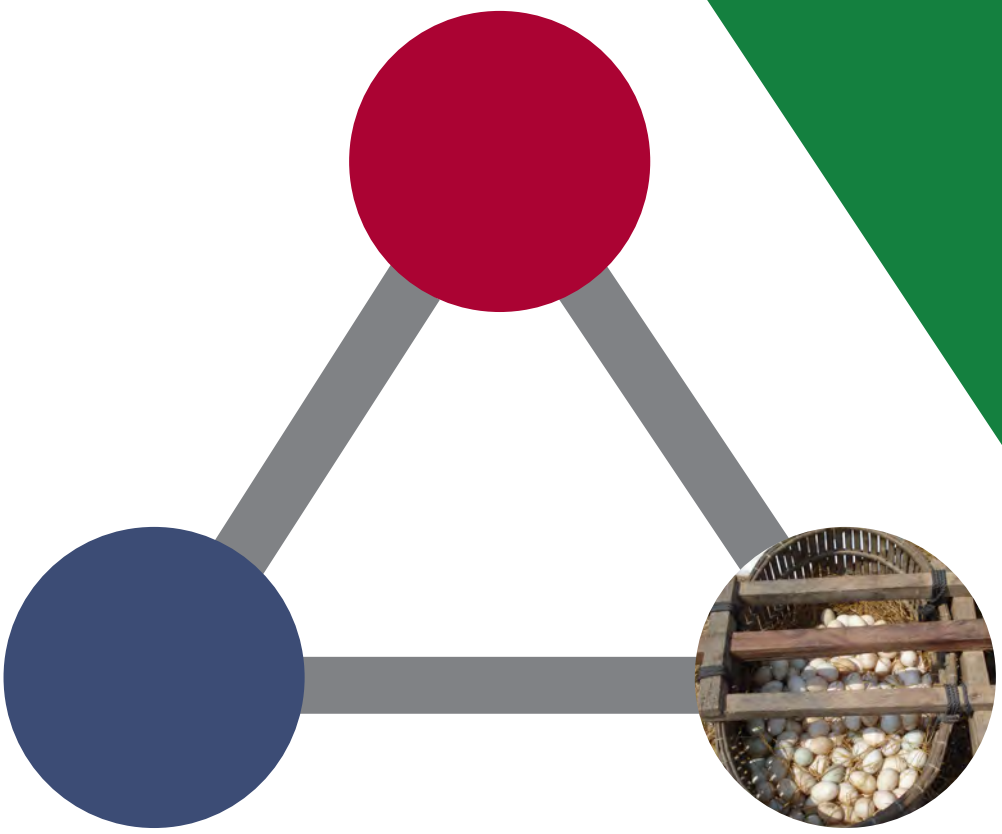
Investigation of duck production and hatcheries and duckling supply in Cambodia



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Contents

Tables

Photos / Figures / Maps

Acronyms

AI	avian influenza
CelAgrid	Centre for Livestock and Agriculture Development
DOD	day-old duckling
FAO	Food and Agriculture Organization of the United Nations
GPS	global positioning system
HPAI	highly pathogenic avian influenza
NaVRI	National Veterinary Research Institute
NGO	non-governmental organization
OAHP	(Provincial) Office of Animal Health and Production
SE	standard error
SPSS	statistical package for social sciences
VAHW	village animal health worker
US$ 1	4 100 Riel

Acknowledgements

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The Centre for Livestock and Agriculture Development (CelAgrid) and the Food and Agriculture Organization of the United Nations (FAO) would like to express their sincere gratitude to the 144 duck farmers, 39 hatchery operators, one trader, four market officers and 21 poultry meat and egg sellers in ten provinces and cities of Cambodia who spent their valuable time providing information to the survey team.

Summary

Duck production

This investigation of duck production and hatcheries and duckling supply from neighbouring countries was carried out from 15 January to 10 February 2009 with financial support from the project "The promotion of strategies of HPAI prevention and control that support sustainable livelihoods and protect poultry breed biodiversity"(GCP/INT/010/GER). Its overall objective was to investigate duck production and hatchery management, health practices, and importation in eight provinces of Cambodia. Interviews with a total of 144 duck production farms, 39 hatchery operations and one duckling importer were complemented by discussions and observation. The study also mapped the location of another 51 duck production farms and nine hatchery operations using global positioning system (GPS) coordinates.

The average age of the duck farmers was 39.6 years. Of the 144 interviewed, 3.4 percent are rich, 75.7 percent are medium-income, 20.1 percent are poor, and 0.7 percent – in Siem Reap – are very poor. Most respondents are rice-based farmers for whom ducks are important in their livelihood activities.

About 80 percent of the farms raise ducks in full confinement in the rainy season, with 56.2 percent grazing them in the dry season. Only 6.9 percent keep Muscovy ducks, and a few keep geese. The average distance from duck grazing areas is 2 461 m, ranging from 10 m to 20 000 m. Ducks are grazed on paddy fields, lakes, ponds, open water and around residential areas. The main reason for duck grazing is to reduce the need to supply feed.

Feed is the most important cost for duck production, reported by nearly 95 percent of farmers. About 61.8 percent of duck farmers use commercial feed, 59.7 percent use paddy rice, and 30.5 percent make their own concentrated feed, with 24.3 percent using rice bran, 7.6 percent freshwater fish, and 6.2 percent fishmeal.

Almost 90 percent of respondents said that they raise ducks for eggs, 18 percent for meat and 1.4 percent for breeding. 59 percent of farmers keep Khakhi Campbell ducks, 4.9 percent Peking, 27.1 percent local long-neck Krolas, 8.3 percent Sampauv, and 2.7 percent Angkam. No significant changes in duck breeds were recorded during and after avian influenza (AI) outbreaks. Regarding duck numbers, 60.4 percent of farmers keep between 200 and 1 000, 38.9 percent keep more than 1 000, and 0.7 percent keep fewer than 200.

The average duck farm size is 2 377 m2, with 52.1 percent located near residential areas, 35.4 percent in paddy fields, 9.7 percent near open water, 1.4 percent around ponds, 0.7 percent near lakes, and 0.7 percent near village roads. 74 percent of duck farmers do not have a set time for changing location, 21.5 percent never change, 2.8 percent change once a year, and 2 percent change once every two years. About 53 percent of farms are located in lightly populated rural areas, 31.9 percent in isolated areas, and 15.3 percent in densely populated areas.

Regarding the sources of ducklings, 67.2 percent of farmers obtain them from breeding farms, 12.1 percent from dealers, 3.4 percent from neighbours, 3.4 percent from markets, and 18.9 percent hatch their own. The main problems are diseases, including duck plague, fowl cholera, weak leg disease, water poisoning, excess heat and lack of water. Farmers obtain assistance when they have problems: about 50.9 percent are helped by district vets, 25.5 percent by provincial vets, 15.4 percent by village animal health workers (VAHWs), 1.9 percent by non-governmental organizations (NGOs), and 3.9 percent by private vets. Only 5.5 percent of duck farms are registered.

