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Hunting for livelihoods by farmers in the lowland forests of Papua's Bird's Head Peninsula, Indonesia

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Abstract. *Arobaya AYS, Apituley JRM, Pattiselanno AE, Mardiatmoko G, Pattiselanno F. 2025. Hunting for livelihoods by farmers in the lowland forests of Papua's Bird's Head Peninsula, Indonesia. Biodiversitas 26: 2375-2382.* Rural people in Indonesian Papua hunt on a part-time basis to supplement livelihoods. Although hunting plays an important role in local livelihood, the profile of hunters in Papua is not really well understood. Therefore, this study aimed to examine indigenous hunting practices across 11 villages of Tambrauw District on the lowland coast of the Bird's Head Peninsula, Papua, Indonesia. Data were collected from 1020 hunters to assess practices in supporting local livelihoods along the coast, and populated by small-scale farmers who currently produce food mainly for local consumption. Hunting was not typically the main source of revenue, because majority of hunters were employed full-time in another field, while performed alternate hunting for additional cash. The results showed that about 69% of respondents were farmers, hunting intermittently to gain extra income, with small plot holders hunting more frequently. Aims of hunting varies, with 49.02% of respondents hunting to supply market demand, 43.73% of respondents hunting for family consumption, and other estimated 7.26% reported hunting for cultural reasons and crop protection. Active hunting with spears, knives, bows, and arrows was the most common hunting practices, while hunting with guns, was the least used in the study villages. Hunting was mostly in primary forests (34.22%), with introduced species deer (37.25%) and wild pig (31.37%) being the most hunting target. Finally, hunter-farmers performed hunting to meet the requirement for an animal protein source to supply family consumption and the bushmeat market demand. Introduced species such as deer and wild pigs contribute significantly to the hunting practices in this study, because they have a higher economic value, with both meat and fat playing a crucial role in meeting the family animal protein need. Hunting patterns at the lowland coastal forests of the Bird's Head Peninsula were similar to other tropical forest sites, to some degree had a significant impact on the hunting practices across the lowland coastal forests.

Keywords: Farmer hunters, indigenous hunting, Indonesian New Guinea, livelihoods, lowland forest, wild meat

INTRODUCTION

Hunting is considered an "alternative" activity, although many hunters often engaged in full-time employment (Ntiamoa-Baidu 1997; Mendelson et al. 2003; Naranjo et al. 2004). Alternative activity means hunting is performed on a part-time basis as people derive their major income from full-time occupations and carry out part-time jobs (hunting) to gain extra income for the household (Naranjo et al. 2004). In Africa, for example, relatively few people hunt as the sole occupation. Most hunters work full-time on another vocation, such as farmers or artisans, while hunting is only carried out on a part-time basis (Ntiamoa-Baidu 1997). Noss (1998) found this pattern in Central Africa, where most snare hunters alternated between formal and informal professions such as fishing, diamond mining, farming, and logging, similar to the study of Van Vliet et al. (2015) explained that subsistence hunting is not a sole occupation in Northeast Gabon, but a part-time work, because they were actively working in gold mining, while others helped wives during the dry season in agricultural plantations. On the other hand, commercial hunters in Ghana work full-time and depend mostly on the sale of bushmeat for livelihood. Farmer-hunters, who are among the principal participants in trade (Cowlishaw et al. 2005), hunt on the side to augment cash crop earnings (Mendelson et al. 2003). A similar trend is prevalent in Latin America, where a hunter may also work as a farm worker, smallholder, settler, fisherman, or miner. The majority of income is derived from full-time jobs and supplemented with hunting as part-time work. Due to the widespread poverty, many people mix formal and informal activities to supplement income (Naranjo et al. 2004).

In the Indonesian New Guinea (the Bird's Head Peninsula, Papua), many people value the forest for the benefits obtained from harvesting plants and animals. Hunting and gathering of wild animals continue to be an important aspect of life in rural Papuan communities (Pattiselanno 2006; Pattiselanno and Lubis 2014; Pattiselanno et al. 2019, 2020). Some ethnic groups also rely on hunting and gathering from the forest for subsistence, social and cultural rites (Pattiselanno 2006).

