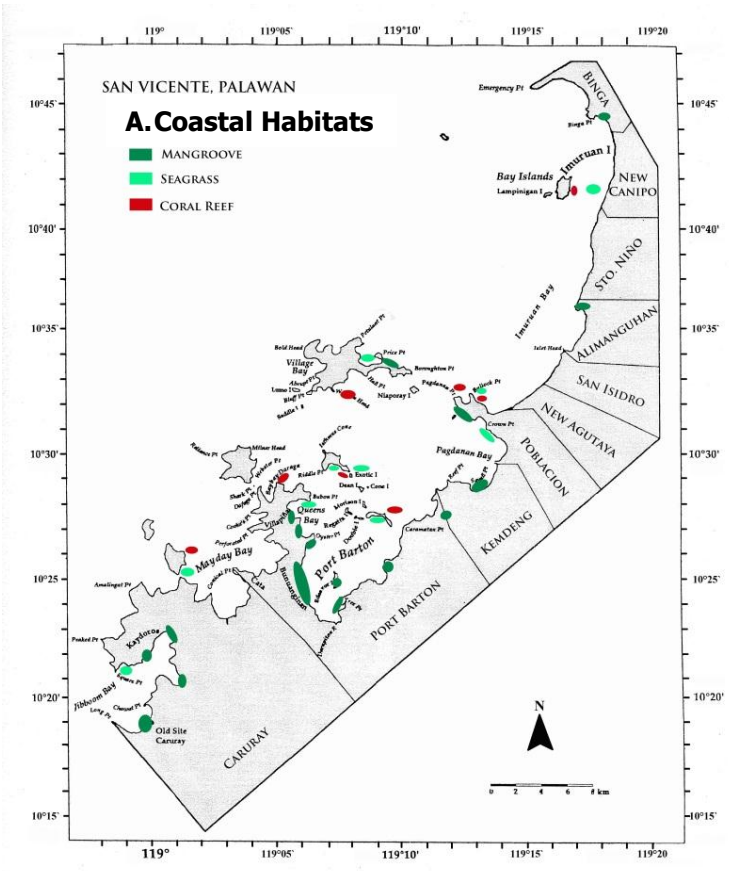
2.3 Research Design and Data Collection

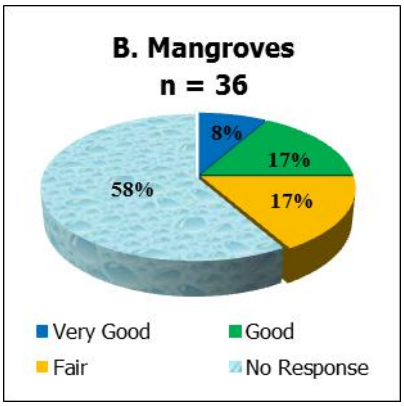
A descriptive-survey design was used in this study. Key informant interview (KII) and focused group discussion (FGD) were used in data collection. In addition to the survey questionnaires, relevant literature was secured. Secondary data collection started on 3 November 2010. This was followed by a reconnaissance survey on 26 November and 01 December 2010. Field data gathering were conducted on 18-23 February and 03-06 March 2011 for the northern and southern *barangays*, respectively. Preliminary results were presented and validated during the stakeholder validation on 1-2 June 2011.

3.0 RESULTS AND DISCUSSION

3.1 Conditions of Coastal Habitats

Three main coastal habitats support fisheries in San Vicente, namely: mangroves at 15.84 km^2, coral reefs at 3.91 km^2, and seagrass beds at 1.15 km^2. These constitute 76%, 19%, and 5%, respectively (Figure 3A).





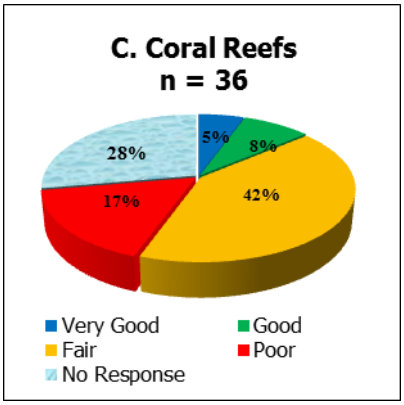


FIGURE 3. Coastal habitats (A) and its perceived conditions for mangroves (B) and coral reefs (C) in San Vicente, Palawan, Philippines.