About 90 percent of duck farmers burn or bury dead ducks, 11.1 percent cook them, 0.7 percent allow them to be eaten by pets, and 0.7 percent use them for compost. About 13 percent of duck farmers said that AI had had an impact on their duck businesses. When their ducks got sick, 84.2 percent said they did not tell anybody.

Eighty-seven percent of farmers said that they clean their duck sheds. About 94 percent use brooms, 15.9 percent spray water, and 21.4 percent use disinfectant. About 55.3 percent put the litter on their own land, 36.1 percent store and sell it, 15.5 percent use it as fertilizer, 3.1 percent burn it, and 0.8 percent feed it to fish. For pest control, 18.7 percent use poison and 43.7 percent use traps.

All the duck farmers (100 percent) received AI information, mostly from radio and television. To prevent the spread of AI to humans, duck farmers said that they wash their hands after touching the birds, vaccinate, restrict the entry of visitors, avoid contact with wild birds, avoid raising mixed species, disinfect, control the origin of their ducklings, and do not introduce new birds into their farms during outbreaks. After the AI outbreak, nearly 47 percent had difficulty selling eggs, 31.9 percent had difficulty selling ducks, 17.4 percent said that their movement of ducks was restricted, 14.6 percent had difficulty getting ducklings, and 11.8 percent spent more on fencing and feed.

Nearly 83 percent of farmers sell their ducks to intermediaries, 30.4 percent to villagers, 26.1 percent to traders, 13.0 percent to market sellers, and 13.0 percent to restaurants. For egg sales, 66.4 percent of farmers use intermediaries, 25.0 percent sell to villagers, 21.1 percent to traders, 28.9 percent to market sellers, 13.4 percent to hatchery operators, and 0.8 percent to restaurants. For 70.1 percent of farmers the buyers of their eggs and duck meat come to the farm, while 29.8 percent deliver the eggs and meat themselves. Only 9.0 percent of farmers have verbal contracts with buyers. 27.2 percent reported Sampauv as the most popular duck breed, and 72.8 percent reported Khaki Campbell. On average, each producer sells 597 Sampauv ducks and 211 633 eggs a year, or 923 Khaki Campbell ducks and 279 543 eggs, before and after the AI outbreaks. Over the previous year, the duck farms had spent an average of 1.2 million riel to construct duck houses, 4.524 million riel for ponds, 47 million riel for feed, 0.4 million riel for equipment/tools, 1.3 million riel for water supply, 3.3 million riel for labour, and 0.8 million riel for other expenses. For 72.9 percent of farmers the source of capital is their own resources, 49.3 percent obtain capital from banks, 29.4 percent from private lenders, and 3.5 percent from relatives.

About 55 percent of duck farmers plan to increase the scale of their duck production over the next 12 months, 7.6 percent to change the type of production, 22.3 percent the source of their ducklings, 14.2 percent their marketing of products, 31.2 percent their location, and 6.2 percent want to stop duck production altogether. To improve their production duck farmers need technical advice, access to credit, marketing assistance, health services and access to land for pen construction.

Hatchery operations

The average age of hatchery operators was 43.6 years, ranging from 25 to 68 years. About 67 percent of hatchery owners are poor, 30.7 percent are medium-income, 2.5 percent are very poor, and 2.5 percent are rich. About 23 percent of hatcheries hire labour from outside. Husbands are responsible for buying eggs, while wives sell ducklings and embryonic eggs.

An average of 5 500 eggs are incubated at one time, with a capacity to incubate 515 616 eggs per year, resulting in 380 600 embryonic eggs or 295 375 ducklings. Among the 39 hatcheries, 79.5 percent use traditional incubators and 20.5 percent electric ones. Regarding sources of eggs for incubation, 5.6 percent of hatchery owners obtain them from their own production, 18.2 percent from neighbours, 66.7 percent from breeding farms, 9.0 percent from dealers, and 0.4 percent (one hatchery) from a duck farm that offered a loan. About 97 percent of hatchery operators reported that they select the eggs for hatching, based on size for 82.0 percent and on shape for 66.7 percent.

About 74 percent of hatcheries produce ducklings, of which 23.9 percent are distributed through collectors/intermediaries and 76.0 percent directly to duck raisers. About 7.0 percent of ducklings are sold within the village, 17.2 percent within the district, 27.6 percent within the province, and 48.3 percent in other provinces. None of the surveyed hatcheries produces ducklings between February and April. Although 10 to 20 percent of hatcheries start their operations between May and August, the most concentrated period for doing so is September to December.

Of the 39 hatcheries, 92.3 percent sell infertile eggs, 15.4 percent feed them to pigs and fish, 10.2 percent throw them away, and 12.8 percent give them to neighbours. Eggshells are sold or given away by 63.3 percent of hatcheries, thrown away by 3.3 percent, used as fertilizer by 23.3 percent, and burned by 10.0 percent.

About 15 percent of the hatcheries said that their business is increasing, for 48.7 percent it is stable, for 33.3 percent it is decreasing, and for 2.6 percent it is unstable. The main reason for increasing business is high consumer demand for embryonic eggs. About 43 percent

of hatcheries plan to increase the scale of their production in the next 12 months, 25.6 percent to change incubators and egg supplier, 25.6 percent to increase their egg production, and 10.2 percent to stop hatchery operations.

Duckling supply from neighbouring countries

For about ten years, duckling supply has been operated by producers in Viet Nam. Traders also collect ducks for meat for markets and restaurants in Phnom Penh. The sources of ducklings are other traders, who transport them across the border to Phnom Penh, buying 1 000 to 2 000 ducklings a week. Peking ducks are imported to supply duck farmers raising for meat. The same breed has continued to be imported after the AI outbreak.

Breed and age are the criteria for evaluating ducklings in price negotiations. The price is also based on negotiation between the trader and the seller. The high demand for ducklings is in the dry season, when a trader can sell about 2 000 ducklings a week at a price of 3 500 to 4 000 riel/head; low demand is in the rainy season, when traders can sell only 1 000 ducklings for 3 000 riel/head.

Imported ducklings are distributed to producers around Phnom Penh and other provinces. Delivery can be through either of two ways: 1) duck producers from the provinces pick up ducklings in Phnom Penh; or 2) distributors deliver ducklings directly to producers in Phnom Penh. Only verbal agreements are used between sellers and buyers. The duckling importer said that the supply of ducklings dropped for about three to four months after the AI outbreak, after which it increased again.

Introduction

Duck farming is a way of life for rural farming families. They keep a few ducks to get eggs for home consumption and sell the surplus at the local market or among their neighbours. Several duck breeds can be found in Cambodia. Sampauv, Angkam and Muscovy are local breeds, while some years ago Khaki Campbell, Peking and Cherry Valley were introduced for meat and egg production. In the past, due to the small scale of production, ducks were nearly always free-range, with nine or ten being kept in a pen where they laid their eggs before being released into the field. This system continues, but recently large farms have emerged in Kampong Cham, Prey Veng, Takeo, Siem Reap and other provinces.