The agricultural sector, together with forestry and mining is considered as the main driver of the economy in West Papua. The primary employer is the agricultural sector, generating 30.83% of the total employment in the province. The agricultural sector provides the highest labor force, and almost every rural household works in agriculture (Bank Indonesia 2022). Pattiselanno and Lubis (2014) found that most of the households actively engaged in farming, and the agricultural products from the field were mostly consumed in the villages although some products were transported by boats to Sausapor and Sorong.

Rural people in the Bird's Head Peninsula, West Papua Province, were active in agriculture but also engaged in hunting in the lowland-coastal forests (Pattiselanno and Lubis 2014). A previous study reported that hunting returns contributed to the local economy although it was an important small economic activity across the relatively similar study sites (Pattiselanno and Koibur 2018). Pattiselanno et al. (2019) also found that consumption and sale were the reasons for the use of wild animal species among ethnic groups along the coast of the Bird's Head Peninsula.

Hunters are actively engaged in the wild meat trade chains at the Bird's Head Peninsula, Indonesia (Pattiselanno et al. 2020), reflecting changes in the traditional business approach by local tribes (Kuryshova and Kuryshov 2019). However, the profile of hunters is less well understood. Therefore, this study aimed to examine indigenous hunting practices across 11 villages of Tambrauw District on the lowland coast in the western end of the island of New Guinea. Hunting was assumedly not the main occupation, as people had other jobs which provided more income opportunities and influenced current practices. We keen to have better understanding on the contribution of hunting as a source of income. The information obtained will provide an overview of the extent to which hunting patterns are sustainable activities or not. Thus the results obtained can be used for sustainable wildlife management in relation to traditional hunting carried out on the Bird's Head Peninsula.

MATERIALS AND METHODS

Study area and period

The study was conducted across the eleven villages on the Bird's Head Peninsula of Papua in Tambrauw District, West Papua Province, Indonesia, approximately 200 km north-east of Sorong (Figure 1) between 2013 and 2014. Human research ethics approval was received from the James Cook University (JCU) Human Research Ethics Committee (H4203), while data were collected through general village and hunting survey.

Tambrauw, a new district created in West Papua Province in 2008 has incorporated parts of the Sorong (Abun) and Manokwari (Amberbaken) districts. Most of the inhabitants relied on hunting and gathering until a few decades ago, with only limited cultivation of subsistence crops and fishing. Currently, other main contributors to livelihoods are cultivation of bananas (*Musa* × *paradisiaca* L.), beans (*Phaseolus vulgaris* L.), yams (*Ipomoea batatas* (L.) Lam.), and vegetables (Pattiselanno and Lubis 2014). Cacao-chocolate (*Theobroma cacao* L.) and coconuts (*Cocos nucifera* L.) are also grown and the produce sold to augment family incomes (Pattiselanno et al. 2020). Pigs and chickens are traditionally raised for subsistence (Pattiselanno and Lubis 2014).

