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Hunting introduced species in Indonesia New Guinea

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Abstract. *Pattiselanno F, Tokede MJ, Arobaya AYS, Mardiatmoko G, Pattiselanno AE. 2023. Hunting introduced species in Indonesia New Guinea. Biodiversitas 24: 3045-3050.* Hunting in tropical forests is mostly performed to obtain animal protein sources, generate income, and enact cultural activities. However, it is acknowledged that hunting was conducted indiscriminately, killing both native and introduced species. This study aimed to describe hunting activities along the lowland coastal forests in Tambrauw Districts. Fieldwork was carried out between June 2011 and December 2012 in eleven villages across the Abun and Amberbaken sub districts of Tambrauw Districts, Papua Barat Province of Indonesia. Information about hunting was gathered through interviews with 220 hunters (focus respondents; 20 hunters in each village). Therefore, to gain an overall picture of hunting in the sampled villages, we distributed 100 questionnaires, not including those focal respondents, and 800 were returned from 11 villages. This study revealed hunting for trading (49%) compared to consumption (44%) and the rest (7%) hunting for others (festive, pest, and trophy). The hunting is classified as very frequent (2-3 days per week) by 10%, frequent (weekly and fortnightly) by 41%, and rarely (monthly) by 49% of hunters. Active techniques used were bows and arrows, spears and blades were primarily used by 38%, and hunting with dogs was 29% by inhabitants in the studied villages. On the other hand, passive hunting using snares and guns were used by 28% and 5% of hunters, respectively. Hunters reported nine main prey species had been hunted, and the prey consisted of six mammal and three bird species. Two of the nine species were introduced species, i.e., rusa deer and wild pig; they provided the largest amount of meat and fat and were economically profitable. Other native species were also hunted, although not much as introduced ones. The average catch per hunting trip was 2 individuals (2.42 ± SD 1.93). In this study, hunting introduced species is important because it is more profitable while protecting the native species or those of conservation concern.

Keywords: Hunting, Indonesia New Guinea, introduced species, livelihoods, wild meat

INTRODUCTION

Wild meat is defined as non-domesticated terrestrial mammals, birds, reptiles, and amphibians harvested for food (van Vliet et al. 2019a). Wild meat has been a food source for people worldwide since prehistory (Barton et al. 2012). It is an important part of the diet of contemporary societies, particularly in tropical and subtropical areas, where it contributes to food security, nutritional diversity, and personal well-being (Brashares et al. 2014; Alves and van Vliet 2018). Wild meat also contributes significantly to local livelihoods for many forest-dwellers around the world (Milner-Gulland et al. 2003; van Vliet et al. 2015), and cultural aspects (Milner-Gulland et al. 2003; Lescuyer and Nasi 2016; Nielsen et al. 2016; Schulte-Herbrüggen et al. 2017).

Previous studies showed that hunting in the Indonesian New Guinea is conducted for one or a combination of different purposes. Sometimes hunting is conducted for cultural purposes or solely for domestic consumption, but it also provides a significant proportion of peoples' income (Pangau-Adam et al. 2012; Pattiselanno and Lubis 2014; Pattiselanno and Mambai 2015; Pattiselanno and Koibur 2018; Pattiselanno et al. 2019; Pattiselanno et al. 2020; Arobaya et al. 2021).

Robinson and Bennett (2000) explained that increasing the use of wild meat for human consumption contributes significantly to the harvest rate. It is calculated that the annual harvest rate of wild meat is 1-5 million tonnes in Central Africa (Endamana et al. 2016), 67,000-164,000 tonnes in the Brazilian Amazon, and 23,500 tonnes in Sarawak. In the Crater Mountain Wildlife Management Area - CMWMA, Papua New Guinea, Mack and West (2005) found during a seven-month study that a total of 696 individual vertebrates were hunted, representing 135 species with a total biomass of 1.84 tonnes. While there is no precise estimation of the amount of wild meat taken to the urban market, it is significant in North Sulawesi, with trading estimated at more than 90,000 animals per year to supply their urban market (Clayton and Milner-Gulland 2000). In Papua New Guinea, many species are hunted across various ethnic groups in different areas. Several species of mammals and birds were hunted in CMWMA (Mack and West 2005). More than 80% of animals hunted in these areas were wild boar, cuscus, tree kangaroo, echidna, and cassowary (Johnson et al. 2004).