Duck meat is not very popular in Cambodia, but duck eggs are very common, especially in rural areas. Eggs are available as fresh, salted and embryonic. Fresh eggs are consumed at any meal, while salted eggs are common for breakfast, particularly with rice soup. Embryonic eggs are sold in small food shops by the roadside and/or in busy places. Most egg hatcheries for ducklings and embryonic eggs still use traditional methods. These traditional hatchery operations – their capacity, sources of eggs, etc. – need to be well documented to help policy- and decision-makers develop appropriate strategies for avoiding avian influenza (AI) risks.

Biosecurity measures to reduce risk are heavily dependent on movement management. Live-bird markets and the transport systems for carrying ducks from farms to markets or slaughterhouses present specific risks of disease spread, as does the movement of ducklings from hatcheries to farms and markets. Knowledge and understanding of the complexity of the duck business – including hatcheries, the movement of ducklings and duck keeping – help the National Veterinary Research Institute (NaVRI) to increase preparedness for highly pathogenic avian influenza (HPAI) outbreaks and to target animal disease control strategies that reduce the spread and minimize the socio-economic impact on poultry keepers and others who derive their livelihoods from poultry.

The Centre for Livestock and Agriculture Development (CelAgrid) was identified as the leading local technical research institution for conducting this study on duck production, hatcheries and duckling supply in Cambodia.

Objectives of the study

The overall objective of the study is to investigate duck production, hatchery management, health practices and importation in eight provinces of Cambodia.

The specific aims were to:

- investigate management and health practices for duck production flocks and hatcheries in eight provinces of Cambodia;
- investigate the scale and pattern of duckling imports from Viet Nam and Thailand;
- support and illustrate the findings with photographs/short digital movie clips, and the global positioning system (GPS) coordinates of duck flocks, hatcheries and markets.

Materials and method

Development of questionnaires

Duck production and hatchery

CelAgrid and FAO jointly developed questionnaires on duck production and management and on hatchery operations. Key people involved in this were Dr Khieu Borin, CelAgrid Director, and Dr Olaf Thieme, Livestock Development Officer with FAO's Animal Production and Health Division in Rome. The duck production and management questionnaire gathered the following information: 1) general information about duck farms; 2) details on duck production, including breeds, feeding, management and supplies; 3) health and care of the ducks, including information about AI; 4) markets for ducks and eggs; and 5) the interviewers' general

observation. The information collected for duck hatchery operations was: 1) general information; 2) hatchery operations; and 3) the interviewers' general observation.

The draft questionnaire for duck production and management was tested on farms in Koh Thom district; that for hatchery operations was tested in Kandal Stung district of Kandal province. Testing aimed at getting a better understanding of the flow of the questions and respondents' feedback on the questionnaire. The questionnaires were then revised accordingly.

Duckling supply from neighbouring countries

Information was collected from a trader to indicate the scale and pattern of the duckling trade from neighbouring countries. This information consists of: 1) general information; 2) business status; and 3) the duckling supply chain.

Training and management of the team

The questionnaires were distributed to team members to read, and a test was conducted. On the first day, the teams met provincial officers of the Office of Animal Health and Production (OAHP) or phoned for appointments. The discussions with OAHP officers were to obtain advice on where to find ducks, hatcheries and duck traders.

The survey was carried out by two teams, each with four members: one team leader and three enumerators. The two team leaders were Mr Pok Samkol and Mrs Seng Sokerya, and the six enumerators were Mr Keo Sath, Mr Khiev Rathna, Mr Seng Theara, Mr Chea Cheang Ly, Mr Chan Choun and Ms Chorn Phanny. On the first day, the enumerators worked in pairs for interviews, after which they worked alone. The team members met every afternoon and the team leaders reviewed the questionnaires every day.

The division of work between the two teams was as follows:
Team 1 = Takeo, Sihanouk Ville, Kampot and Prey Veng.
Team 2 = Phnom Penh, Kandal, Kampong Cham, Kampong Chhnang, Siem Reap and Battambang.

Sampling

Duck production

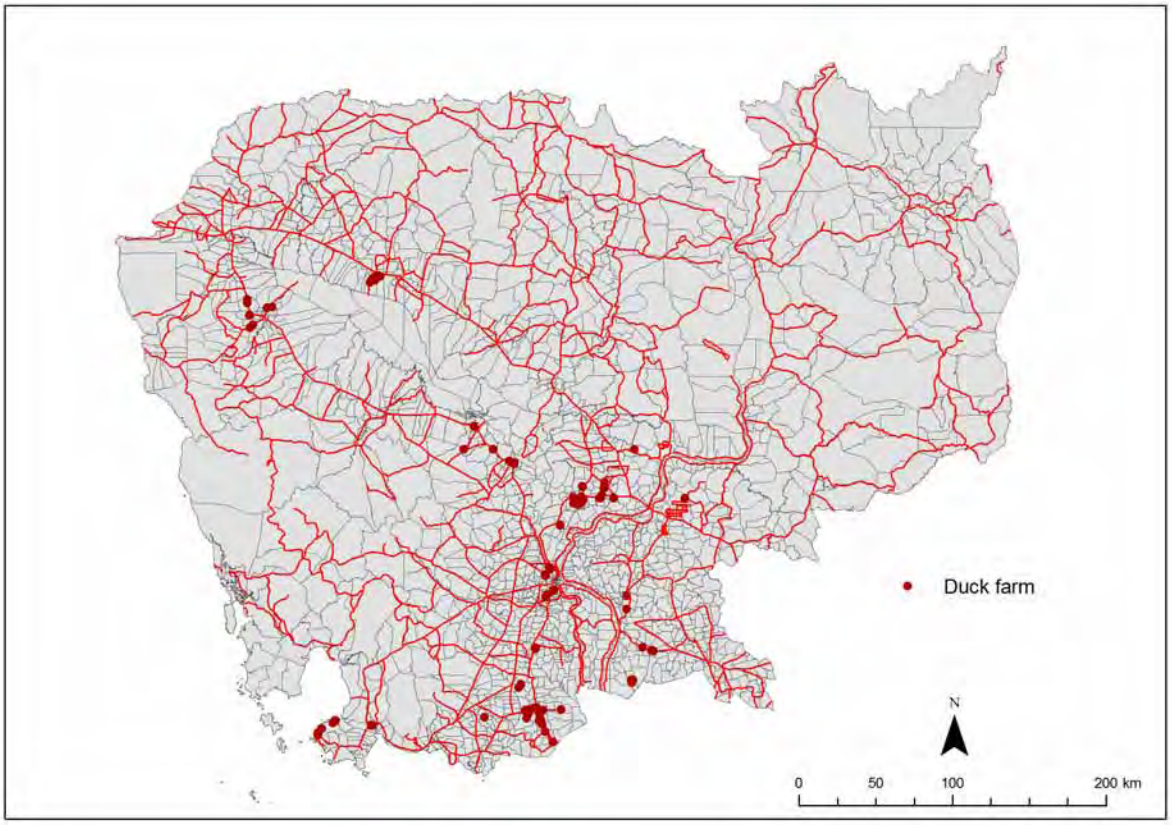
Investigation of duck production was conducted in eight provinces, with 144 duck owners interviewed (Table 1). The respondents were randomly selected from all those keeping at least 150 ducks each.

