

Hunting pattern and pressure of communities inside protected areas in Leyte

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ABSTRACT

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The study was conducted to describe the hunting pattern and determine the factors associated to hunting pressure inside protected areas in Leyte.

The primary motivation to hunt inside protected areas is for both subsistence and commercial use. Because of low economic opportunities, hunting respondents hunt despite legal restrictions to augment income. Some non-hunting respondents are indirectly involved in hunting by participating in the wildlife trade.

The hunting pattern is characterized by preference for big game although hunting success is low because of the large amount of meat per unit catch. Hunting efficiency is improved with the use of homemade explosives and acquisition of air rifles. Wild pig is the most sought game and the improvement of hunting technology is geared toward increased harvest of this animal. The improvement of technology and the preference for big game made this group of animals highly vulnerable to overhunting. Equally vulnerable are doves, pigeons and parrots, which are considered secondary hunting targets for their meat and for pet trade.

The result of the correlation analysis showed that hunting effort is negatively associated with education, farm and total income of the respondents, and number of years the respondents availed of livelihood projects.

The overall scenario illustrates a classic interaction wherein pressure is continuously exerted on a limited resource in a fragile biological system by economically depressed sector of society. This therefore calls for urgent implementation of integrated conservation program in protected areas that would address both the biological diversity resources under constant pressure and the seemingly obligate users exerting the pressure.

Keywords: hunting pattern, hunting methods, wildlife management and conservation

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INTRODUCTION

Since time immemorial, hunting has been practiced in the tropical forest around the world, and meat of wildlife species has been considered an important source of animal protein in rural populations (Balakrishnan and Ndhluvo, 1992). Recently, however, in many areas, harvested populations show consistent declines in density, and species have been locally wiped out and wildlife populations have been reduced to densities where they have ceased to be significant resource to human. Globally, this condition has further advanced in the tropical forest of West Africa and Southeast Asia (Robinson and Bodmer, 1999).

In the Philippines, overhunting is one of the major causes of the stiff decline in wildlife resources, which to a very significant degree, has threatened most of its important wildlife species (DENR, 1996). Such problem on overexploitation of wildlife resources even extends to protected areas, which are considered the last frontier to harbor biological diversity resources in the country. With the current threats hunting puts on wildlife as integral part of biological diversity, it is but urgent to determine the factors associated with hunting pressure in protected areas so as to come up with comprehensive strategies to control overhunting. Successful conservation efforts require knowledge of both biological features of animal populations, and the socio-economic forces that shape human impacts of the environment (Sajise, 1993 as cited by Shively, 1997). Little is known about the hunting patterns and factors associated with hunting pressure particularly in protected areas. Hence, this investigation.

METHODOLOGY

The Study Site

The study was conducted in selected hunting communities near the border of the Philippine National Oil Company (PNOC) Geothermal Reservation in Tongonan, Leyte. The reservation covers an area of 107,625 hectares in the central portion of Leyte Island. With the primary purpose of geothermal

exploration and utilization, the reservation was declared as such through proclamation No. 1412 in April 1975. The reservation has important bearing to the conservation of biodiversity because it practically contains vast areas of the last remaining forest in Leyte Island, recognized recently as one of the biodiversity areas in the country that requires urgent protection (DENR, 2000).

The area contains the Anonang-Lobi which is considered as one of the key conservation sites in the Philippines by Haribon Foundation and Birdlife International (Mallari, *et al.*, 2001). Included in the list of important bird area (IBA), that falls within the endemic bird area (EBA) of Mindanao and Eastern Visayas, in the reservation contains 19 threatened species of birds, 11 of which are in restricted range. It is also home to big mammals like the Philippine Deer, Philippine Warty Pig as well as Philippine Tarsier. The forests of Anonang-Lobi range and elsewhere in Leyte are part of the network of sites required for conservation of the critically endangered Philippine Eagle.

Selection of Sampling Sites

The study was conducted in three communities within the border of the PNOG Geothermal Reservation. These included Sitio Cantilong, Barangay Milagro, Ormoc City; Sitio Cambantug, Barangay Danao, Ormoc City; and a village in Barangay Mahayahay, Albuera, Leyte. These communities were selected for the study because of their long association to hunting according to account of several reliable sources like extension agents, forest guards and barangay officials. At least fifty percent of the total households in each community or village were randomly selected for the primary data collection. The respondents of the study were the heads of families. In the absence of the household head, the spouse served as replacement. The distribution of respondents is shown in Table 1.