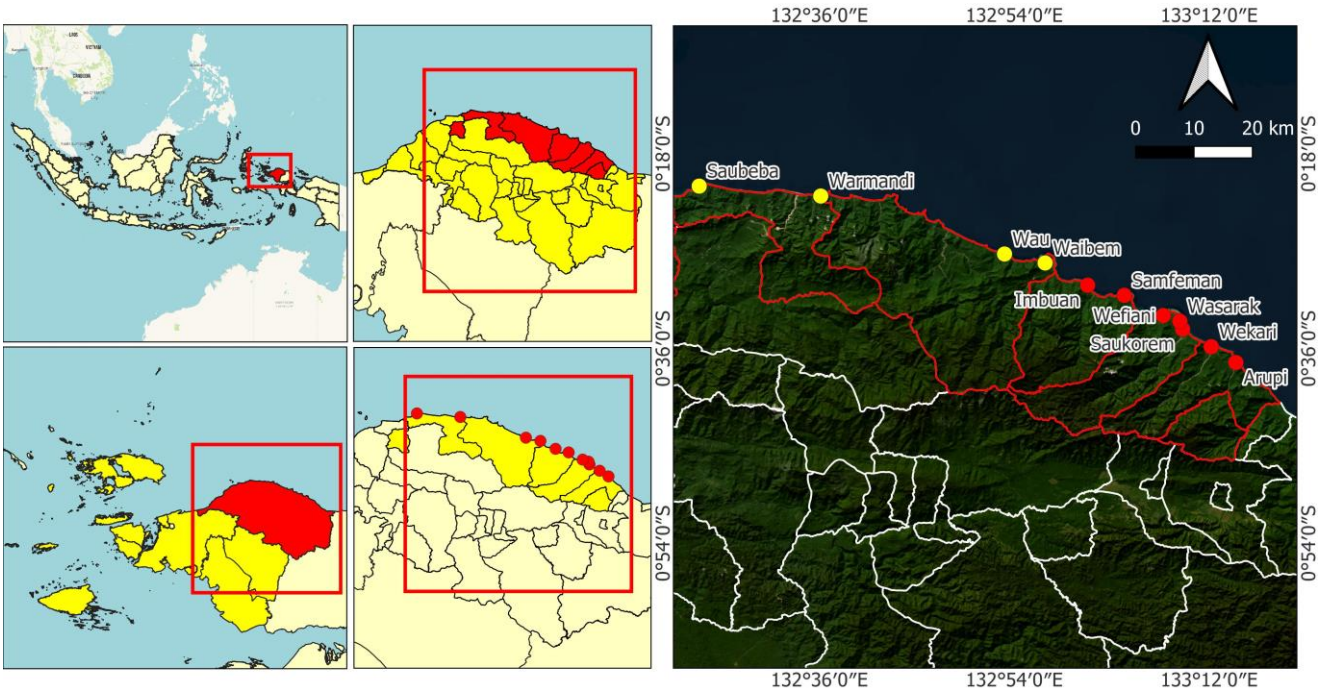

Figure 1. Location of the study sites on the Papua's Bird's Head Peninsula of Tambrauw District, West Papua Province, Indonesia. Yellow dots represent four villages in Abun Sub-district, also designated as Abun Regional Marine Protected Area (ARMPA). Red dots represent seven villages in Amberbaken Sub-district. The land areas in both sub-districts are part of North Tambrauw Nature Reserve

From May to August, when the sea is calm, people fish along the coast using canoes and nets (Pattiselanno et al. 2020). All these activities are still carried out using traditional knowledge and equipment. Geographically, Tambrauw District is located in the northern part of the Bird's Head region, West Papua Province between 0°36'18.36" S, 132°29'56" E. To the east, it shares a border with Manokwari and to the west with Sorong and the district Maybrat in the south. Additionally, the northern border is provided by the Pacific Ocean.

Procedures

Two survey tools were used to gather the data namely village survey (included 800 randomly selected respondents) and hunting survey (included 220 focused/purposively selected respondents). The study team went up to the chairman in each of the 11 villages to explain the objectives and request permission. Furthermore, it was requested that the village secretary or chairman designate 20 active hunters in each community as focal respondents (Kaltenborn et al. 2005). Throughout the study, this method was also used for all additional interview procedures.

Interviews with 220 hunters were used to acquire information regarding hunting. The respondents were questioned in Indonesian using the Wildlife Conservation Society's hunting questionnaire (Rao et al. 2005). Data on the dynamics of hunting, such as engagement, frequency, and techniques, were collected through interviews. More precisely, questions about the purpose of the hunt, the start and end times, the frequency, the number of hunters who participated, the use of weapons, spears, and traps, the number and species of animals hunted, the use of the harvested game, the hunting areas, and the distance from the village were asked to the hunters (Rao et al. 2005; Franzen 2006). To provide a thorough image of hunting trips and to learn particular details about each hunter, information on individual hunters was obtained.

A total of 100 questionnaires, each with seven multiple-choice items, were sent to randomly selected respondents in each of the 11 villages, omitting the 20 "focal respondents," to obtain a general understanding of hunting from various occupational backgrounds in the sampled communities. About 800 surveys were sent back for additional examination. Focused respondents (n = 220) and community survey respondents (n = 800) provided specific information about hunting tactics. This information covered topics such as the purpose, frequency, methods, duration, the size of the party, and the amount of hunting that occurred in the three weeks before the interviews.

Data analysis

Each quantitatively measurable response to the questionnaire was inputted into a database and examined using log-linear models, allowing the analysis of the relationship between two or more categorical variables (León and Montiel 2008) using the S-Plus package for analysis of biological data as in Jones et al. (2012).