Table 1 Numbers of duck farmers interviewed in the eight provinces

Province	No. of duck farms
Battambang	10
Kampong Cham	25
Kampong Chhnang	10
Phnom Penh	10
Preah Sihanouk	21
Prey Veng	10
Siem Reap	15
Takeo	43
Total	1

As well as the 144 duck farms surveyed, the teams also mapped the GPS coordinates of another 51 duck farms during the fieldwork. The location of the surveyed duck farms are shown by the Map 1.

Map 1 Location of the surveyed duck farms



Duck hatcheries

For the investigation of duck hatchery operations seven provinces were selected: Kampong Cham, Kampong Chhnang, Phnom Penh, Preah Sihanouk, Prey Veng, Siem Reap and Takeo. The sample size was 40 hatcheries. Through discussions with duck producers and OAHP officers, the team discovered that the hatcheries in Preah Sihanouk and Kampong Chhnang had stopped producing ducklings. After identifying the locations of these hatcheries, the survey teams went there to collect GPS coordinates and interview people to find out their hatching capacity and why they had stopped their businesses.

In Kampong Chhnang district, Kampong Chhnang province, the hatchery had stopped operating two years ago owing to lack of labour and the owner's health problems. The capacity of the hatchery was 3 000 eggs, producing both ducklings and embryonic eggs. This farm had practised traditional hatchery methods using rice husks. The supply of eggs for hatching and the sale of products were both within the province. The hatchery worked throughout the year to produce embryonic eggs (of 15 days) to sell for local consumption; duckling production was for only three months a year, from October to December. This was when duck farmers came to order and is the peak production time, because feed is available from paddy fields, rice bran and broken rice. The owner of this hatchery is now an intermediary, obtaining embryonic eggs and ducklings from Sre Ronorng commune, Tramkak district, Takeo to supply Kampong Chhnang province. He plans to restart his hatchery if his children are interested in taking it over.

In Kampong Tralach district, Kampong Chhnang province, the hatchery stopped production four years ago owing to lack of labour and the owner's involvement in a car accident. The capacity of this hatchery was 2 000 eggs, producing both ducklings and embryonic eggs. This farm also practised traditional hatchery methods. The eggs for hatching were supplied in the district and products were sold in Sala Lek 5 market. Duckling production was for only two months a year, October to November, because this is the main time for duck raising; embryonic eggs were produced throughout the year. This farmer has also become an

intermediary, obtaining embryonic eggs from Psar Deumkor market, Phnom Penh. He said that sellers of embryonic eggs in Psar Deumkor also get eggs from Takeo province. He plans to restart his hatchery, but with an electronic incubator.

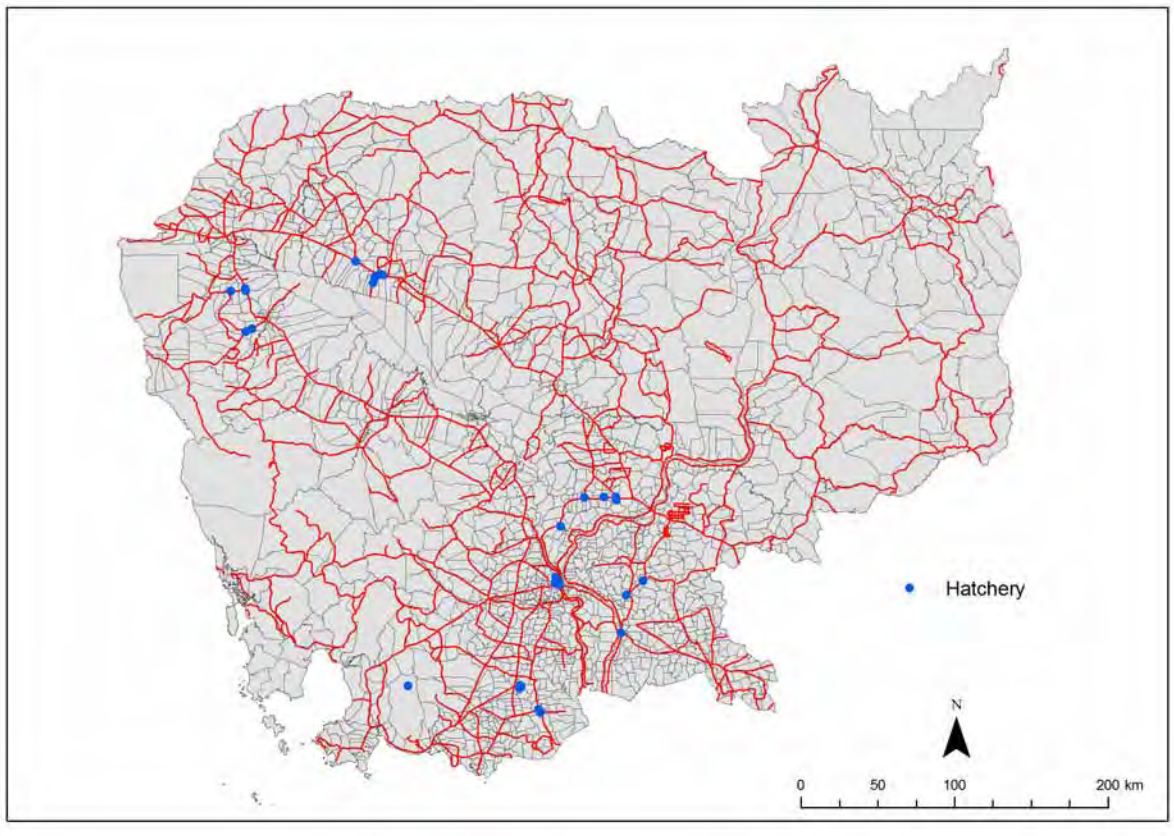
The team then found six duck hatcheries in Battambang province (Table 2), while in Phnom Penh, of the five hatcheries identified, only four agreed to be interviewed. The farm that did not agree to an interview is located in Mouk Kleu, Sangkat Chbar Ambauv I, Khan Meanchey, Phnom Penh. In total, 39 hatchery owners were interviewed in six provinces, including Phnom Penh.

Table 2 Numbers of duck hatchery operators interviewed in the six provinces

Province	No. of hatcheries	
	Planned	Actual
Battambang	-	6
Kampong Cham	3	6
Kampong Chhnang	4	-
Phnom Penh	5	4
Preah Sihanouk	5	-
Prey Veng	3	3
Siem Reap	5	5
Takeo	15	15
Total	40	39

The study teams used GPS coordinates to record the locations of these 39 duck hatcheries and the ones that had stopped operating or refused to be interviewed. The location of the surveyed duck hatcheries are shown by the Map 2.

Map 2 Location of the surveyed duck hatcheries



Duckling importation

It was planned to interview ten duckling traders. However, via discussions with the duck farmers visited and the OAHP officers, only two traders importing ducklings from Viet Nam were identified in Phnom Penh, and one did not agree to be interviewed.