The mangrove ecosystem is the largest among the coastal habitats in San Vicente. It provides many ecological and economic benefits (Melana et al. 2000; Deguit et al. 2004). There are 22 species of mangroves (Silliman University Marine Laboratory 1997) in San Vicente, which represents 47% of the total mangrove species found in the Philippines. Further, reef areas are concentrated in the west-central coast particularly in Port Barton, which is a premier tourist destination. Under the ECAN classification, Manta Ray Reef, the largest reef of about 1.5 km^2 in Port Barton is a marine core zone (Municipal Government of San Vicente 2010). A core zone is an area of maximum protection and free of human disruption as defined in the strategic environmental plan for Palawan. Finally, seagrass beds are concentrated near the town proper (*Poblacion*), which covers an area of approximately 1.0 km^2.

Similar to the report of Arquiza (1999), most of the fishers interviewed were hesitant to talk about illegal fishing but they acknowledged that the problem exists in the municipality. This contributes to the deteriorating conditions of coastal habitats as perceived by the respondents. Figure 3B presents the perceived conditions of mangroves, where more than half (58%) of the respondents had no response about its condition. This was taken to mean that this habitat is under threat. Also, it confirms the Palawan Council for Sustainable Development report (2010) that San Vicente is one of the municipalities in Palawan which manifested reduction in its mangrove forest. On the other hand, 42% of the fisher-respondents answered “fair”

as to their perceived condition of the coral reefs (Figure 3C). This finding is lower than the earlier reports of "good coral cover" by Silliman University Marine Laboratory (1997) and "good and stable condition" by the Port Barton Marine Park Coral Reef Monitoring Team (2000-2001). These results suggest that coral reefs are continually degraded.

3.2 Physical Characteristics

San Vicente has a passive continental margin marked by wide and shallow continental shelves, and numerous coral reefs. Its water mass is characterized by the West Philippine Sea.

3.2.1 Sea Surface Temperature

Year 2010 was a hot year in San Vicente where the average monthly sea surface temperature (SST) reached above the coral bleaching threshold SST of 30.9°C. Above bleaching threshold SSTs were recorded in the months of June and July 2010. Figure 4 illustrates a two-year comparative average monthly SST for 2010 and 2011 with the coral bleaching threshold.