Studies across Indonesia New Guinea indicated that wildlife hunting was carried out to support local livelihoods (Pangau-Adam et al. 2012; Pattiselanno and Lubis 2014; Pattiselanno and Mambai 2015; Pattiselanno and Koibur 2018). Hunting was conducted indiscriminately, killing native and introduced species (Pattiselanno 2006; Pangau-Adam et al. 2012). Introduced species such as deer and wild pig were mostly sold for their meat (Pattiselanno 2006; Pangau-Adam et al. 2012), and native species like bandicoot, cuscus, cassowary, tree kangaroo, were locally consumed (Pattiselanno and Koibur 2018), while parrots, amphibians, and reptiles sold as pets (Pangau-Adam et al. 2012; Natusch and Lyons 2013).

However, relatively little is known about the conservation status and whether either species target is native or introduced. In addition, there is growing concern that where the trade in wild meat occurred, ungulates (including wild pig and deer) are important because it is profitable (Pangau-Adam et al. 2012; Luskin et al. 2014; Pattiselanno et al. 2019; Pattiselanno et al. 2020). Although, a study by Chandru et al. (2020) indicates that ungulates play an important role in seed dispersal. Here, we aim to describe the hunting activities and identify hunted species and their conservation status to understand better the relationship between hunting prey and local livelihoods at the Bird's Head Peninsula (BHP) in Indonesian New Guinea and supposed to be projected on a wider dimension, including Asia and the Pacific.

MATERIALS AND METHODS

Study area

The study site is located in Abun and Amberbaken sub districts in Tambrauw Districts on Papua's Bird's Head Peninsula, approximately 200 km northeast of Sorong (Figure 1). Fieldwork was carried out between June 2011 and December 2012 through the general village and hunting surveys. We studied four villages in Abun: Saubeba, Warmandi, Wau, and Waibem, mainly from Karon ethnic group. At the same time, seven Amberbaken villages dominated by Mpur ethnic group were Arupi, Wekari, Saukorem, Wasarak, Wefiani, Samfarmun, and Imbuan. The study site has a wet, tropical climate subject to the seasonal northwest monsoon from November to March and southeast trade winds from June to September. Rain falls in most months in Tambrauw, although drier weather is experienced in May and November. Temperatures are uniformly high in the lowlands, ranging from 23 to 30°C, decreasing with elevation (Figure 1).

