The economic value of edible wild and semi-domesticated species sold in an urban market in Khon Kaen municipality in Northeast Thailand

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ABSTRACT: Previous research on wild food species in Northeast Thailand has focused mostly on their use by rural households, both as a source of food for their own consumption and as products that they collect to sell to gain cash income. Research about the marketing of wild products is limited, however, and studies of wild food species in urban markets are especially sparse. To help fill this information gap, this paper presents the results of an investigation of the economic value of all edible wild and semi-domesticated species of plants, fungi, and animals sold in urban markets in Khon Kaen municipality. This paper reports findings of a survey that was conducted during 2006 in Bang Lam Phu market, which is the central fresh market in Khon Kaen municipality, the capital of Khon Kaen province, in the Northeastern region of Thailand. The survey included identification of all species of plants, fungi, and animals being sold and recording of the quantities and prices of each species. The average daily value of sales for all 81 species of edible wild and semi-domesticated products in the dry season was 32,702 baht/day (US$ 919), which can be extrapolated to a total sales values for the whole 206 day long dry season of 6.7 million baht (US$ 189,231). The comparable figures for the 159 day long rainy season are 45,530 baht/day (US$ 1,279) for a seasonal total of 7.2 million baht (US$ 203,350). When these sample data are extrapolated to the whole year, the estimated total annual sales value of wild and semi-domesticated products in 2006 is almost 14 million baht (US$ 392,581). Although this is only an order-of-magnitude estimate, it suggests that wild and semi-domesticated foods have considerable economic significance in the urban context in Northeast Thailand. Of the 81 species sold in the market, plant products had the highest total annual value (7.7 million baht), followed by animals (5.7 million baht) and fungi (508,000 baht). Insects (2.3 million baht), crustaceans (1.6 million baht), and amphibians (1.5 million baht) accounted for most of the value of animal products sold over the course of the year. The number of species available in the market is affected by the seasons. In the rainy season, 44 species of plants were on sale with an average daily sales value of 32,007 baht. In the dry season, the number of species decreased to 35 and the average daily sales value declined to only 12,674 baht. Fungi were found only in the rainy season. Because all six species are completely wild they are now rare products with an average daily value of sales of only 3,200 baht. Fourteen species of animals were available in the dry season and 15 species in the rainy season but their average daily value in the dry season (20,028 baht) was considerably greater than in the rainy season (10,324 baht). Prices vary from a few baht per kilogram (for common plants like phak bung na) to more than one hundred baht per kilogram (some rare animals). There are also major differences in the total quantities of different species sold in the market ranging from only a few kilograms per year for some animal species to nearly 100,000 kilograms for the most abundant plant species. In general, there appears to be a negative correlation between sales prices (baht/kilogram) and total quantities of these products, so that those species in the most abundant supply fetch the lowest prices. Heavy urban demand for these products may also be a force encouraging rural people to try to domesticate high value species that are becoming increasingly rare and difficult to find in the wild. This study's finding of the high economic value of wild food products sold in an urban market suggests that more investment in research on domestication of these species may be justified. (**Keywords:** biodiversity, domestication, rural-urban interactions, urban food supply, urban marketing system, economic value of wild species)

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Introduction

This paper presents the results of a detailed investigation of the economic value of all edible wild and semi-domesticated products sold in urban markets in Khon Kaen municipality. Wild species are defined as species that grow under natural conditions without deliberate human management. Semi-domesticated species are formerly wild species that are now to a greater or lesser extent actively managed by humans.[2] Quite a number of species are in transition, being sometimes collected from the wild and other times produced under semi-domesticated conditions.

Wild foods are collected and consumed in many countries. Even in industrialized countries, wild foods are highly valued (e.g., truffles in France, maple syrup and wild rice in the United States, forest mushrooms in Japan), but these products are especially important in subsistence-oriented societies where they help to ensure food security during seasonal food shortages and also serve as a source of supplementary cash income for rural households. Urban people, many of whom have only recently migrated to the cities from rural areas and, thus, retain their taste for wild foods, also constitute a large and growing market (Vantomme *et al*. 2002). Therefore, it can be expected with some degree of confidence that the economic value of wild products will increase in the future because degradation of forests in every country in the region is diminishing their supply, thus leading to increases in their prices (Kono and Rambo 2004).