Table 1. Distribution of respondents by study site.

Study Site	Hunter	Non-hunter	Total
Cambantog	8	14	22
Cantilong	8	4	12
Mahayahay	6	9	25
Total	22	47	49

Location and Accessibility of Sample Villages

The location of the different study villages is shown in Figures 1 and 2. Sitio Cantilong is within the administrative jurisdiction of Barangay Milagro, the gateway to the Greater Tongonan Area, the site of the massive geothermal exploration in Leyte. It is inside the PNOC Reservation but outside its geothermal block. It is also situated at the margin of the Lake Danao Natural Park. The site is about 16 kilometers from Ormoc City. Accessible by a concrete road all throughout from the city proper, it can be reached using passenger jeepneys regularly plying Barangay Milagro and the northern barangays of Danao and Cabintan.

Sitio Cambantug is within the administrative jurisdiction of Barangay Danao. It is part of the PNOC reservation and situated inside its geothermal block. The same with Sitio Cantilong, it is also situated at the margin of Lake Danao Natural Park. It is about 18 kilometers from Ormoc City and accessible by a dirt road going to Barangay Danao and Cabintan which is about two kilometers from Sitio Cantilong.

Barangay Mahayahay is under the administrative jurisdiction of the Municipality of Albuera, the next municipality of Ormoc City going south. It is situated outside but close to the margin of PNOC reservation. Mahayahay is accessible by a 3-kilometer dirt road branching out from the national highway in Barangay Damulaan about 7 kilometers from the town proper. The main mode of transport from the national highway to the barangay is single motorcycle.

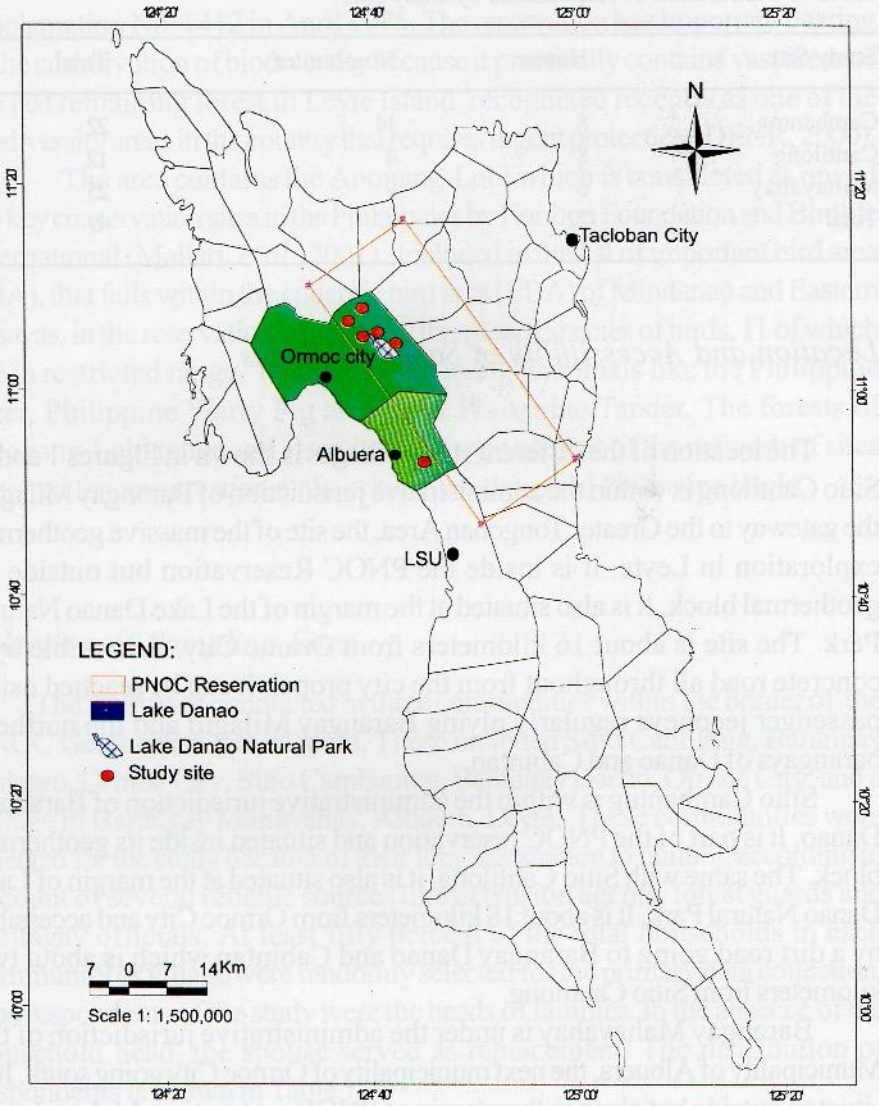


Figure 1. Map of Leyte, Philippines showing the location of the study sites.