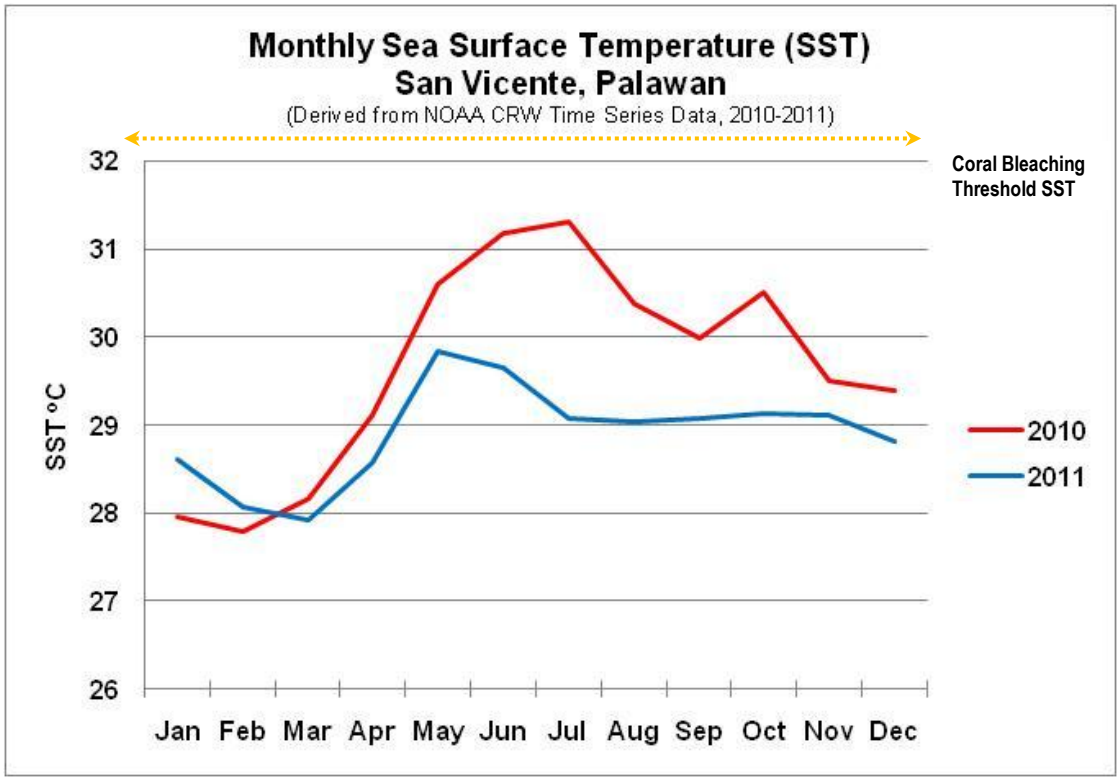


FIGURE 4. Average monthly SST in San Vicente, Palawan, Philippines (Source of Data: National Oceanic & Atmospheric Administration Coral Reef Watch 2011)

The above plot was derived from the National Oceanic and Atmospheric Administration Coral Reef Watch (NOAA-CRW) time series data available online. During the June-July 2010 period, the NOAA-CRW generated coral bleaching alerts: (a) warning on the second week of May, (b) alert level 1 on the first week of June, (c) alert level 2 on the second week of June until last week of July, and (d) bleaching watch from the first week of August to last week of October 2010. A similar incident

was cited by Arquiza (1999), when a coral bleaching took place in August 1998 which resulted to water temperature reaching 34°C in four Port Barton reef sites.

3.2.2 Tidal Circulation Patterns

Wave and current studies from seven stations conducted by Silliman University in May 1996 revealed that the general direction of both flood and ebb currents in San Vicente was northeast (Silliman University Marine Laboratory 1997; Arquiza 1999). Based on these studies, there is an apparently weak clockwise circulation of water mass ranging from 0.033 meters per second (mps) during ebb tide to 0.120 mps during flood tide. This circulation pattern transports nutrients into Imuruan Bay, which is one of the most productive fishing grounds in Palawan.

3.3 Type of Fishing Gears and Catch Per Unit Effort (CPUE)

The fishery resources in San Vicente are diverse, thus, fishing gears and capture methods vary according to the target species and across sites. There are eight major types of fishing gears identified during the field observation, interviews, and the validation workshop (Table 1).

TABLE 1. Major types of fishing gears used in San Vicente, Palawan, Philippines.

#	Fishing Gear	Local Name	Description	ISSCFG* Code
1.	Beach Seine	*Baling, Sikad-Sikad*	Active	SB
2.	Driftnet	*Pamo, Palutang*	Active	GND
3.	Ring Net	*Talakop*	Active	RN
4.	Bottom Set Gillnet	*Lambat, Palubog*	Passive	GNS
5.	Fish Corral	*Baklad*	Passive	FWR
6.	Handline	*Kawil*	Passive	LHP
7.	Squid Jig	*Pamusit*	Passive	JIG
8.	Fish/Crab Trap	*Bubo*	Passive	FPO

*****International Standard Statistical Classification of Fishing Gear 1980

Accordingly, five of these fishing gears are passive while three are active gears. The use of active gears in municipal waters, bays, and other fishery management areas is prohibited under Section 90 of Republic Act No. 8550 “Philippine Fisheries Code of 1998” (Congress of the Philippines 1998).

The average catch per unit effort (CPUE) of major gears in San Vicente ranged from less than a kilogram (kg) to 1,000 kg. Except for one passive gear (fish corral), active gears have higher CPUEs, which means active gears are more effective in catching fish species than passive gears. Table 2 presents the various CPUEs by major gear type in San Vicente, Palawan, Philippines.

TABLE 2. Catch per unit effort by major gear type in San Vicente, Palawan, Philippines.