Data analysis

Both the qualitative and the quantitative data on duck production and hatcheries were coded and entered in the Excel spreadsheet program. The data were analysed using the descriptive statistical package for social sciences (SPSS version 14.0). The results are presented as percentages, mean values by province, overall mean and standard error (SE).

Scope and limitations

- It was easier to interview the duck farmers who raise their ducks in confinement and who were more likely to be present at their farms. It was more complicated interviewing owners who practise grazing with supplementation, because they herd their ducks outside the village. In these cases, the interviewers had to follow the farmers to the grazing areas or wait until they returned.
- Hatcheries in Preah Sihanouk and Kampong Chnang provinces had stopped operating, but six hatcheries for interviewing were found in Battambang, which had not been included in the original survey plan.
- Hatchery owners demanded the presentation of a letter before agreeing to be interviewed by the teams. They are afraid that sharing information might affect their businesses.
- The survey was not carried out during the period of duckling production, so teams were not able to make observations regarding the management of ducklings and shells. Instead, guiding questions were used to obtain the information from hatchery owners.
- It was very difficult to interview the hatchery owners in Phnom Penh because they were unwilling to participate. Instead, the team managed to talk with workers, who provided the information.
- Traders were reluctant to talk to the team because importing ducklings from other countries is not allowed. One of the two traders identified agreed to talk to the ducklings has become a very sensitive issue since the AI outbreak and the subsequent banning of poultry and poultry product imports. Importers are therefore wary of talking, as it might affect their businesses.

Duck farming

General characterization of duck farms

General information and income classification

The average age of the duck farmers interviewed was 39.6 years, ranging from 17 to 61 years. Among respondents, 75.7 percent are medium-income, 20.1 percent poor, 3.4 percent rich, and 6.7 percent (in Siem Reap) very poor (Table 3). Duck owners in Battambang, Phnom Penh and Prey Veng are better-off and medium-income. Classification into these categories is based on farmers' assets, such as houses, domestic tools and equipment, farming tools and equipment, TVs and transportation.

Table 3 General information and income classification of duck farmers

Provinces	Age (years)	Income classification (%)			
		Very poor	Poor	Medium-income	Better- off
Battambang	49.0	-	-	70.0	30.0
Kampong Cham	41.0	-	20.0	76.0	4.0
Kampong Chhnang	44.0	-	20.0	80.0	-
Phnom Penh	39.8	-	-	100	-
Preah Sihanouk	37.3	-	38.1	57.1	4.7
Prey Veng	36.6	-	-	100	-
Siem Reap	38.8	6.7	20.0	73.3	-
Takeo	37.6	-	25.6	74.4	-
Total	39.6 ± 0.79	0.7 (n = 1)	20.1 (n = 29)	75.7 (n = 109)	3.5 (n = 5)

Duck farmers in Cambodia derive their incomes from diverse sources, including rice production, other crops, livestock, aquaculture, village shops and selling their own labour. Of the 144 duck farmers interviewed, 88.2 percent consider their incomes from raising ducks to be very important. Other income sources judged to be very important are rice farming, selling labour and government work (Table 4). More than 60 percent of respondents give importance to their incomes from vegetables, cattle/buffaloes, aquaculture, village shops and selling labour. Duck farmers who apply confinement systems generally have ponds, and therefore raise fish for additional income.

Table 4 Respondents' main sources of income (percentages)

Activity/income source	Very important	Important	Less important
Rice	65.6 (n = 22)	26.7 (n = 24)	7.8 (n = 7)
Vegetables	-	73.3 (n = 22)	26.7 (n = 8)
Fruit trees	-	7.0 (n = 2)	93.0 (n = 25)
Cattle/buffaloes	14.3 (n = 8)	67.8 (n = 38)	17.8 (n = 10)
Pigs	8.8 (n = 5)	63.1 (n = 36)	28.1 (n = 16)
Chickens	1.1 (n = 1)	41.4 (n = 39)	57.4 (n = 54)
Ducks	88.2 (n = 127)	11.8 (n = 17)	-
Aquaculture	11.1 (n = 2)	66.7 (n = 12)	22.2 (n = 4)
Village shop	37.5 (n = 3)	62.5 (n = 5)	-
Selling labour	40.0 (n = 4)	60.0 (n = 6)	-
Government work	50.0 (n = 2)	25.0 (n = 1)	25.0 (n = 1)
Trading	10.0 (n = 1)	30.0 (n = 3)	60.0 (n = 10)

Responsibilities and decision-making in duck production

Labour availability is one of the factors determining the scale of duck production. Most medium-scale duck farmers use their own labour, while larger-scale farmers tend to hire additional labour to assist in the management, feeding, cleaning, etc. Overall, about 12 percent of duck farmers hire labour to help care for, graze, feed and clean the ducks. These farmers are distributed over all the provinces except Takeo. Interviews revealed that work is distributed between husbands and wives, and in some cases sons and daughters also help. Between 80 and 90 percent of husbands are heavily responsible for decisions about buying ducklings and layers and caring for, grazing, feeding, cleaning and selling ducks; wives are involved to a lesser extent. Although wives are responsible for household activities such as cooking, cleaning and caring for children, almost 50 percent of them are also involved in grazing ducks (Table 5). Sons are more involved in duck farming than daughters. The explanation for this might be that daughters are more likely to be helping their mothers in home activities. As a general observation, both sons and daughters take cattle and buffaloes for grazing after school.

Table 5 Responsibilities and decision-making for duck production within farming families (percentages)

Activity/decision	Husband	Wife	Son	Daughter	Workers
Buying ducklings/layers	92.4 (n = 133)	61.8 (n = 89)	3.5 (n = 5)	-	-
Caring for ducklings/layers	93.0 (n = 134)	70.8 (n = 102)	27.1 (n = 39)	11.1 (n = 16)	9.0 (n = 13)
Grazing ducks	87.6 (n = 71)	49.4 (n = 40)	32.1 (n = 26)	9.9 (n = 8)	12.3 (n = 10)
Feeding ducks	88.2 (n = 127)	69.4 (n = 100)	27.1 (n = 39)	8.3 (n = 12)	10.4 (n = 15)
Cleaning ducks	81.2 (n = 117)	76.0 (n = 109)	19.4 (n = 28)	9.7 (n = 14)	9.0 (n = 13)
Selling ducks	79.1 (n = 114)	82.6 (n = 119)	6.9 (n = 10)	2.8 (n = 4)	-
Selling eggs	77.8 (n = 102)	83.2 (n = 109)	6.1 (n = 8)	3.8 (n = 5)	-

Duck production

Production system

About 80 percent of farmers raise ducks in full confinement in the rainy season, and 56.2 percent graze them in the dry season (Table 6). Most ducks are kept confined in the rainy season to prevent them from grazing the paddy fields for the first 25 days after the rice has been transplanted. Ducks that are being raised for meat and eggs graze in the paddy during the dry season after harvest, but layers are confined throughout both seasons.