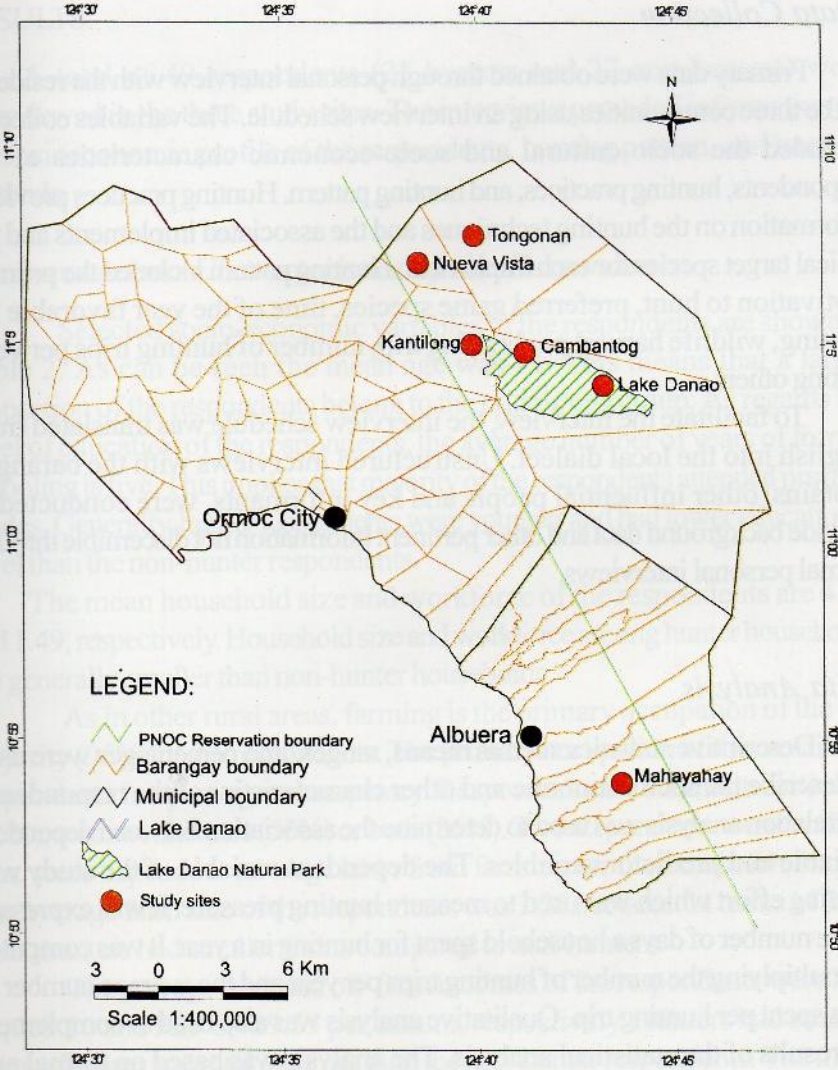


Figure 2. Map of Ormoc City and Albuera Leyte showing the location of the study sites.

Data Collection

Primary data were obtained through personal interview with the residents of the three communities using an interview schedule. The variables collected included the socio-cultural and socio-economic characteristics of the respondents, hunting practices, and hunting pattern. Hunting practices provided information on the hunting techniques and the associated implements and the typical target species for each implement. Hunting pattern included the primary motivation to hunt, preferred game species, time of the year favorable for hunting, wildlife harvest per hunting trip, number of hunting trips per year, among others.

To facilitate the interview, the interview schedule was translated from English into the local dialect. Unstructured interviews with the barangay captains, other influential people and key informants, were conducted to provide background data and other pertinent information not discernible through formal personal interviews.

Data Analysis

Descriptive statistics such as means, ranges, and percentages were used to describe the socioeconomic and other characteristics of the respondents. Correlation analysis was used to determine the association between dependent variable and predictor variables. The dependent variable of the study was hunting effort which was used to measure hunting pressure. It was expressed as the number of days a household spent for hunting in a year. It was computed by multiplying the number of hunting trips per year and the average number of days spent per hunting trip. Qualitative analysis was also used to complement the results of the statistical analysis. The analysis was based on formal and informal discussions and in-depth interviews with key informants and personal observations.