#	Fishing Gear	CPUE (kg)			Unit of Effort	Fishing Time (Day)
		Min.	Max.	Ave.		
1.	Beach Seine	25	500	262.5	per trip	1
2.	Driftnet	20	100	60.0	per haul	1
3.	Ring Net	20	1,000	510.0	per trip	1
4.	Bottom Set Gillnet	10	60	35.0	per haul	1
5.	Fish Corral	50	1,000	525.0	per haul	Variable (~7)
6.	Handline[1] (live fish)	< 1	10	5.5	per trip	1~3
	Handline[2]	2	50	26.0	per trip	1~3
7.	Squid Jig	1	60	30.5	per trip	1

[1]Leopard coral grouper; [2]Other species

For instance, the average CPUE of handline in catching Leopard coral grouper (*Plectropomus leopardus*) is 5.5 kg per trip. One fishing trip using handline to catch live fish (LRFF) ranged from 1 to 3 days. Very effective gears in catching marine species in San Vicente are the ring net (active gear) and fish corral (passive gear), both had the highest maximum yield of 1,000 kg/trip. However, fish corral has variable fishing time ranging from 1 day to 1 week.

3.4 Fishing Grounds and Seasonality of Gears and Methods

The wide and shallow continental shelves, maximum water depth of about 73 meters at mean lower low water, serve as the municipal fishing grounds. These are characterized by corals, sand, mud, and rocky seabed (Table 3).

TABLE 3. Fishing ground characteristics by major gear type in San Vicente, Palawan, Philippines.

#	Fishing Gear	Distance from Shoreline (km)	Water Depth (m)	Bottom Characteristics
1.	Beach Seine	0 – 0.5	0 – 15	Sandy
2.	Driftnet	10 & beyond*	60 & over	n/a
3.	Ring Net	0.5 & beyond*	20 & over	Sandy, Muddy
4.	Bottom Set Gillnet	0.5 – 2	10 – 40	Sandy, Rocky
5.	Fish Corral	0.2 – 0.5	5 – 20	Sandy, Muddy
6.	Handline[1] (live fish)	0.5 & beyond*	10 – 20	Coral
	Handline[2]	0.5 & beyond*	10 – 40	Coral, Sandy, Rocky
7.	Squid Jig	0.5 – 7	10 – 40	Soft Bottom

*****Beyond the 15-km municipal waters
[1]Leopard coral grouper; [2]Other species

Of the eight major types of fishing gears, beach seine operates during the onset of the northeast monsoon (November) with peak yields during February to April (Figure 5).