RESULTS AND DISCUSSION

Description of the respondents

The average household size in the 11 study villages (N = 1020 total respondents: both focal respondents N = 220, and random respondents N = 800) was five people, with a maximum household size of 12. Only a small number of elite households possessed "luxury" goods such as TVs, telephones, generators, and others, while the rest were living at a basic subsistence level.

All participating households engaged in farming and, while most of the products were consumed within the village, some were sold in markets in the towns of Sorong and Sausapor. Regular boats that pass by the villages pick up agricultural products to sell in Sorong and the provincial capital Manokwari. In addition, since 2010, some households earned money by raising poultry and pigs and from paid labor as conservation rangers or contract workers in a mining company.

Households along the shore engaged in a variety of subsistence activities, such as fishing, hunting, smallholder husbandry (with pigs, goats, and chickens), shifting agriculture, and the cultivation of trees and palms. Hunting was not the main source of revenue, as the majority of hunters had full-time jobs such as farming, fishing, government service, paid labor in mining, conservation industries, and students who went hunting occasionally to supplement income.

Government statistics showed that people in the study area were amongst the poorest in Indonesia (BPS Indonesia 2019). Although none of the respondents were living on less than US$ 1 a day, some respondents were living on less than US$2 per day. Most food was from subsistence crops and little was purchased. Approximately 87% of respondents owned individual houses and the remaining 13% lived with parents. Although most respondents generated revenue and maintained a way of life from a range of sources, with crops playing a major part, the others also engaged in hunting to supplement income.

Profile of hunters

Hunting was not typically the main source of revenue in this study. The majority of hunters were employed full-time in another field, such as farming, fishing, government service, paid labor in mining, conservation industries, and students who went hunting occasionally for additional cash (Table 1).

Within the sampled villages, most of the respondents (69%) were farmers, while the rest were non-farmers, working on different jobs, including students, government employees, laborers (such as those in mining and conservation), and fishermen ($t = 1.812$, $df = 10$, $P = 0$). People owned varying amounts of cropland, including coconut, cacao, banana, peanuts, tuber crops, areca nuts, betel, and vegetables, ranging in size from 250 to 10,000 m^2. The majority of people relied on agriculture for income, identifying as part-time laborers and hunters who supplemented cash crop incomes by joining paid hunts.

Table 1. Major occupations of respondents in the studied districts

District	Occupation						Total
	Farmer	Civil servant	Paid labour	Fisherman	Student	Forest gatherer	
Amberbaken	494	37	41	52	61	17	702
Abun	210	18	38	23	29	0	318
Total	704	55	79	75	80	17	1020
%	69.02	5.39	7.75	2.16	8.82	1.67	

Table 2. Maximum land ownership and time spent on hunting by focus hunters in the sampled villages (Pattiselanno 2015)

Land size category (m^2)	Maximum land ownership (m^2)	Maximum time spent on hunting (hours)
<5,000	5,000	20
5,001-10,000	10,000	17
>10,000	50,000	14

Hunters were dedicated to primary jobs from Monday through Friday but hunted on the weekends to supplement income. The amount of time spent on other household tasks was not available, although hunters in the villages under study averaged 10.38 (±SD 3.41 hours, N = 220) hours per day. The amount of time hunters spent hunting was impacted by the quantity of cropland (m^2) held (Table 2, t = 9.94, df = 219, P = 0), with bigger land ownership linked to shorter hunting sessions. In most cases, hunting was based on free time from work or after farmers planted and harvested.

Given that study villages coastal position and because most of the respondents were farmers, hunting was practiced occasionally. Each household monthly revenue was different, but not entirely derived from farming. The average monthly income of focal respondents (N = 220) was USD 108.12 (± SD 82.27). Per capita monthly income from selling wild meat alone during the 7-month hunting period reported by 33 participating hunters was USD 76.23 (±SD 26.24) amounting to 70% of monthly income.

Common hunting practices

The reasons for hunting were similar across the studied villages namely for food, sale, and other purposes. Respondents who hunted for family consumption totaled 43.73%, while 49.02% hunted to supply market demand for wild meat, and other estimated 7.26% reported different purposes including cultural hunting and crop protection. Based on the results, the reasons for hunting between hunters in the studied villages were significantly different ($\chi2$ = 42.36, df = 20, P<0.005). Different hunting techniques were also used in each hunting excursion including machetes, spears, bows, arrows, dogs, and guns as well as passive techniques namely nylon snare traps in the studied villages. Each hunter used multiple techniques, and the frequency across the studied villages was similar ($\chi2$ = 50.343, df = 40, P>0.05).