RESULTS

A total of 49 respondents (22 hunters and 27 non-hunters) were interviewed in the three study sites. The interviews provided information on the socioeconomic profile of the respondents, hunting pattern, and hunting methods.

Socio-economic Characteristics of the Respondents

Selected socio-economic variables of the respondents are shown in Table 2. As can be seen the mean age was 41. This means that a larger proportion of the respondents belong to the middle age group. As regards the level of education of the respondents, the average number of years of formal schooling is five. This implies that majority of the respondents attended primary grades. Generally, hunter respondents were younger and had lower educational level than the non-hunter respondents.

The mean household size and workforce of the respondents are 4.35 and 1.49, respectively. Household size and workforce among hunter households are generally smaller than non-hunter households.

As in other rural areas, farming is the primary occupation of the big majority (96%) of the respondents. The primary occupation of the remaining respondents is tailoring and carpentry. Respondents are claimant-cultivator (36%), tenant-cultivator (55%) or both (36%). Two respondents were landless thus, were dependent on wage labor from farming for their main livelihood. The average farm size of the respondents was 1.26 hectares. In terms of farm sizes, hunters had smaller farms compared to non-hunters.

The average farm and off-farm incomes of the respondents were PhP 14,708.16 and PhP 8,429.55 per annum, respectively. Hunters had smaller farm, off-farm and total incomes than the non-hunter respondents. The mean total annual income of the respondents was PhP 23,137.70. When translated into per capita income, this would be PhP 4,485, which is far below the rural poverty line and rural subsistence threshold of PhP 7,946 and PhP 5,569, respectively (DENR, 1998).

The bulk of their farm income came from onion (35%), tomato (32%), rice (21%) and abaca (21%). More than half (51%) of the respondents reported wage labor as their source of off-farm income. Few (14%)

Table 2. Socioeconomic characteristics of the respondents.*

Variable	Hunter	Non-Hunter	Total
Age (No. of years)	39.59	42.07	40.95
Education (No. of years)	4.59	6.11	5.43
Household Size (No. of individuals)	4.13	4.52	4.35
Work Force (No. of individuals)	1.32	1.63	1.49
Farm Size (Hectare)	0.84	1.62	1.26
Farm Income (Pesos)	7,986	20,230	14,708.16
Off-farm Income (Pesos)	3,321	12,626	8,429.55
Total Income (Pesos)	11,307	32,856	23,137.70

*Expressed as mean

respondents attributed their off-farm income to livelihood projects.

In general, the results show that hunters were less economically endowed than the non-hunters. The very low livelihood opportunities of the hunter respondents was an important factor that led this subsistence type of hunting to perpetuate. Distance from the residence to the hunting sites was a less significant factor to deter hunting because the opportunity cost of their time spent for hunting was quite low (Shively, 1997). Likewise, hunting respondents can endure going to far hunting sites although it meant staying for longer days in the hunting ground because they did not have income from other productive activities to forego while hunting.

Comparing the per capita incomes of the hunting community with that of national poverty line and rural subsistence threshold, both hunters and non-hunters belonged to the less privileged sector of the society. Their livelihood, which is anchored principally on subsistence farming, could not provide them with a substantial year-round income to support a decent living. This scenario pushes them to explore every opportunity to earn additional income to improve their living conditions.

This situation seems alarming as non-hunters are equally susceptible to pursue hunting in the future as the last recourse when their economic condition gets tough. As a matter of fact, they have already been promoting hunting indirectly by participating in the local wildlife trade particularly meat. Not surprisingly, wildlife as can be gleaned from Robinson and Bodmer (1999), is the most accessible source of animal protein among forest dwellers in the

tropics. Any intervention to control if not stop hunting must therefore address not only the hunters but also the whole hunting community.

Hunting Pattern

Household heads and male members typically hunt alone or in small group involving multiple households. The average hunting party size was 8, which ranged from 1 to 20. They usually hunted at the forest margins or in the forest interiors in the PNOC reservations. Most (90%) of the respondents reported that they hunted inside the PNOC reservation with an average distance of 15 kilometers from their residence. Only few respondents reported to hunt within few kilometers away from their residence.