Earlier studies in Northeast Thailand have shown that wild products are highly valued by rural people, especially poor villagers, because they contribute to their food security (Moreno-Black 1994, Moreno-Black *et al*. 1996, Moreno-Black *et al*. 2000; Somnasang *et al*. 1986, 1988, 1998; Fujita 2000a, 2000b; Shibahara 2002). The Northeastern Region (Isan) is a very high-risk environment for farming because of poor soil fertility and unstable weather conditions. Although modernization is causing profound changes in rural livelihood systems as the region becomes increasingly integrated into the market economy, wild products continue to play a very important role in the livelihood strategies of rural households, both by providing food for their own consumption and also as a commodity sold in markets that now link subsistence-based communities to larger economic and political systems (Moreno-Black *et al*. 1996). Many types of wild foods collected in rural areas are being sold in markets in towns and cities for consumption by the region's growing urban population. Urban market demand is so strong that some farmers around Khon Kaen Municipality have actually begun to produce products (e.g., production of honey, raising of wild boars and frogs) that in previous times used to be collected from the wild (Shirai and Praweenwongwuthi n.d.).

Although many wild foods can be observed on sale in urban markets in the Northeast, little is known about the kinds, quantities, and values of these products. To help fill this gap in our knowledge, in 2005-2006, a detailed investigation was carried-out of wild and semi-domesticated species sold in urban

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[2] Some species that were identified by informants as being "wild" would appear to be domesticated species that have moved back into wild or semi-domesticated status. For example, star fruit (Averrhoa carambola) and tamarind (Tamarindus indica) have a long history of domestication but can voluntarily propagate themselves to some extent in upland fields and gardens in the Northeast. People who collect fruit from these volunteer trees consider them to be wild.

markets in Khon Kaen Municipality. The survey included identification of all species of plants, fungi, and animals being sold and recording of the quantities and prices of each species being sold in the urban markets. The diversity of wild and semi-domesticated species observed in the urban markets has been described in another paper (Shirai and Rambo n.d.). It was found that 81 species of edible wild and semi-domesticated species were on sale in the urban markets in Khon Kaen Municipality. In the present paper, the economic value of these products is analyzed.

Materials and Method

The Study Site

This study was conducted in Bang Lam Phu market, which is the central fresh market in Khon Kaen municipality, the capital of Khon Kaen province, in the Northeastern region of Thailand. The distance from Khon Kaen Municipality to Bangkok is around 450 kms on an all-weather road.

Khon Kaen was designated as the regional development center for Northeast Thailand by the Thai government in 1960. At that time, the municipality had a population of 19,591 persons (Mizuno 1981; Fukui 1988, 1993; Kuchiba 1990). By 2004, it had increased to 123,151 persons, making Khon Kaen Municipality one of the three largest urban centers in the Northeast. The total area of Khon Kaen municipality is 46 square kilometers (www.kkmuni.org/geninfo/info03/). According to statistical data, there are 78 industrial factories and shops in the municipality. Four government markets and seven private markets are identified by the municipal administrative office in 2003. (www.kkmuni.org/geninfo/info03/.) Preliminary investigations revealed that Bang Lam Phu wet market served as the central distribution point for most edible wild and semi-domesticated products being sold in the municipality. This made it possible to focus data collection for this study in Bang Lam Phu market.

Research Design

In order to be able to estimate the total value of edible wild and semi-domesticated products sold in the Bang Lam Phu market, it was necessary to collect detailed data on the kinds, quantities, and prices of all species available in the market over a full annual cycle. Ideally, data would have been collected from every vendor in the market on every night during the course of the year. Because resources were much too limited to permit such an intensive study it was necessary to devise a sampling plan for collecting data from a smaller number of vendors on a relatively limited number of nights in each of the main seasons.

Because the supply of different kinds of edible wild and semi-domesticated products to the market is affected by seasonal variation, the sampling plan had to include data collection in different seasons. Generally, the climate of Northeast region is differentiated into three seasons: Cool dry season, hot dry season, and rainy season. In 2006, however, the rains started unusually early so that there was no true hot dry season. Consequently, data collection was only done in the rainy season (from July until September) and the cool dry season (January and February).