The most common type of hunting was active with spears, knives, bows, and arrows. Hunting with guns, was the least used in the study villages. According to reports, the traditional hunting weapons used by the Papuans are created from forest resources. To construct traps, bows-and-arrows, and spears, a variety of materials such as bamboo, lianas, palm leaves, and plant fibers are used (Pattiselanno 2006; Supuma 2018). Although shotguns were only used by roughly 5% of the hunters, the results suggest that the culture of forest-dwelling peoples is changing. Some hunters carry dogs to chase and catch game, as well as spears and machetes. In tropical Asia, the most common method of hunting was with dogs and spears (Fa and Brown 2009). Hunters use dogs in the Crater Mountain Wildlife Management Area (CMWMA) in Papua New Guinea's Eastern Highlands (Mack and West 2005).

Hunting frequency recognized during the study included very frequent (daily and 2-3 days a week) frequent (weekly or fortnightly), and rare (monthly across the sites). About 50% of respondents hunted once a month, and the frequency was different across the study villages ($\chi2$ = 69.972, df = 20, P = 0). Furthermore, 40% of the respondents hunted more frequently, namely weekly or fortnightly, and the rest 10% actively hunted 2-3 days a week (N = 1020). Hunting was more common in primary forests (34.22%), whilst in secondary forests and riversides was 26.28 and 22.16% respectively, with croplands supporting 17.45% of all hunting. Although most of the harvest was made in primary forests, hunting tenures across the studied villages were not different ($\chi2$ = 31.724, df = 30, P>0.05).

The prey species hunted by the respondents three weeks before the interviews included six animals and three birds. The number of people caught on a hunting trip ranged from one to five. Two people were engaged on average in every hunting expedition (2.42±1.93 SD). Table 3 shows the prey species hunted during the previous hunting excursion in each of the surveyed villages including deer, pigs, and native species. More deer were hunted across the study villages at 37.25% compared to wild pigs at 31.37% and native species at 27.06% ($\chi2$ = 8.554; df = 3; P<0.05).

Table 3. Species hunted in the coastal villages of West Papua

Scientific name	Common name	IUCN Status[1]	Protected status[2]
Casuarius unappendiculatus (Blyth, 1860)	Northern Cassowary	Vulnerable	Protected
Dendrolagus inustus (Müller, 1840)	Grizzled Tree Kangaroo	Vulnerable	Protected
Ducula pinon (Gaimard, 1823)	Pinon Imperial-pigeon	Least concern	
Echymipera kalubu (Fischer, 1829)	Spiny bandicoots	Least concern	
Rhyticeros plicatus (J.R.Forster, 1781)	Papuan Hornbill	Least concern	
Rusa timorensis (Blainville, 1822)	Timor Deer	Vulnerable	Protected
Spilocuscus maculatus (É.Geoffroy Saint-Hilaire, 1803)	Common spotted Cuscus	Least concern	Protected
Sus scrofa (Linnaeus, 1758)	Wild pig	Least concern	
Thylogale brunii (Schreber, 1778)	Dusky pademelon	Vulnerable	

Note: [1]http://www.iucnredlist.org/; [2]Indonesian Law for Natural Resource and Ecosystem (Government Regulation PP No. 7/1999)

Discussion

The introduction of a cash economy, combined with rapid urban and infrastructure development, particularly road connections along the coast, has brought significant changes to hunting purposes and practices in Indonesia New Guinea including the Bird's Head Peninsula (Pattiselanno and Krockenberger 2021). The associated changes, especially in hunting, are demonstrated by a shift from subsistence hunting to market-based hunting. Pattiselanno et al. (2020), found that wild meat from hunters was transported to town through the current roads, by the involvement of different actors (hunters, intermediaries, market traders, and restaurant owners) to the traders, or directly to the restaurant owners.