Result of the survey shows that the primary purpose of hunting is for both subsistence and cash. The same observation was reported by Skonhofs and Solstad (1996) which served as the primary basis in classifying hunting worldwide into two types namely, subsistence and commercial. Robinson and Bodmer (1999) forwarded the same classification which is specific to the tropics where sports hunting as a recreational value attached to wildlife is not as important as that in the temperate regions. Subsistence hunting uses wildlife products mostly for local consumption; commercial hunting barter them for cash in the market.

Most respondents usually targeted big games although hunting success is low because of their large amount of meat. Wild pig (*Sus philippensis*) is the most sought after game because of its higher market price. Many have noted that a wild pig's meat tastes even better than the domesticated pig. Deer (*Cervus mariannus*) is the next most sought after game due to its large amount of meat. Some respondents however, do not like the taste of its meat because it has an odor and taste resembling that of the goat's. Traditionally, Visayans are not as inclined as their counterparts in the Ilocandia to eating goat meat.

The third most sought after game species are the smaller mammals particularly Palm Civet (*Paradoxurus hermaphroditus*) and Malay Civet (*Viverra zibetha*). These are hunted primarily for their taste, which approximates that of the native chicken and not by the amount of their meat. Hunting of these game animals is resorted only during desperate times of harvest failure of the more sought after game such as wild pig and deer. The meat of

one individual Palm Civet or Malay Civet is barely enough for all the members of the hunting party.

During most desperate hunting trips, monkeys (*Macaca fascicularis*), which are still abundant along forest margins adjacent to agricultural clearings, are hunted just to compensate for the time and effort used in hunting. However, only a limited number of hunters have good appetite for monkeys. In few instances, monkeys are captured live as pets. Tamed monkeys can be a man's good companion and can develop excellent skills to collect human lice during siesta time. Tamed monkeys are sold at PhP 350 each in Barangay Milagro.

Although there was no definite hunting season for wild pigs, there are periods of the year considered more favorable to hunting this game due to anticipated higher harvest. The fruiting season of ulayan (*Lithocarpus llanosii*), from September to November, was considered by many respondents to be more favorable to hunt wild pigs. During this period, encounters with wild pigs were high because they tended to go close to ulayan trees to feed on the fallen fruits. Traditionally, the relative abundance of fallen fruits on the ground under ulayan indicates the absence or presence of wild pigs in the vicinity. Absence of fallen fruits on the ground below a fruit-bearing ulayan tree indicates that wild pigs are somewhere nearby. Hunter respondents also noted that agricultural clearings are excellent hunting spots for wild pigs. Wild pigs would tend to concentrate themselves near agricultural clearings where camote and cassava abound. These crops are favorite food source for wild pigs.

Considered as secondary hunting targets, birds are usually hunted along the way to and from the primary hunting sites. There are times of the year, however, that hunting becomes deliberate and exclusive for birds. Bird hunting is best undertaken during the fruiting season of some fruit-bearing species of the Family Moraceae and Euphorbiaceae such as antipolo (*Artocarpus blancoi*), hagimit (*Ficus minahassae*), balete (*Ficus balete*), alim (*Mallotus multiglandulosus*), and binunga (*Macaranga tanarius*). From April to June, hunting success is considerably high because birds tend to converge on selected patches where the fruit-bearing trees are present. Papaya and hot pepper are also noted to attract birds. Most preferred birds are White-eared Brown Fruit Dove (*Phapitreron leucotis*), Amethyst Brown Fruit Dove (*Phapitreron amethystina*), and Green Imperial Pigeon (*Ducula aenea*). The average harvest per hunting trip among the respondents is relatively high at 5.25.

These fruit-bearing trees are mostly successional if not pioneer species hence, are confined in periodically disturbed areas at the forest margins adjacent to agricultural clearings, which are relatively accessible. Access also encouraged bird hunting in addition to the high probability of hunting success per trip due to the availability of food materials.

Monitor Lizard (*Varanus salvator*) and Sailfin Water Lizard (*Hydrosaurus postulosus*) were occasionally hunted during dry months. During this period, watercourses, the favorite harborages of these cold-blooded animals, normally dry up favoring high hunting success. Dead chicken and fish were commonly used as bait in hunting these animals. Most respondents prefer the water lizard over the monitor lizard because the latter has been noted to feed especially on dead animals.

Based on the primary motivation to hunt and the preference for a specific game, two patterns were established. First, preference for big games was clearly linked to commercial hunting. Increased harvest of big game, therefore, is a manifestation of the increased commercialization of wildlife meat trade, which also holds true in other areas in the tropics (Robinson and Bodner, 1999). Although hunting success is low, big games are preferred because aside from the large amount of meat per unit catch, they command better market price more so if traded outside the local community.