For purposes of sampling vendors to interview, the Bang Lam Phu market was divided into three blocks, labeled as A, B, and C. Each block contained a manageable number of vendors to interview in a single night (around $\pm$ 20 people per night). Data were collected from vendors in each of the three blocks

on a rotating basis in sequences of 3 nights. Each of the nights and blocks for collecting data was randomly selected. To provide a hypothetical example, on the first night in a sequence, data might be collected from all the vendors in Block C, then, on the next night, all the vendors in Block A would be interviewed, and, finally, on the third night, data would be collected from all the vendors in Block B. In the dry season, interviewing was carried out on a total of 18 nights. Thus, the vendors in each block were interviewed on a total of 6 nights during this season. In the rainy season, interviews were done on a total of 12 nights, so that the vendors in each block were interviewed on 4 different nights. Data collected from the three different blocks in a sequence of three nights can be combined to provide an estimate of the total value of edible wild and semi-domesticated products sold in the whole market on a single composite "night." A total of six composite nights can be constructed for the dry season compared to four composite nights for the wet season.

Data Collection

On a given sample night, each vendor in the selected block was interviewed to ascertain all of the different kinds of wild products she was offering for sale. In order to identify edible wild and semi-domesticated products, each vendor was asked if these products had come from nature or not and then asked what they were called. Color photographs were taken for later identification species.? The quantity of each product, its purchase price and selling price, and the location from which it had been obtained, was also recorded as was the name and the place of residence of the vendor being interviewed. All the data obtained from each vendor were recorded on the spot on a standardized data collection sheet. When the situation did not permit a full interview, just the names and amounts of products were recorded.

Data Analysis

All data were entered into an Excel database. They were separated by day of collection, number of block, name and address of vendor, total amount, purchase and selling price, and source of product. Data collected in each of the 3 blocks in a sequence of 3 nights were then combined to represent the total values of all the different products in each major category (plants, fungi, animals) in the whole market on a single composite night. The totals for the six composite nights in the dry season were added together and divided by six to obtain average values for a single "typical" dry season night. Similarly, the totals for the four composite nights in the rainy season were added together and then divided by four to obtain average values for a "typical" rainy season night. The average total value for a typical dry season night was then multiplied by 206 (the number of days in the dry season in 2006) to generate an estimate of the total value of wild and semi-domesticated products sold in the market in the dry season. Similarly, the average total values for a typical rainy season night were then multiplied by 159 (the number of days in the rainy season in 2006) to generate an estimate of the total value of wild and semi-domesticated products sold in the market in the rainy season. The estimates for each of the two seasons were then combined to generate an estimate of the total value of wild and semi-domesticated products sold in the market in the whole year of 2006.

Results and Discussion

The Value of Edible Wild and Semi-domesticated Products Sold in the Urban Market

Table 1 presents information on the value of sales of all wild and semi-domesticated products in the Bang Lam Phu market. The average daily value of sales for all 81 species of edible wild and semi-domesticated products in the dry season was 32,702 baht/day (US$ 919)[3], which can be extrapolated to a total sales value for the whole 206 day dry season of 6.7 million baht (US$ 189,231). The comparable figures for the 159 day long rainy season are 45,530 baht/day (US$ 1,279) for a seasonal total of 7.2 million baht (US$ 203,350). When these sample data are extrapolated to the whole year, the estimated total annual sales value of wild and semi-domesticated products in the Bang Lam Phu market in 2006 is found to be almost 14 million baht (US$ 392,581). This is quite a large amount for products that are often referred to as "minor" products. Although this is only an order-of-magnitude estimate, it suggests that wild and semi-domesticated foods have considerable economic significance in the urban context in Northeast Thailand.

Although the absolute value of sales of wild food products in the Bang Lam Phu market seems quite large, it would be useful to know how it compares to the value of fully domesticated food species sold in the market in the same period. Unfortunately, however, no official statistics are available and vendors are unwilling to divulge information about their total sales figures to researchers for fear of tax problems.

Table 1. Total value of sales (in baht) of edible wild and semi-domesticated products sold in Bang Lam Phu market in 2006

	Plans	Fungi	Animals	amphibians	birds	crustaceans	fish	insects	mammals	mollusks	reptiles	Total
Average daily value of sales in rainy season	32,000	3,200	10,324	2,740	120	1,650	369	4,446	0	914	85	45,530
Total estimated value of sales (159 days)	5,089,113	508,736	1,641,358	435,660	19,080	262,350	58,671	706,835	0	145,247	13,515	7,239,207
Average daily value of sales in dry season	12,674	0	20,028	5,155	0	6,377	20	7,972	22	419	63	32,702
Total estimated value of sales in dry season (206 days)	2,610,782	0	4,125,789	1,061,930	0	1,313,683	4,120	1,642,232	4,450	86,314	13,060	6,736,571
Total estimated value of sales for whole year (365 days)	7,699,895	508,736	5,767,146	1,497,590	19,080	1,576,033	62,791	2,349,067	4,450	231,561	26,575	13,975,778

[3] The official exchange rate was US$1.00 = 35.6 baht on 6 March 2007.