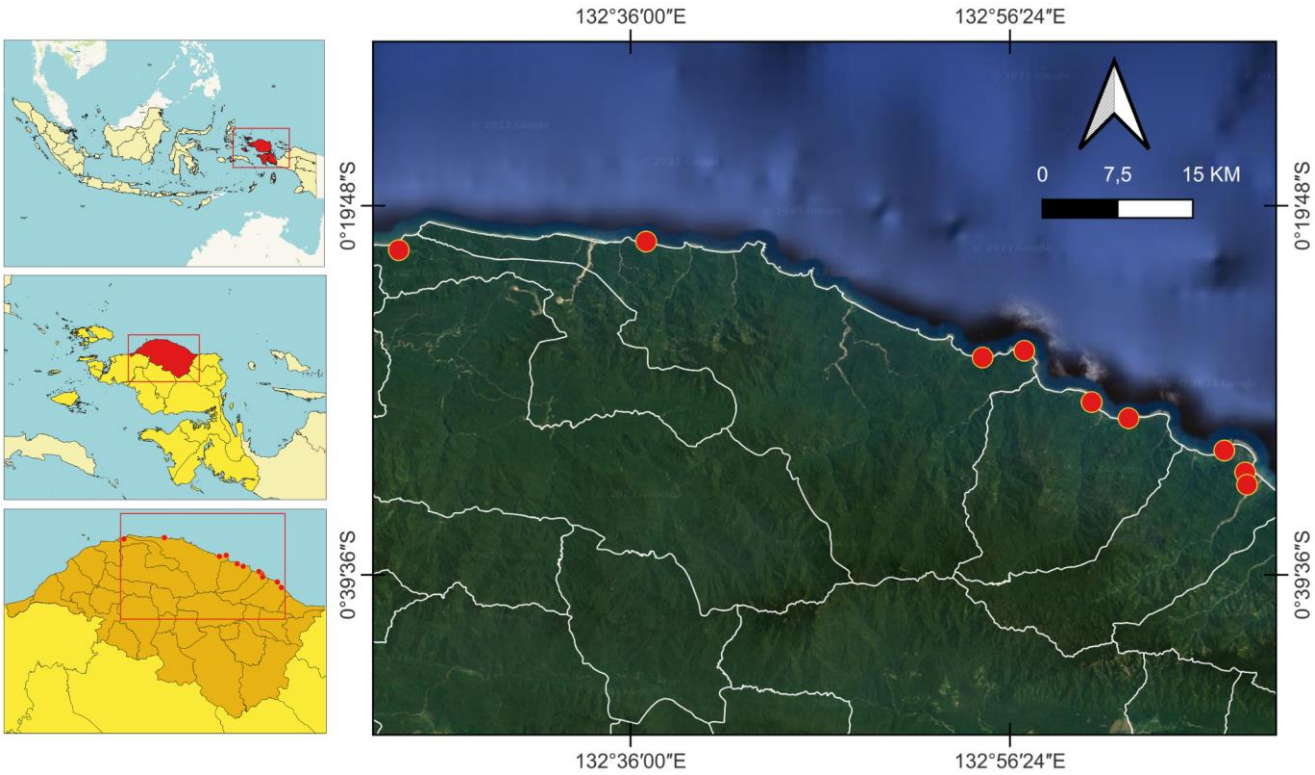

Figure 1. The map shows the location of the study sites on the Bird's Head Peninsula, Tambrauw Districts, West Papua, Indonesia. The land areas in Abun and Amberbaken sub districts are part of the North Tambrauw Nature Reserve

Procedures and samplings

Data collection was done through general village surveys to get an overview of the village, the total population, and the main occupation of the community. In addition, the hunting survey was conducted to obtain data on their dynamics. We interviewed 220 active hunters (20 hunters as focus respondents in each of the 11 villages) to gain information on the nature of hunting within the study sites, including the hunting purpose, techniques, targets, and returns (captured animals). Only prey species brought home from the most recent hunting excursion (within three weeks) were recorded before the interviews. Focal respondents were selected at the suggestion of the village chief or secretary, as they knew better those who actively hunt in the village. Focus respondents were interviewed using the modified Wildlife Conservation Society hunting questionnaire (Rao et al. 2005). In addition to gaining an overall picture of hunting in the sampled villages, we distributed a total of 100 questionnaires in each village - a total of 1,100 questionnaires in all villages to gather information from a sample of respondents (excluding the focal respondents) and 800 were returned, a participation rate of 73% of respondents.

The information was triangulated through informal discussions and interviews with other hunters, housewives, and those involved in meat trading. We had two sources of background information to verify the number of animals brought home from each participating hunter. Then, following Fa (2000), information from all interviews (220 active hunters as focal respondents and 800 random respondents (who are not hunters) was used to understanding the nature of hunting across the sites, prey species, their conservation status, and contribution to local livelihoods.

Data analysis

All the observation results obtained in this study were analyzed using descriptive statistics. The data obtained were analyzed and displayed in graphs, figures, and tables. Furthermore, the contextual approach was used to explain the situation in the field to complete the description of the study sites. This study received human research ethics approval from the James Cook University (JCU) Human Research Ethics Committee (Approval number: H4203).

RESULTS AND DISCUSSION

Hunting practices

People from villages in both sub districts hunted for trading (49%) compared to consumption (44%), and the rest (7%) hunted for others (festive, pest, and trophy). Hunting was conducted very frequently (2-3 days per week) by 10%, frequently (weekly and fortnightly) by 41%, and rarely (monthly) by 49% of hunters. Active techniques (bows and arrows, spears and blades) were primarily used (38%), and dogs (29%) by inhabitants in the studied villages. Both passive hunting - snares - and hunting with guns were used by 28% and 5% of hunters. Techniques used in hunting (Figure 2a, b, c, d) depended on the prey they hunted - techniques used adapted to hunting target. Active hunting using spears, blades, bows, and arrows was the most popular technique (391 ± SD 6.14) compared to passive technique using snares (280 ± SD 11.11). Native Papuans use traditional hunting weapons made from forest materials. Hunting with guns was the least used in the sites (53 ± SD 2.22). In addition, some hunters bring dogs to chase and catch animals hunted (296 ± SD 5.13).

Target animals

Hunters reported that nine main prey species had been hunted during the three weeks before the interviews. The prey comprised six mammal and three bird species (Table 1). Two of the nine species were introduced, Rusa deer (*Rusa timorensis*) and wild pig (*Sus scrofa*), while others were native species. Although deer are introduced species, it is protected under Indonesian Law as it is the native Indonesian deer species whose population tends to decline in their natural habitat due to hunting. We had 44 respondents report not getting any results when hunting.