Second, hunting small games like civets and birds can be more associated to subsistence hunting. Although most hunters sought big game, some tend to focus on smaller games, because hunting success is better due to higher encounter rates (Shively 1997). Although their meat is considered inferior, small games can provide higher harvest per hunting effort, which assures the hunter of a steady supply of meat to meet his daily protein requirement.

Hunting within the PNOC Reservation, therefore is remarkably becoming a significant threat to the population of big game. Because they require large areas for cover, big games are highly vulnerable to overhunting. According to Bailey (1984), self-regulation seldom operates in wildlife harvest involving big game. Hunters have the inherent tendency to continue their efforts at harvesting the animal despite experiencing failure in the previous attempt. As a matter of fact, overharvesting had been considered one of the main reasons for the extinction of deer in the province of Bohol (Rabor, 1986).

Recently, the conservation status of the Philippine Warty Pig (*Sus*

philippensis mindanensis), which occurs in the Greater Mindanao including Leyte, Samar and Bohol, has been elevated to vulnerable under the IUCN Red List of Threatened Animals (Oliver, 1998). The other two sub-species of Philippine Warty Pigs, *Sus philippensis philippensis*, and *Sus philippensis oliveri*, which occur in Greater Luzon and Mindoro faunal regions, respectively, also face almost the same threat. The former is considered vulnerable while the latter is endangered. The Philippine Deer (*Cervus mariannus*) has been officially recognized as endangered throughout the country since 1991 (DENR, 1991).

Aside from the pressure exerted by the local inhabitants to big game, there are natural conditions of the tropical forests that render wildlife highly vulnerable to overhunting. In the tropical forests, wildlife species are vulnerable to overharvest because of an inherent low supply of animals (Robinson and Bodmer, 1999). Tropical forests are low-productivity ecosystems for wildlife. They do not support a high standing biomass of large-bodied wildlife (generally under 3,000 kg/km²). In comparison, standing biomass of large-bodied animal in tropical savannas can exceed 20,000 kg/km². In addition, many tropical forest species have low inherent rate of natural increase (Robinson and Redford, 1986 as cited by Robinson and Bodmer, 1999).

Hunting Methods

Several hunting techniques were employed by the hunting respondents in the pursuit of wild animals. The most elaborate tactic in hunting, which has increased sophistication through the years, was closely associated to hunting their most preferred game, such as deer and wild pigs. Recently, however improvement of hunting techniques has been emphasized on wild pig hunting most probably because of relatively higher encounter rates and consequently higher harvest probability than deer hunting. Nonetheless, techniques commonly used to subdue wild pigs are applicable also to deer.

Undoubtedly, the improvement of the hunting techniques also compounds the threat to the population of big game in PNOC reservation. Incorporation of new hunting technologies which certainly increases animal harvest brings strong potential to turn a previously customary resource use into an unsustainable exploitation (Lyver and Moller, 1999).

Practically, three techniques are commonly associated to hunting big games particularly wild pigs. These include the use of improvised shotguns, pit-traps, and improvised explosives. Improvised shotgun locally known as surit, is the most common implement being used to subdue wild pigs and other big mammals. All hunting respondents reported ownership of homemade shotgun. The implement, which is ideally used for close range hunting, can instantly kill big game eliminating the possibility of animal attack in retaliation.

Trap locally known as gahong to mean pit, is made by digging a hole on the ground about 4-5 feet deep and 2-3 feet wide. Sharp pointed stakes or posts made out of tree branches and bamboo poles are driven vertically at the bottom of the pit with the pointed ends pointing upward. The trap, which is constructed at the suspected path of the animal, is then concealed by covering the opening with small branches and leaves of trees. In this method, the hunter intends to kill the animal immediately so that it cannot escape from the pit once trapped. They have to kill the animal instantly because wild pig if not killed at once can destroy the wall of the pit to maneuver for an escape.

A modification of this trap, which involves the use of empty oil container or drum, is now being widely used by the respondents. A pit is dug, big enough to accommodate the drum, along animal's suspected path. The same with the conventional pit trap, the drum will be concealed using small branches and leaves of shrubs or trees. This method is increasingly used because the game is rarely killed instantly. Pointed stakes are eliminated in this method in order not to kill the game instantly to preserve the game alive for days inside the drum until the hunter returns to the site to retrieve it. In the traditional pit method, there were instances that the meat of the wild pig was already ruined when the hunter returned to the site to check for the kill.