However, it has been possible to obtain data on sales of fresh fruit and vegetables, fish, and meat at the Makro super store in Khon Kaen. The total value of sales of these products for the whole year of 2006 was 82,677,329 baht (US$ 2,322,397) (Chywai Wityakon, a senior Makro manager: Personal communication, 1 March 2007). Thus, the value of wild products sold in the Bang Lam Phu market is equal to approximately 17 percent of total fresh food sales in the Makro super store. Of course, Makro is just one of three super stores and 11 fresh markets serving the city, all of which also sell domesticated fruit, vegetables, meat, and fish, so that wild food products represent a much smaller share than this of total fresh food sales in Khon Kaen municipality. Nonetheless, this research definitely shows that edible wild and semi-domesticated food products are of considerable economic significance in the urban context.

As can be seen from Table 1, plant products had the highest total annual value (almost 8 million baht), followed by animals (5.7 million baht) and fungi (509,000 baht). Within each of these large biological categories, certain species contributed a disproportionate share of value.

Although 54 plant species were sold in the market, just 4 species (*Ipomoea aquatica Forssk., Bambusa arundinecea, Bambusa shreber* and *Arundinavia ciliata*) accounted for almost half of the total sales value of plants and 16 species account for over 90 percent of total sale value. *Ipomoea aquatica*, a water spinach that is locally called **"***Phak Bung Na*,**"** had the highest total value (1 million baht) of all 81 species. This vegetable is very popular in the Northeast. It can be eaten by raw or cooked, and especially the raw taste is a great match for the favorite local dish **"**Somtam Lao**"** (green papaya salad). This plant can be easily collected from paddy fields during the whole year. Many vendors prefer to sell this vegetable, because of the certainty that their customers will demand it. *Phak Bung Na* was observed on every night that we conducted the survey. Although this species can be cultivated, all of the *Phak Bung Na* found in the market was collected from the wild.

Bamboo shoots from several different species of bamboo had the second, third, and fourth highest values so they collectively contribute a very large share of total sales value of plant products. *Bambusa arundinecea* had the second highest total sale value (926,555 baht) while *Bambusa shreber* contributed the third highest amount (918,034 baht) and *Arundinavia ciliate* was the fourth most valuable plant species (816,863 baht). Bamboo shoots are the most representative indicator of rainy season in the market. Bamboo shoots sold in the Bang Lam Phu market are collected from a wide area that includes five provinces (Loei, Mahasarakam, Kalasin, Sakonnakon and Khon Kaen) as well as some of unknown origin that are shipped in from Bangkok.

Among the different groups of animals, insects (2.3 million baht), crustaceans (1.6 million baht), and amphibians (1.5 million baht) contributed most of the value of animal products sold over the course of the year.Among insects, the giant water-bug (*Mang Daa*) contributed the highest value (just under 1 million baht), followed by crickets (*Jing Lid*) at 617,000 baht, and eggs of red ants (*Kai Mod Dang*) at 502,640 baht. Basically, the collection of insects needs a lot of human labor. Most (83 percent) of all of the species of insects sold in the Bang Lam Phu market were collected from the wild, so the quantities available are always limited. Consumption of insects is a tradition for Isan people, so that customer demand is strong.

Land crabs contributed most of the value for crustaceans while small toads accounted for most of the sales value of amphibians.

Seasonal Variation in Availability and Values of Wild and Semi-domesticated Products

The number of species is affected by the seasons, and their values also reflect the volume in which they are sold. In the rainy season, 44 species of plants were on sale with an average daily sales value of 32,007 baht. In the dry season, the number of species decreased to 35 and the average daily sales value fell to only 12,674 baht.

Fungi were found only in the rainy season. All six species of mushrooms were completely wild because there is no technique for raising them in domestication. Thus, they are now rare products with an average daily value of sales of only 3,200 baht.