Moreover, several different hunting prey were acknowledged during informal discussions with hunters before data collection. However, species hunted across the study villages were similar, including Timor deer (*Cervus timorensis*), Wild pig (*Sus scrofa*), Dusky padamelon (*Thylogale brunii*), Grizzled tree kangaroo (*Dendrolagus inustus*), Common spotted cuscus (*Spilocuscus maculatus*), Spiny bandicoots (*Echymipera kalubu*), Northern cassowary (*Cassuarius unappendiculatus*), Papuan hornbill (*Rhyticeros plicatus*) and Pinon imperial-pigeon (*Ducula pinon*).

A **B** **C** **D**

Figure 2. A. Hunter setting the traps, B. Dog aids chasing and killing prey, C. Hunting weapons used by respondents in the study sites, D. Hunter using bow and arrow carrying prey

Table 1. Species hunted in the coastal villages along the Bird's Head Peninsula, West Papua, Indonesia

Scientific name of species	Common name	Hunting returns by hunters	IUCN status[1]	Protected status[2]
Rusa timorensis	Timor Deer	380	Vulnerable	Protected
Sus scrofa	Wild pig	320	Least concern	
Thylogale brunii	Dusky pademelon	17	Vulnerable	
Dendrolagus inustus	Grizzled Tree Kangaroo	0	Vulnerable	Protected
Spilocuscus maculatus	Common spotted Cuscus	101	Least concern	Protected
Echymipera kalubu	Spiny bandicoots	115	Least concern	
Casuarius unappendiculatus	Northern Cassowary	24	Vulnerable	Protected
Rhyticeros plicatus	Papuan Hornbill	19	Least concern	
Ducula pinon	Pinon Imperial-pigeon	0	Least concern	

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

The results brought home on the last hunting excursion (within three weeks) before the interviews were 37% or 380 ± SD 11.2 deer, 31% or 320 ± SD 6.29 wild pig, and 27% or 276 ± SD 7.33 native species. These native species, including Dusky padamelon, Grizzled tree kangaroo, and Common spotted cuscus, with the average catch per hunting trip was 2 individuals (2.42 ± SD 1.93). Although there is no formal market for wildlife products, selling wild meat to traders provides cash to the hunters. We recorded 44 hunters, or 4%, who experienced returning home without catching prey. In this study, deer and wild pig meat were the most sold products in all sites. Deer and wild pigs were also dominant species used in trading as they provided the largest amount of meat to supply wild meat to consumers in surrounding villages and towns. The local price per kilogram was IDR 25,000 (US$ 1.89) for deer meat and IDR 15,000 (US$1.13) for wild pig meat.

Discussion

The nature of hunting

Our survey showed that both subsistence (mostly for consumption) and commercial (for trade) hunting were common across the areas of Bird's Head Peninsula. We also recorded cultural hunting (obtaining wild animals' body parts for cultural accessories) and hunting for crop protection in the sites, but not much as subsistence and commercial hunting. Some respondents acknowledged that most crop damage in the study area was attributable to the foraging activities of wild pigs. Thus, hunting is generally conducted for one or a combination of different purposes. Sometimes hunting provides a supplementary income from selling meat or live animals; alternatively, hunting is simply for domestic consumption (Chaves et al. 2017; van Vliet et al. 2019b).

In this study, the most popular technique was active hunting using spears, blades, bows, and arrows. Culturally, hunting practices with arrows and bows is a hereditary activity from the ancestors (Pattiselanno 2006; Pattiselanno et al. 2015). The finding shows that hunters at these study sites mostly relied on traditional methods of hunting based on cultural practices. Normally, native Papuans use traditional hunting weapons made from forest materials. Various kinds of timbers, bamboo, lianas, palm leaves, and plant fibers are used to build traps, bows, arrows, and spears (Pattiselanno 2006).

Passive hunting by trapping is also important in our study because it's less time-consuming as the hunter does and does not actively search for animals than more active techniques. It can also be incorporated into a schedule based on farming activities to protect cropland and could operate across wide-ranging areas. Furthermore, the re-set traps can also use on previous traps during working in the agriculture plots. Trapping requires little or no money as traps and snares can be built from forest materials and nylon or ropes that can be reused; this allows hunters to produce large numbers of traps cheaply and easily. Importantly, building traps requires effort initially but does not require active pursuit of the animals. In addition, some hunters also used dogs to chase and catch animals, based on cultural practices in Papua (Pattiselanno 2006).