In cases where the use of drum is impractical, hunters still use the pit method but the pointed stakes are eliminated for the safety of the hunters and other forest users. Hunters seem to arrive at a consensus of eliminating the pointed stakes of the conventional pit method due to past accidents involving humans associated to the method.

The most common form of improvised explosive is known as pingpong. Substantial amount of gunpowder or match powder together with an igniter is wrapped with silver paper (cigarette inside-wrapper is commonly used) and will be formed into a pingpong-like ball. The igniter is assembled using tiny

pieces of broken glass or porcelain plate. In between them, small piece of match igniter is placed so that once pressed against each other, spark is created initiating the explosion. To make it water-resistant in order to last long in the field, the ball has to be coated with paraffin wax. Coating is an important consideration in this method because it is expected that the ball has to be in the field for a number of days before the animal gets attracted to it. Wild pigs are so sensitive to the smell of humans that they do not take fresh bait easily. The balls are placed along suspected animal path. Once eaten, the ball will explode blowing up the head of the victim.

Other techniques employed in hunting include the use of air rifle, snares, and dogs. Possession of air rifle, which is commercially fabricated, was reported by about 60% of the hunting respondents. Air rifle can practically be used for all kinds of game animals but traditionally, its use is limited for small game which are extremely shy such as birds and small mammals like the civets.

Air rifle is not commonly used to subdue big game for some limitations. The first limitation is that it cannot kill the animal instantly, so the animal once hit can still run, and take refuge away. It will be very difficult for the hunter to recover the carcass. Second limitation is associated with the immediate safety of the hunter. If it is used at close range, there is great possibility that the animal can still retaliate and this makes the use of air rifle very risky particularly in hunting wild pigs.

Snares of different designs and variations are still used by the respondents for shy smaller game like jungle fowls, ground birds, and monitor lizards. Since snares are intended to capture animals alive, hunters will just leave the site after setting up the snare and will return a day or couple of days after to see if there are animals caught.

To capture arboreal birds alive for pet trade, the respondents use a combination of live lure and perching twig with adhesive. Latex is extracted from trees belonging to the Family Moraceae like antipolo (*Artocarpus blancoi*) and anubing (*Artocarpus ovatus*) and processed into an adhesive substance. The adhesive is then wrapped around a selected twig, which will be made as the perching twig. This perching twig will be placed on a strategic spot of the tree crown carefully selected as regard to its visibility to targeted individuals. To attract other individuals, a captured bird will be placed near the twig serving as live lure. Birds popularly captured for trade are Philippine

Green Pigeon (*Treron pompadora*), Blue-naped Parrot (*Tanygnathus lucionensis*) and Philippine Hanging Parrot (*Loriculus philippensis*).

The use of dogs in hunting was reported by almost 37% (8 out of 22) of the respondents. Traditionally, dogs play a major role in hunting and are responsible for most of the kill particularly for small game animals. But because of the recent improvement of hunting technology, in most cases dogs just play a support role in hunting. Owing to their super sensitive smelling power, dogs are particularly useful in identifying the exact location of the target game and in the retrieval of the animal carcass deep in the bushes.

Correlates of Hunting Effort

Correlates of hunting effort were determined using the Pearson-product moment correlation coefficient. Hunting effort was expressed as the number days the hunter is willing to spend in hunting in a year. Table 3 presents the relationship between selected variables and hunting effort. Among the variables tested, only 4 were found significantly associated to hunting effort. These were education, farm income, total income and number of years with livelihood projects.

Education refers to the number of years of formal schooling of the respondents starting in Grade 1. Education showed negative significant relationship with hunting effort at 5% level of significance. This means that respondents with higher education level are not inclined to hunt or less likely to hunt. This could be attributed to the respondents' awareness about legislation concerning wildlife conservation. Persons with relatively high educational attainment may tend to be more receptive to new information particularly on innovative approaches to resource management.

Farm and total income showed negative significant relationship with hunting effort at 5% and 1% level of significance, respectively. This means that respondents with high income are less likely to hunt or spend more effort to hunt. Respondents with high income might be contented already with their income and this deterred or lessened their urge to hunt aside from the fact that they were already preoccupied with activities other than hunting. On the contrary, respondents with low income have to spend more effort to hunt, most probably in order to supplement farm income.

Table 3. Correlation coefficient between hunting effort and selected variables.