High percentages of farmers using the full confinement system are found in Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk and Siem Reap, while large numbers of farms in Takeo and Prey Veng graze ducks with supplementation (Photos 1 and 2). Farmers normally practise grazing with supplementation for four to five months during the duckling period. They then confine their flocks when the birds start laying, to avoid egg laying outside the pens. Farmers said that grazing ducklings and ducks reduces the cost of feeding.

Only 6.9 percent of the duck farmers keep Muscovy ducks, in Battambang, Kampong Cham, Phnom Penh, Preah Sihanouk, Prey Veng and Takeo. For these Muscovy ducks, 70 percent of farmers use grazing with supplementation and 30 percent use full confinement together with their non-Muscovy duck flocks. A few (1.4 percent) farms in Kampong Chhnang and Phnom Penh also keep geese in full confinement.

Table 6 Duck production systems (percentages)

Province	Rainy season Grazing plus supplement	Dry season Fully confined
Battambang	70.0	100
Kampong Cham	40.0	100
Kampong Chhnang	30.0	90.0
Phnom Penh	50.0	80.0
Preah Sihanouk	14.3	100
Prey Veng	90.0	60.0
Siem Reap	20.0	93.3
Takeo	95.3	51.2
Total	56.2 (n = 81)	79.9 (n = 115)

Photo 1 Ducks graze in a rice field and on a canal with feed supplement, Battambang district, Battambang.

Photo 2 Ducks in full confinement fed concentrated feed, Cheung Prey district, Kampong Cham

The distance the owners take their ducks for grazing varies according to the seasonal availability of water and feed, and averages 2 461 m (Table 7). The longest distances are in Kampong Cham (5 556 m on average, ranging from 20 to 20,000 m) and Prey Veng (3 000 m on average, ranging from 1 000 to 5 000 m), while the shortest distances are in Kampong Chhnang (183 m on average, ranging from 100 to 300 m) and Siem Reap (703 m on average, ranging from 50 to 2 000 m).

Of the duck farmers interviewed, 83.9 percent reported that they graze their ducks in paddy fields, 37 percent graze them on the lake, 29.6 percent on ponds, 28.4 percent on open water, and 13.6 percent around residential areas.

Apart from in Phnom Penh, high percentages of duck farmers graze their ducks in paddy fields. None of the farmers in Preah Sihanouk reported to graze ducks on ponds, and none in Battambang, Kampong Chhnang and Prey Veng graze them on open water. Ducks are grazed around residential areas in Battambang, Preah Sihanouk, Prey Veng and Siem Reap.

Table 7 Grazing distances and places where ducks are grazed (percentages)

Province	Grazing distance (m)	Around residential area	In paddy fields	On open water	On lake	On pond
Battambang	10–7 000	-	85.7	-	57.1	28.6
Kampong Cham	20–20 000	18.2	72.7	18.2	18.2	36.4
Kampong Chhnang	100–300	33.3	66.7	-	33.3	66.7
Phnom Penh	20–5 000	25.0	25.0	25.0	50.0	75.0
Preah Sihanouk	250–3 000	-	100	33.3	33.3	-
Prey Veng	1 000–5 000	-	77.8	-	55.6	44.4
Siem Reap	50–2 000	-	100	33.3	33.3	66.7
Takeo	30–8 000	17.1	92.7	43.9	34.1	17.1
Total	2 461 ± 392	13.6 (n = 11)	83.9 (n = 68)	28.4 (n = 23)	37.0 (n = 30)	29.6 (n = 24)

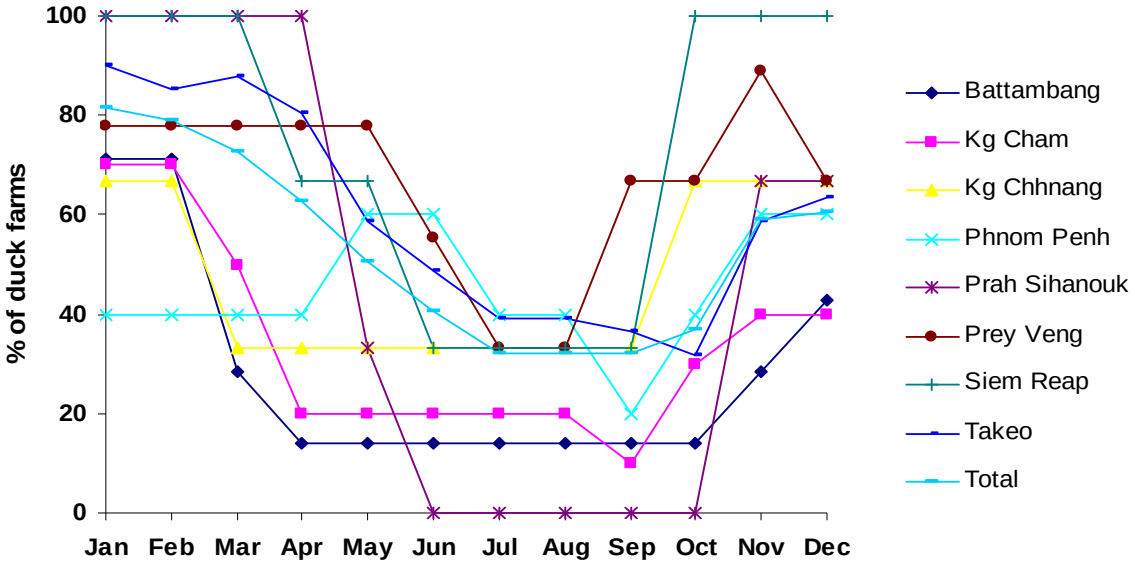
Duck confinement and grazing throughout the year

As already mentioned, ducklings and ducks for meat are grazed but not the laying ducks because farmers think they would lose the eggs. Generally, ducks are not grazed in paddy fields for about 21 days after rice transplanting, during the flowering stage and throughout the paddy harvest. If open water is available, such as around Tonle Sap Lake in Siem Reap, ducks can graze there. Paddy field owners often do not want their fields grazed by ducks because they think that it makes the soil harder, particularly during the wet season.

In general, farmers who keep ducks for meat start buying ducklings in July and August, and raise them until the rice harvest in November to February before grazing them in paddy fields. As shown in Figure 1, grazing activities are concentrated in the months of January to April and October to December. These are the periods before and after rice harvests. The low grazing activities between May and September are because land is occupied by crops, and

duck farmers are busy with rice cultivation. As already mentioned, duck farming is only one of the respondents' livelihood activities, and rice is among the most important farming activities.

Figure 1 Grazing of ducks throughout the year



Reasons for grazing ducks

Overall, about 93 percent of duck farmers reported that grazing helps to reduce the cost of feed, while 39.5 percent reported that it keeps their ducks happy and healthy; these farmers are distributed in all provinces except Battambang, Kampong Cham, Phnom Penh and Siem Reap (Table 8). Overall, about 35.8 percent of duck farmers reported that they graze their ducks because of tradition, but no farmers in Battambang and Phnom Penh gave this reason. 12 percent of duck farmers in Takeo reported that they have no room for keeping their ducks confined, so they allow them to graze; 12 percent of the farmers in Prey Veng and Takeo provinces reported that they lack money for fencing.