Currently, hunting with dogs and spears is the most widespread hunting practice. Using dogs in hunting is very helpful because dogs are a major support in finding and killing prey. For example, in the Crater Mountain Wildlife Management Area of the Eastern Highlands of Papua New Guinea, 42% of the kills were found with dog support (Mack and West 2005). Hunters believe dogs have a strong instinct to locate and kill prey across the study sites, especially the largest mammals (wild pigs). Occasionally, dogs also hunt cuscus; while the tree where the cuscus was playing was shaken, the dogs chased and caught the cuscus that fell.

Target species and their conservation status

The hunter's assessment of profitability determines the range of species taken. Deer and wild pigs, introduced species, are targeted because they provide a large amount of meat for subsistence and sale. Although the hunting targets vary in Papua, wild pigs and deer are the most widely distributed and commonly hunted species in all study sites (Pattiselanno 2006; Pattiselanno 2012). In addition, pigs are an extremely important source of hunted meat for traditional groups elsewhere in Southeast Asia and contribute significantly to traditional economies across the entire island of New Guinea (Hide 2003).

The people we studied were mainly hunting these introduced species. There was little evidence of the hunting of native species or those of conservation concern (Pattiselanno and Arobaya 2013). This may be because native species are more susceptible to hunting and have

experienced severe population declines. In addition to responding to biophysical changes such as road access, forest conversion, and demographic changes, wildlife communities (e.g., species composition including native species and relative abundance) are also changing within the new landscapes (Karim et al. 2020; Pattiselanno and Krockenberger 2021). Overall, our survey suggests that hunting is not exerting pressure on native species.

Moreover, the meat and fat from deer and pig are highly favored, and the animals are large, resulting in plenty of food per animal hunted. Wild meat was valued for its taste and offered variety in the household diet. The need for wild meat consumption as an animal protein source in the study sites is very important. These animals provide more meat for food and generate economic benefits (Greengrass 2016; Mendonça et al. 2016), an essential complement to local livelihoods. However, regarding cultural attitudes towards animal species Muslim fellows consume, pork is prohibited. In this case, meats with no religious restrictions were transported to the nearest district (Pattiselanno et al. 2020), where the meat was sold to ethnic non-Papuans, mostly Muslim, at the transmigrant settlements.

Hunters acknowledged that introduced species, deer and wild pigs, had more economic value than native species. Some hunters expressed how they worked with particular middlemen in a special relationship. In this case, the middlemen supplied hunters with string for snares and cigarettes. This situation is similar to those hunters in North Sulawesi, who tied to particular dealers because they provided them with string for making snares (Clayton and Milner-Gulland 2000). In reality, hunters with string for snares supplied by dealers looked for wild pigs or deer that were preferred for trading because they needed cash. In addition, native species caught during hunting are usually locally consumed in the villages.

Demand for introduced species

Our study proved that introduced species play an important role in supporting local livelihood in Indonesia New Guinea. Deer (average body weight 65 kg) and wild pigs (average body weight 75 kg) are the largest mammals in this region that supply meat and fat for trading and local consumption. Venison (deer meat) has no consumption restriction for Muslim fellows and is easy to diversify into other food products such as meatballs (*bakso*), jerky (*dendeng*), and floss (*abon*). On the other hand, pork is the required meat in particular cultural events provided for local consumption.

More commonly, animals were traded on dead, and hunters removed and used heads, bones, legs, and intestines before selling the meat. Those hunters who hunted for trading were still providing the family with lower-quality meat, including bones and other less valuable parts. In addition, the weight of the wild pigs was approximately 60%; dressed weights are animals' weight after evisceration, a weight loss of 40% (Albrechtsen et al. 2006). When animals were eviscerated, available carcasses for both species were 39 kg for deer and 45 kg for wild pigs. Given the local price per kilogram of IDR 25,000 for venison and IDR 15,000 for pork, hunters obtained IDR 975,000 (US$ 66) and IDR 675,000 (US$ 46) when selling one individual of deer and wild pig, respectively.

In conclusion, this study found that introduced species (deer and wild pigs) significantly contributed to local livelihood in Indonesia New Guinea. They provided consumers with the largest amount of meat and fat in surrounding villages and towns. Economically, introduced species were profitable, with the local price per kilogram being IDR 25,000 (US$ 1.89) for venison and IDR 15,000 (US$1.13) for pork.

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