VARIABLES	CORRELATION COEFFICIENT
Age	0.093
Education	-0.306*
Household size	-0.013
Work force	-0.101
Farm size	-0.236
Farm income	-0.322*
Off-farm income	-0.209
Total income	-0.364**
Number of years with livelihood projects	-0.313*

*Significant at 5% level

**Significant at 1% level

Aside from low income directly derived from farming being the principal source of income of the hunting communities, seasonal availability of wage labor for farming operations also triggers an increase of the tendency of low-income households to hunt. Having no other options to supplement farm income, they have to intensify hunting during period in the cropping season when labor is not fully utilized for farm operations.

De Boer and Baquete (1998) emphasized that poorer families normally depend on natural products such that when labor becomes available, they would try to secure subsistence needs as well as participate in market economy. In most cases, family labor as pointed out by Sierra (1999) can be shifted from subsistence to commercial production, thereby increasing pressure on natural resources. Due to available labor, hunting can be shifted from subsistence to commercial, transforming a seemingly sustainable traditional hunting into unsustainable resource exploitation.

The number of years with livelihood projects showed negative relationship with hunting effort. This implies that respondents with higher number of years involved in livelihood projects would tend to spend less effort in hunting. The relationship between these variables can be explained by the additional income the households derived from livelihood activities. The number of years with livelihood projects was significantly related to the household total income, which means that they must have derived income from those projects, which significantly contributed to the total income.

This result emphasizes the need to provide livelihood project as part of the overall strategy in protected areas management so as to lessen dependence of the inhabitants on existing resources around them.

CONCLUSION

The hunting pattern of the respondents is characterized by preference for big game, which is linked to commercial use of wildlife meat. Although hunting success is low, big games are sought basically because of the large meat per unit catch and the attractive market price pegged on their meat. Improvement of hunting techniques to increase harvest efficiency for big game further manifests the increase commercialization of wildlife meat trade.

Hunting inside PNOC reservation is remarkably becoming a significant threat to big games. Aside from the hunting pressure, there are other factors that render big game vulnerable to overhunting. Big games require big areas for cover and have low intrinsic rate of natural increase.

Although they are just secondary targets, small game animals are becoming equally vulnerable because of the procurement of air rifle by majority of the respondents to increase harvest efficiency. Small games are usually targeted out of frustration when hunters failed in their pursuit of their most sought game. When big game gets depleted, the small game will surely absorb the pressure.

The low socioeconomic profile of the hunting communities is significantly associated with hunting pressure. With very low income from both agricultural produce and wage labor, hunter respondents have to intensify hunting to augment income especially during period of the year when wage income from seasonal agricultural activities is not available.

One point is made clear: local hunters have been exerting tremendous pressure to the wildlife resources of the PNOC Reservation. This illustrates a classic scenario of the strong dependence of the under-privileged sector of society to a limited resource in a fragile ecosystem. Considering that the resource and users are virtually inseparable, this calls for an integrated conservation program that would cater to both the resource and users of the resource.

Given the importance of wildlife resources to the local communities in and around protected areas, this opens the possibility of legalizing hunting but harvest of wildlife must be managed within sustainable levels. However, before any move to manage wildlife shall be carried out, wildlife management institutions should first be strengthened to enable them to give utmost priority to wildlife management. The mere fact that wildlife hunting still persists despite legal restriction is something to think about.

Harvest of wildlife as pointed out by Bailey (1984) can be sustained by removing only the harvestable surplus of a given population. Any effort to increase harvestable surplus must be geared towards augmenting wildlife productivity through habitat manipulation, and controlling harvest. Basic information regarding hunted species in Leyte must be gathered because they are necessary in evaluating sustainability of hunting. In the meantime that information specifically on the population of local games species heavily affected by hunting pressure is limited if not absent, the most rational step is to absolutely prohibit hunting in and outside protected areas pending the result of wildlife population census and other studies, which will serve as the basis of prescribing species-specific hunting quota to sustain harvest. This means strengthening of protection work as an indispensable component of wildlife management by involving all sectors of society coupled with effective information campaign.

Protection of the remaining primary forests in Leyte is also essential because they play a major role as the wildlife cover of sensitive interior wildlife species whose survival and reproduction is highly affected by habitat fragmentation. Some other habitat types like regeneration forests, brushlands, grasslands, and wetlands, may be maintained to increase structural complexity across landscape elements thereby increasing wildlife productivity and diversity.

While depriving local communities of their economic off-take from wildlife resources, income opportunities, which are directed away from the forest and wildlife resources, will have to be provided. Introduction of improved farming technology to increase farm yield and income is a sound alternative to reduce pressure on wildlife resources.

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