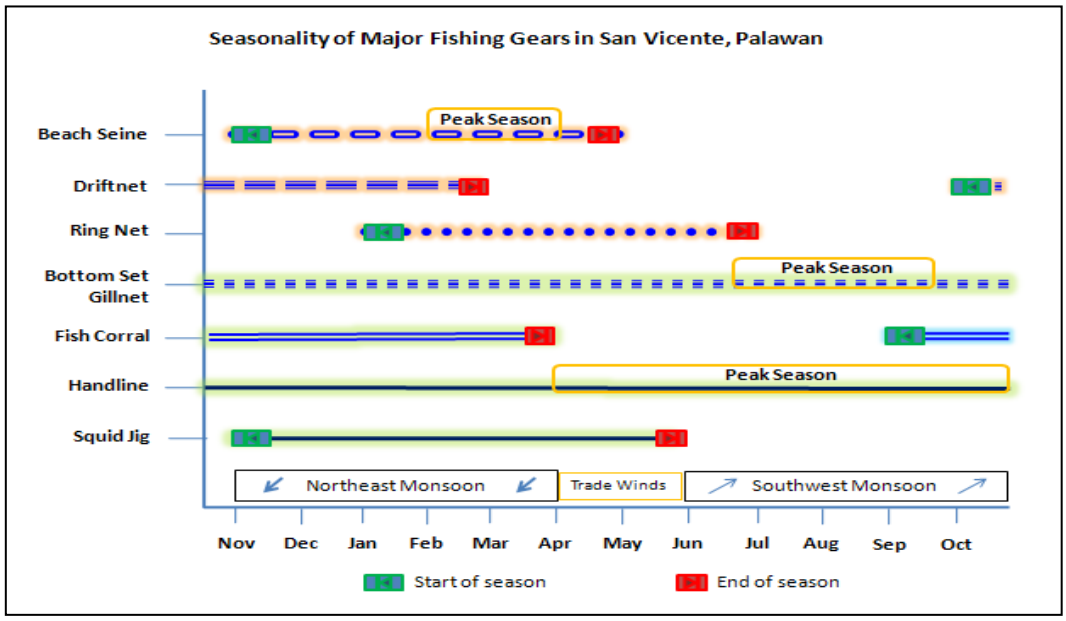


FIGURE 5. Seasonality of major fishing gears in San Vicente, Palawan, Philippines.

As illustrated in Figure 5, all gears are operating during the northeast monsoon where schools of fish are abundant. This may be attributed to the northeast monsoon-induced coastal upwelling in the western coast of Palawan, which normally brings nutrients into the surface waters needed for fish productivity. Two passive gears such as the bottom set gillnet and handline which target demersal species had their peak yields during the southwest monsoon.

3.5 Dominant Species and Associated Fish Habitats

A total of 103 fish species from 48 families and a major species of squid were recorded. Twenty three (23) new species from 21 families were added to the list of Silliman University Marine Laboratory (1997) findings. The dominant species caught by major gears in San Vicente are presented in Table 4.

TABLE 4. Dominant species caught by gear type in San Vicente, Palawan, Philippines.

#	Fishing Gear	Species	Common Name	Local Name	Habitat
1.	Beach Seine	*Stolephorus sp.*	Anchovy	*Dilis*	PN
		Rastrelliger kanagurta	Indian mackerel	*Alumahan*	PN
		Sardinella sp.	Sardines	*Tamban*	PN/RA
		Leiognathus sp.	Ponyfish	*Sapsap*	DM
2.	Driftnet	*Thunnus sp.*	Tuna	*Tambakol*	PO
		Katsuwonus pelamis	Skipjack	*'Tulingan*	PO
		Scomberomorus commerson	Spanish mackerel	*'Tanguigue*	PN
3.	Ring Net	*Rastrelliger kanagurta*	Indian mackerel	*Alumahan*	PN
		Alepes melanoptera	Blackfin scad	*Salay-salay*	PN
		Decapterus muroadsi	Amberstripe		PO

		Atule mate	scad Yellowtail scad	*Galunggong* *Kalapato*	RA
4.	Bottom Set Gillnet	*Rastrelliger faughni* *Nemipterus nematophorus* *Rastrelliger kanagurta* *Leiognathus sp.* *Atule mate*	Island mackerel Doublewhip threadfin bream Indian mackerel Ponyfish Yellowtail scad	*Buraw* *Bisugo* *Alumahan* *Sapsap* *Kalapato*	PN DM PN DM RA
5.	Fish Corral	*Atule mate* *Decapterus muroadsi* *Rastrelliger brachysoma*	Yellowtail scad Amberstripe scad Short mackerel	*Kalapato* *Galunggong* *Hasa-hasa*	RA PO PN
6.	Handline	*Plectropomus leopardus* *Lutjanus gibbus* *Nemipterus virgatus*	Leopard coralgrouper Humpback red snapper Golden threadfin bream	*Suno* (Live fish) *Maya-maya* *Lagaw*	RA RA DM
7.	Squid Jig	*Sepioteuthis lessoniana*	Bigfin Reef Squid	Pusit	SfB

Legend: RA – reef-associated; PN – pelagic-neritic; PO – pelagic-oceanic; DM – demersal;
BP – benthopelagic; SfB – soft bottom

Commonly caught fish species were Indian mackerel (*Rastrelliger kanagurta*) and Yellowtail scad (*Atule mate*). Handline was used to catch live coral grouper (*Plectropomus leopardus)* for the LRFF industry. However, anchovies (*Stolephorus sp.)* were caught only by beach seine. Most of the fish caught in San Vicente are reef-associated species, which comprised about 60% of the total fish species recorded. These are followed by pelagic, demersal and benthopelagic at 20%, 16%, and 4%, respectively. The high (60%) yield of reef-associated species marked an increase of more than 8% compared to 51.3% as reported by Silliman University Marine Laboratory (1997). The increase in catch of reef-associated species may be attributed to the coastal resource management efforts of the local government unit of San Vicente, particularly in delineating the marine core zones which serve as the breeding grounds of reef fishes.