In Indonesia New Guinea, the expansion of road connections in Nimboran District expanded access that led to increased harvest rates of the hunting targets (Pangau-Adam et al. 2012). Currently, in areas where roads are connecting rural areas along the coasts with towns in Tambrauw District, wild meat is being transported and sold using motor vehicles (Pattiselanno et al. 2020). As the distance between hunted areas to markets and other commercial centres decreases, market-driven hunting tends to increase. In sites without road access, hunting is mostly conducted to obtain meat for family consumption, whereas hunting for trade is more common in sites with road access. Different hunting tools were used, and each hunter typically combined more than one tool. Traps are predominantly used along roadsides, showing how hunters reorient their hunting practices towards export rather than subsistence. There also a shift from traditional to modern hunting tools to maximise harvest rates.

A market-based hunting orientation may increase the hunters' dependence on trading, which could increase the harvest rates that may also increase impact on the sustainability of hunting. Fortunately, there are few large native mammals and the largest potential hunting targets are introduced species Rusa deer and wild pigs (Pattiselanno et al. 2019). They significantly contributed to local livelihood in Indonesia New Guinea, as both species provided consumers with the largest amount of meat and fat to consume and to trade in surrounding villages and towns. In this case, hunting introduced species not only benefits conservation of native species, but is also ecologically positive to the environment by reducing crop damage. Economically, this also indicates the profitability of hunting introduced species, because of the large amount of meat provided by each animal caught since ungulates are marketable commodities.

As hunting is an alternative activity, providing people with sustainable alternative livelihoods is important to reduce their dependence on wild meat for food and trading. The study site in the present study is populated by small-scale farmers who currently produce food, such as bananas, beans, yams, and vegetables, mainly for local consumption. Therefore, increasing agricultural production sustainably may be important for increasing cash incomes that may reduce people's reliance on hunting. Development efforts should also be focused on creating jobs for remote rural communities to reduce their dependence on the wildlife trade.

Livelihood strategies of local communities living along the coast of the Bird's Head Peninsula

All respondents admitted to hunting when there were no activities on the main job. The situation in coastal Indonesian Papua is similar to that found in other parts of the tropics (Wang et al. 2022; Bose 2023). Farmers find it challenging to generate enough revenue to sustain families when there is limited access to markets for selling agricultural produce. According to Nasi et al. (2008), farming is more likely to be lucrative than hunting in villages close to roadways and have been inhabited for a long period. Rural farmers in other tropical locations supplement income by hunting part-time.

West Papuan farmer-hunters hunt part-time to augment cash crop revenues, similar to any other forest inhabitant (Mendelson et al. 2003). According to Nasi et al. (2008), many people in Southeast Asia depend on wildlife resources as a safety net to get through difficult times such as unemployment, family illness, crop failure, or a source of supplementary cash for specialized requirements including funerals, festivals, or school fees. Another study by McNamara et al. (2016) and Schulte-Herbrüggen et al. (2017) indicated that most hunters in Ghana were farmers who hunt for family food and bushmeat market demand in urban areas. In Latin America, especially in the Central Amazon of Brazil, residents rely on agriculture and hunting to provide animal nutrition for families (Chaves et al. 2017). Workers earned the majority of income from full-time jobs and supplemented income with part-time work.

Due to the extremely impoverished state, the workers mix formal and informal activities to supplement income (Naranjo et al. 2004).

In this study, the practice of hunting as a side activity was indicated by the frequency and agricultural land owned by hunters (Table 2). Hunting was only performed when hunters did not carry out the main job, or not working in the gardens. Gaining more income opportunities through hunting provided extra money for the families. The data obtained indicates that there were no fully commercial hunters in the study villages. However, the trend of selling kills at the market indicated that the hunters were taking advantage of the coastal market need for wild meat. Due to poor pricing and difficulties in marketing agricultural products, part-time hunters turn to bartering wild meat for additional revenue. A recent study by Pattiselanno et al. (2020) proved that the trade chain of wild meat along the coast of the Bird's Head Peninsula supports income generation for local livelihoods. Wildlife products are lucrative commodities compared to other products since the price-to-weight ratio of wild meat is often higher than that of any agricultural product (Williamson 2002; Nasi et al. 2008).