Table 8 Reasons for grazing ducks (percentages)

Province	Reduce feeding cost	Keep ducks happy and healthy	Tradition	Not enough space	Lack of money for fencing
Battambang	100	-	-	-	-
Kampong Cham	100	-	20.0	-	-
Kampong Chhnang	66.7	66.7	66.7	-	-
Phnom Penh	100	-	-	-	-
Preah Sihanouk	100	100	66.7	-	-
Prey Veng	100	11.1	44.4	-	33.3
Siem Reap	66.7	-	33.3	-	-
Takeo	92.7	63.4	43.9	12.2	17.1
Total	93.8 (n = 76)	39.5 (n = 32)	35.8 (n = 29)	6.17 (n = 5)	12.3 (n = 10)

Important inputs for duck production

Most of the duck farmers (96 percent) consider feed an important input for their duck production; 53.5 percent considered a water source to be important, 47.2 percent the duck breed, 38.9 percent medicine, and 33.3 percent a duck house (Table 9). Very few duck farmers consider veterinary services to be important. The veterinary services in rural Cambodia are still poor and the low capacity of rural veterinarians is another handicap, so duck farmers try to solve problems themselves, with advice from vet shop owners. About 50 percent of duck farmers in Battambang and 30 percent in Kampong Chhnang said that capital is important, while 90 percent of those in Phnom Penh and 83.7 percent in Takeo reported that a water source really matters to them. The high population density in Takeo makes it difficult for

duck keepers to find places to graze their ducks, so some have moved their duck businesses to areas in Siem Reap where they can find places for grazing. Large percentages of duck farmers in Kampong Cham, Kampong Chhnang and Siem Reap said that medicine is important.

Table 9 Important inputs for duck production (percentages)

Province	Breed	Feed	Duck house	Medicine	Labour	Vet services	Water source	Capital
Battambang	10.0	90.0	80.0	30.0	10.0	-	30.0	50.0
Kampong Cham	36.0	96.0	44.0	84.0	24.0	-	8.0	-
Kg Chhnang	60.0	100	10.0	50.0	10.0	-	50.0	30.0
Phnom Penh	70.0	100	-	10.0	20.0	-	90.0	10.0
Preah Sihanouk	57.1	100	23.8	23.8	42.8	9.5	38.1	-
Prey Veng	50.0	90.0	10.0	30.0	10.0	-	100	10.0
Siem Reap	33.3	86.7	60.0	86.7	6.7	-	26.7	-
Takeo	53.5	97.7	30.2	11.6	23.2	2.3	83.7	-
Total	47.2 n= 68	95.8 n=138	33.3 n= 48	38.9 n= 56	21.5 n= 31	2.1 n=3	53.5 n= 77	6.9 n= 10

Types of feed for ducks

A large percentage (62 percent) of duck farmers feed their ducks with concentrated feed, particularly in Battambang, Takeo, Kampong Cham, Prey Veng and Kampong Chhnang (Table 10). Concentrated feed is used mainly for laying ducks, while ducks for meat generally depend on the feed they can find in paddy fields during the grazing season, supplemented with paddy rice and rice bran. Duck farmers consider that feeding paddy rice to their laying ducks gives the yolks a red colour, making them attractive to consumers. Large percentages of duck farmers, particularly in Preah Sihanouk, Siem Reap and Kampong Chhnang, make their own concentrated feed (Photo 3), but this is fed mainly to growing ducks. Farmers in Battambang and Takeo reported that mixing feed for laying ducks is a delicate task, because it must provide sufficient nutrients and imbalances or changes in the feed can lead to declines in the number of eggs per day. About 50 percent of duck farmers in Kampong Chhnang and 26.7 percent in Siem Reap feed their ducks with fresh fish. These provinces are located around Tonle Sap Lake, where there is easy access to trash fish, as well as an important supply of fish for human consumption. Duck farmers in Kampong Chhnang said that feed is expensive, so when ducks lay at the rate of 50 percent it is just enough to pay for the feed. Three farmers in Kampong Cham and Siem Reap, four in Takeo and one in Siem Reap use water spinach, crabs and banana stems to feed their ducks (Photo 4).

Table 10 Duck feed types used (percentages)

Province	Type of duck feed								
	C	HC	PR	RB	FM	WS	FF	CR	BS
Battambang	100	30.0	10.0	50.0	-	-	-	-	-
Kampong Cham	76.0	32.0	60.0	60.0	16.0	8.0	4.0	-	-
Kampong Chhnang	60.0	40.0	60.0	60.0	20.0	-	50.0	-	-
Phnom Penh	30.0	30.0	40.0	-	-	-	-	-	-
Preah Sihanouk	9.5	80.9	28.6	-	-	-	-	-	-
Prey Veng	70.0	10.0	70.0	-	-	-	-	-	-
Siem Reap	46.7	46.7	60.0	60.0	20.0	6.7	26.7	-	6.7
Takeo	81.4	2.3	88.4	-	-	-	2.32	9.3	-
Total	61.8 n = 89	30.5 n= 44	59.7 n= 86	24.3 n= 35	6.3 n= 9	2.1 n = 3	7.6 n= 11	2.8 n= 4	0.7 n = 1

Notes: C = concentrated feed; HC = homemade concentrate; PR = paddy rice: RB = rice bran; FM = fishmeal; WS = water spinach; FF = fresh fish; CR = crabs; BS = banana stems.

Photo 3 Mixing feed for ducks, Siem Reap district, Siem Reap

Photo 4 Chopped water spinach for feeding ducks, Siem Reap district, Siem Reap

Breeds and management

Purpose of duck keeping

Almost 90 percent of the respondents said that they raise ducks for eggs, 18 percent for meat and few for breeding (Table 11). Only one farmer in Kampong Cham keeps ducks to produce embryonic eggs and ducklings. Owing to the high demand, a high percentage of duck farmers in Phnom Penh raise ducks for meat and eggs, while farmers in other study provinces raise them for eggs only.

On the other hand, 100 percent of the duck farmers who keep Muscovy ducks do so for meat; 55.6 percent said that they also keep them for breeding. These farmers are distributed across all provinces except Preah Sihanouk and Takeo. It should be noted that most farms keep only a few Muscovy ducks, mainly for meat for home consumption and visitors. Geese are not common, but some farmers keep them to prevent snakes from coming to their farms and for breeding for market.

Table 11 Purposes of duck keeping (percentages)

Province	Meat	Eggs	Breeding	Hatching	
				Embryonic eggs	DODs
Battambang	-	100	-	-	-
Kampong Cham	8.0	92.0	-	4.0	4.0
Kampong Chhnang	10.0	90.0	10.0	-	-
Phnom Penh	60.0	70.0	10.0	-	-
Preah Sihanouk	9.5	95.2	-	-	-
Prey Veng	20.0	90.0	-	-	-
Siem Reap	13.3	100	-	-	-
Takeo	25.6	76.7	-	-	-
Total	18.0 (n = 26)	87.5 (n = 126)	1.4 (n = 2)	0.7 (n = 1)	0.7 (n = 1)

Note: DOD = day-old duckling.