3.6 Resource Use Conflicts

At least 27 major coastal resource management issues in San Vicente were identified by Arquiza (1999). These are grouped into four categories, namely: impact of land-based activities, resource use, resource access, and social services. Even with the enactment of San Vicente's CLWFUP and the 2006 Municipal Fisheries Code, resource use conflicts still exist. This is mainly due to open-access system in the utilization of fishery and other marine resources in the municipality.

Notable resource use conflict in the municipality is the use of coral reefs by both fishers and tourists. As such fishing with the use of handline, spear, bottom set gillnet, and harvesting of abalones are on-going in coral reef areas. Likewise, tourism activities such as snorkeling, diving, spear fishing, collection of organisms and boat anchoring are also taking place. Another conflict issue is the continuous cutting of

mangroves for charcoal in *Sitio* Cata, Port Barton which affects the catch and livelihoods of trap fishers, shellfish and honey gatherers.

3.7 Fisheries Potential

Considering the following fish yields estimates: (a) 600 kg/ha/year (Melana et al. 2000) to 1.08 mt/ha/year (Schatz 1991 as cited by Deguit et al. 2004) for a healthy mangrove ecosystem; and (b) sustainable extraction rate of 20 mt/km^2/year in an area adjacent to a 'no-take' marine reserve (Alcala 2001; Deguit et al. 2004). Thus, having a fishing ground zone of about 140,805 ha (1,408 km^2), the fisheries productivity potential of San Vicente is higher than its current yield.

Therefore, by establishing at least 25% of bays as fish refuge and sanctuaries to strengthen the habitat and spawning grounds of fish (from RA 8550), the fisheries potential of San Vicente based on the estimate used by Alcala (2001) is 7,040.40 mt/year (Table 5).

TABLE 5. Fisheries potential of San Vicente, Palawan, Philippines.

#	Fishing Ground	Area (km^2)	Marine Reserve (km^2)*	Fish Production (mt/yr)**
1.	Imuruan Bay	543.27	135.82	2,716.40
2.	Pagdanan Bay	317.63	79.41	1,588.20
3.	Mayday Bay	167.48	41.87	837.40
4.	Jibboom Bay	160.00	40.00	800.00
5.	Adjacent Waters	219.67	54.92	1,098.40
	Total	**1,408.05**	**352.02**	**7,040.40**

*25% of areas in bays; **Based on the estimate used by Alcala, 2001

Thus, San Vicente's potential fish production of 7,040.40 mt/year is about 4.5 times higher than the current productivity of only 1,557.68 mt/year.

4.0 CONCLUSION

The coastal resource management in San Vicente has some successes, although there are areas that need to be improved. The coastal habitats are under threat and continuously degraded. Fishery resources remain abundant and diverse, however, catches have been declining for most species across gears. The fishery resource of San Vicente remains crucial for local food security, and it supplies part of the food fish requirements in Puerto Princesa City, other northern municipalities in Palawan, and Metro Manila.

On the whole, the fisheries industry in San Vicente is operating less than one-fourth of its fishery potential. Improving coastal fisheries management is necessary to increase fish production at a sustainable level of 7,040.40 mt/year. This would redound to the sustainability of fishery resources in the West Philippine Sea and the BIMP-EAGA Region in general.

5.0 RECOMMENDATIONS

In view of the conclusion, the following recommendations are made: (1) in addition to the marine core zones, San Vicente should allocate about 25% of the municipal fishing grounds as marine reserves – this is provided in Section 81 of RA 8850; (2) continues monitoring of coral reefs (including dive sites), seagrass beds and mangroves; (3) ban active gears in municipal waters (as provided in RA 8550) and closely monitor and regulate the operation of driftnet; (4) design and publish ecosystem-based information, education and communication (IEC) materials for the use of fishers; (5) require fishers to undergo competency assessment before the issuance of any fisher's license or permit; (6) categorize and issue fishers' license or permits appropriate to their competencies; and (7) provide post-harvest facilities.

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