Hunting practices along the coast

Hunting was primarily practiced for food supply in the home, but also significant for trade. In general, croplands enable the production of substantial amounts of carbohydrates, in this case, tuber crops and bananas, for people engaged in agriculture, such as the coastal villages. These farming practices do not quite meet household needs for sources of animal protein (Dai and Hu 2017; Nielsen et al. 2017; Evans et al. 2020; Gaüzère et al. 2020). About 40% of the respondents admitted to hunting primarily for commercial motives. Although there is no institutional market for wildlife products, hunters can earn money by selling wild meat to dealers. There was legitimate trading in several bird species and wildlife items including deer jerky and antler at traditional markets in Manokwari (Pattiselanno et al. 2020). Wild meat was also transported and exchanged in urban areas from rural regions (Pattiselanno et al. 2020).

Given that different hunting tactics produce a variable number of target animals, the most suited strategy may be used for unique species-specific behaviors. More specifically, traps were used to kill wildlife such as deer and pigs. Along deer and pig trails, 20 to 200 snare traps were installed. The traps were checked and captured animals were removed regularly, typically while visiting gardens. Trapping, which is prevalent in the study communities, demonstrates how hunters maximized hunting returns for business purposes. According to Fa and Brown (2009), using traps is the most effective method to catch a large number of animals. Passive hunting by trapping is also less expensive and time-consuming than more aggressive tactics. It may also be integrated into a timetable based on farming operations and used in a variety of settings. Trapping requires little or no money since traps and snares may be made using forest resources and reusable nylon or ropes. This allows hunters to simply and cheaply build vast numbers of traps (Fa and Brown 2009). More importantly, creating traps needs initial effort but does not necessitate active animal pursuit (Lee 2000).

Hunting was intimately tied to other means of subsistence as hunters had other jobs and practiced hunting when not working. This conclusion is consistent with the indigenous Buglé hunters of Panama, who hunt in spare time outside of agricultural labor employment (Smith 2005). An unofficial timetable was discovered whereby weekly visits by traders from the closest town were made to the villages to purchase meat. Therefore, to produce meat for the town market demand, hunters also worked weekly. Pangau-Adam et al. (2012) claimed that hunters performed hunting once a week in the northeastern regions of Papua, and different durations of time were committed due to the practice being on a part-time basis. Hunters in Arunachal Pradesh, north-east India, had no set hunting schedule. Hunting excursions, on the other hand, were more frequent and may have followed a timetable during village festivals and other activities (Aiyadurai et al. 2010). It may also be used to determine, hunting tenure, the number of animals movement, and the ecosystem condition (Stammler and Ivanova 2020; Tukuboya et al. 2024).

Tropical environments vary widely in terms of the wildlife communities supported and the human stresses faced. Increased agricultural land expansion is a common response to fast-expanding rural human population densities (Pattiselanno 2015). Game hunting was impacted by the fact that varied land tenures supported various prey species. Smith (2005) reported that garden hunting was a productive activity that supplemented many other parts of the hunter economy and may become increasingly unviable as the focus shifts further to main forests. Mature woods were favored in Northeast Gabon because visibility is better than other tenures such as secondary regrowth, agricultural fields, swamps, marshy forests, and rivers (Van Vliet and Nasi 2008).

Prey species were comparable across villages, with deer and wild pigs dominating (Table 3). This demonstrates the value of both species in terms of trade and consumption. This study did not record the spiny bandicoot, northern cassowary, Papuan hornbill, or Pinon's imperial pigeon. The hunters admitted to only focusing on specific species that contributed considerably to household livelihoods for both trade and food.

In conclusion, the survey showed that both subsistence and commercial hunting were common across the areas of the Bird's Head Peninsula. Hunters with different occupations hunted part-time, and farmers were the most dominant occupations. Farmer-hunters with large land holdings spent less time hunting, while the integration of wildlife utilization into the market increased the interest to hunt, alternately supporting income generating across the study sites. Passive hunting by trapping was found to be important because it is not time-consuming, and can also be incorporated into a schedule based on farming activities to protect cropland. Furthermore, the reset traps may be also used on previous traps while working in the agriculture plots. This study found that the requirement for an animal protein source to supply family consumption and the

bushmeat market demand, to some degree had a significant impact on the hunting practices across the lowland coastal forests. Introduced species such as deer and wild pigs have a higher economic value, with both meat and fat playing a crucial role in meeting the family animal protein need.

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