Fourteen species of animals were sold in the dry season, and 15 species in the rainy season, but they had a considerably greater average daily value in the dry season (20,028 baht) than in the rainy season (10,324 baht). This reflects the seasonal availability of the products. For example, insect products, such as giant water-bugs and eggs of red ants, are available only in dry season, and the average daily value of sales are quite high. Crickets, land crabs, and small toads are available in both seasons, but the quantity is quite different between the seasons, so these products pushed up the total estimated value of sales of animals in the dry season.

The Value of Wild and Semi-Domesticated Products in Relation to Quantities Available in the Market

Prices for different edible wild and semi-domesticated species vary from a few baht per kilogram for some common plants like *phak bung* to more than one hundred baht per kilogram for some rare animals. There are also major differences in the total quantities of different species sold in the market, ranging from only a few kilograms per year for some animal species to nearly 100,000 kilograms for the most abundant plant species.

Not surprisingly, unit prices are closely related to total quantities. **Figure 1** and **2** are scatter diagrams showing the relationship between total sales volume and sales prices per kilogram of the 54 species of plants and 18 animal species for which full data are available. Because only 6 species of fungi were recorded, no scatter diagram is presented for these species. In general, there appears to be a negative correlation between sales prices (baht/kilogram) and total quantities of these products, so that those species in the most abundant supply fetch the lowest prices. This relationship is clearest with regards to plants. Most plant species are sold in large quantities but have low prices per kilogram. All fungi species are available in small quantities and command relatively high prices. Although overall the same relationship between quantity and price is evident for animal species, the relationship is least clear for them. Most animal species are available in small quantities and sell for high prices but some species that are available in quite large quantities also command relatively high prices.

Species with high unit prices that are only available in low quantities would seem to deserve priority attention for domestication experiments. The species that particularly stand out in this regard are *Pak Waen* (Water clover), *Pak Kuud* (Vegetable fern), *Pak Nam* (*Lasia spinosa (L.) Thwaites*), *Dok Sang* (Wood-apple), *Pak Chi Nam* (*Oenanthe stolonifera (Roxb.) DC.*), *Ked Ma Noi* (*Cyclea barbata Miers*),

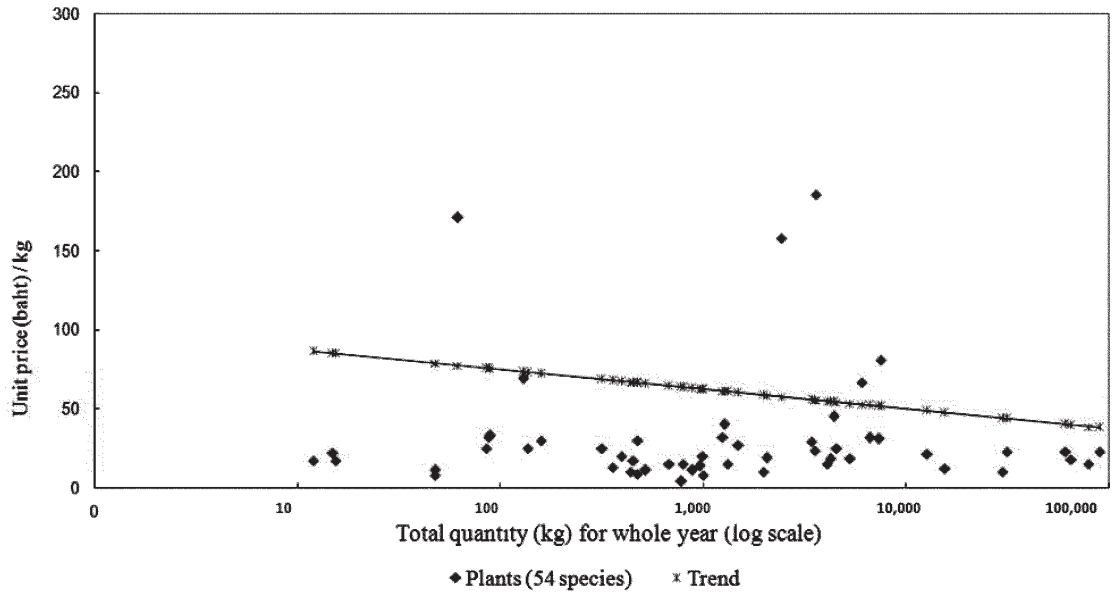


Figure 1. Relationship of quantity and unit sales prices of edible wild and semi-domesticated species of plants sold in the Bang Lam Phu market in 2006.

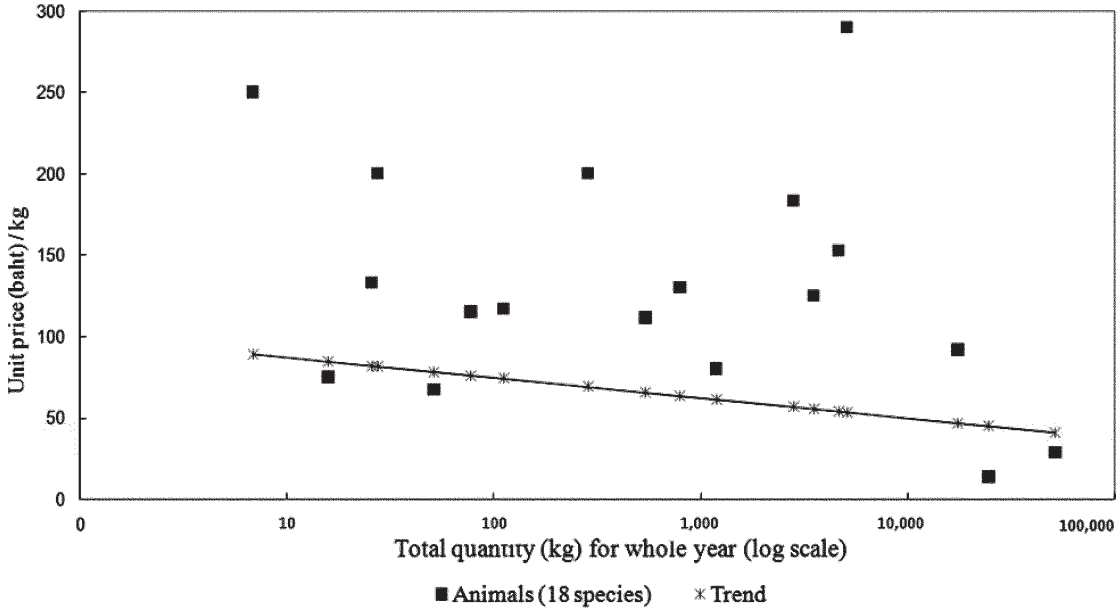


Figure 2. Relationship of quantity and unit sales prices of edible wild and semi-domesticated species of animals sold in the Bang Lam Phu market in 2006.

Pak Tob (Arrow-leaf monchoria), *Ta Kob Kwai* (Rukam), *Pak Sa Ngea*, *Man Sa Khu* (West Indian arrow-root), *Pla Lai* (Swamp eel), *Nu Puk* (Lesser rice field rat), and *Nu Tong Kaow* (Rice-field rat).

Conclusions

This research has revealed that wild and semi-domesticated food species are important commodities in the urban markets of Khon Kaen Municipality. The 81 edible plant, fungi, and animal species are the source of many different foods, including vegetables, fruit, and meat, that make an important nutritional contribution to the diet of urban consumers. With an estimated total sales value of almost 14 million baht per year, these products are also of considerable economic importance, not just for urban consumers who purchase them but also for the rural people who supply them to the market and the vendors who sell them there. Heavy urban demand for these products may also be a force encouraging rural people to try to domesticate high value species that are becoming increasingly rare and difficult to find in the wild. Unfortunately, there has been very little research by government agencies or universities aimed at fostering domestication of wild species. This study's finding of the high economic value of wild food species sold in an urban market in Khon Kaen municipality suggests that more research aimed at speeding domestication of these valuable species is justified.

Acknowledgments

This paper is based on research conducted by the author in partial fulfillment of requirements for the Masters degree in the Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University. Viriya Limpinuntana, Aran Patanothai, and Suchint Simaraks have provided valuable advice on this research. Sam-ang Homchuen assisted in identifying the scientific names of wild and semi-domesticated species. We are grateful to all of the vendors in Khon Kaen municipality markets for their participation, patience, information and hospitality and would also like to thank Patarapong Kroeksakul for his assistance as interpreter and also like to thank Analaya Nansaior for her help in processing all of the data.

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