Duck breeds

The breed of duck kept by duck farmers depends on market demand. Of the 144 duck farmers interviewed, 59 percent reported that they raise Khaki Campbell for eggs and 4.9 percent raise Peking (Photo 5) for meat (Table 12). About 27.1 percent raise local long-neck Krolas; 8.3 percent raise Sampauv, which are known for being large, growing quickly and laying big eggs; and a few – 2.8 percent – raise Angkam. High percentages of farmers in Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk, Prey Veng and Siem Reap keep Khaki Campbell. Most duck farms in Takeo raise long-neck Krolas (Photo 6).

Table 12 Duck breeds raised (percentages)

Province	Local			Exotic	
	I	II	III	IV	V
Battambang	-	-	-	100	-
Kampong Cham	16	-	-	84.0	-
Kampong Chhnang	-	-	10.0	90.0	-
Phnom Penh	40	10.0	-	30.0	50.0
Preah Sihanouk	-	4.7	-	95.2	-
Prey Veng	-	-	20.0	70.0	10.0
Siem Reap	-	6.7	-	86.7	6.7
Takeo	9.3	2.3	83.7	4.6	-
Total	8.3 (n = 12)	2.8 (n = 4)	27.1 (n = 39)	59.0 (n = 85)	4.9 (n = 7)

Notes: I = Sampauv; II = Angkam; III = long-neck Krolas; IV = Khaki Campbell; V = Peking.

Photo 5 Peking ducks kept for meat production, Rosey Keo district, Phnom Penh.

Photo 6 Long-neck Krolas kept for egg production, Koh Andet district, Takeo.

Changes in duck breeds following AI outbreak

Regarding duck breeds before the AI outbreak, 60.7 percent of farmers reported that they kept Khaki Campbell, 17.1 percent kept long-neck Krolas, 10.2 percent Sampauv, 8.5 percent Angkam, and 3.4 percent Peking (Table 13). Almost no changes in the duck breeds kept were reported after the AI outbreak. Farmers said that if they do not experience the AI outbreak on their farms or nearby and if the market continues to demand duck meat and eggs they will continue their usual business.

Table 13 Duck breeds kept before and after AI outbreak (percentages)

Provinces	Before AI					After AI				
	Local			Exotic		Local			Exotic	
	I	II	III	IV	V	I	II	III	IV	V
Battambang	-	-	-	88.9	-	-	-	-	100	-
Kampong Cham	18.1	-	-	81.8	4.5	18.2	-	-	81.8	-
Kampong Chhnang	-	-	12.5	87.5	-	-	-	12.5	87.5	-
Phnom Penh	37.5	25.0		12.5	37.5	37.5	12.5	12.5	25.0	37.5
Preah Sihanouk	-	5.5	-	94.4	-	-	5.5	-	100	-
Prey Veng	-	-	16.7	66.7	-	-	-	16.7	66.7	16.7
Siem Reap	-	-	-	100	-	-	-	-	92.8	7.1
Takeo	15.6	21.8	56.2	6.2	-	9.3	3.1	81.2	6.2	-
Total	10.2 n = 12	8.5 n= 10	17.1 n = 20	60.7 n =7)	3.4 n = 4	8.5 n = 10	2.6 n = 3	24.8 n = 29	62.4 n = 73	4.3 n = 5

Notes: I = Sampauv; II = Angkam; III = long-neck Krolas; IV = Khaki Campbell; V = Peking.

Numbers of ducks kept

Only one duck farmer in Phnom Penh keeps about 150 ducks; overall 60.4 percent of the duck farmers in the study keep between 200 and 1 000, while 38.9 percent keep more than 1 000 (Table 14). Large numbers of farms with 200 to 1 000 ducks each were found in Kampong Cham and Takeo, while the farms with more than 1 000 ducks are in Battambang, Kampong Chhnang and Preah Sihanouk. Most of the ducks in these provinces are for egg production.

Table 14 Numbers of ducks raised per farm (percentages)

Province	Less than 200	200–1 000	More than 1 000
Battambang	-	30.0	70.0
Kampong Cham	-	80.0	20.0
Kampong Chhnang	-	40.0	60.0
Phnom Penh	10	50.0	40.0
Preah Sihanouk	-	28.5	71.4
Prey Veng	-	50.0	50.0
Siem Reap	-	46.7	53.3
Takeo	-	86.0	13.9
Total	0.7 (n = 1)	60.4 (n = 87)	38.9 (n = 56)

Type of production

Overall, 84 percent of duck flocks are kept for egg production, 9.7 percent for meat and 6.2 percent for both meat and eggs (Table 15). In Battambang and Kampong Chhnang, all duck farms are for egg production. Eggs are an important part of rural diets, and embryonic eggs of 15 days incubation are an important snack food for Cambodians in cities and towns.

Table 15 Types of duck production (percentages)

Province	For meat	For eggs	For both
Battambang	-	100	-
Kampong Cham	4.0	92.0	4.0
Kampong Chhnang	-	100	-
Phnom Penh	20.0	60.0	20.0
Preah Sihanouk	4.7	90.5	4.7
Prey Veng	10.0	80.0	10.0
Siem Reap	-	86.7	13.3
Takeo	20.9	74.4	4.6
Total	9.7 (n = 14)	84.0 (n = 121)	6.3 (n = 9)

Farm locations and sizes

The duck farms are an average of 2 377 m^2 each, ranging from 30 to 60 000 m^2 (Table 16). It was observed that duck farms are small in Takeo, at 290 m^2 on average (ranging from 30 to 1 800 m^2) and Prey Veng, at 735 m^2 on average (ranging from 40 to 6 500 m^2); the largest farms recorded are in Phnom Penh (60 000 m^2), Battambang (30 000 m^2), Kampong Chhnang (15 000 m^2) and Preah Sihanouk (13 000 m^2).

Of the 144 duck farms, 52.1 percent are located near residential areas and 35.4 percent, excluding Phnom Penh, in paddy fields. 9.7 percent of farms in Kampong Chhnang, Preah Sihanouk and Takeo are near open water. Only two farms in Battambang and Phnom Penh, one in Preah Sihanouk and one in Siem Reap are close to ponds, the lake or a village road (Table 14).

Table 16 Duck farm sizes and locations (multiple answers possible)

Provinces		Location (%)					
	Farm size (m2)	Near residential area	In paddy field	Near open water	Near lake	Around pond	Near village road
Battambang	80–30 000	60.0	30.0	-	-	10.0	-
Kampong Cham	40–10 000	76.0	24.0	-	-	-	-
Kampong Chhnang	60–15 000	70.0	20.0	10.0	-	-	-
Phnom Penh	60–60 000	90.0	-	-	-	10.0	-
Preah Sihanouk	72–13 000	52.4	9.5	33.3	4.7	-	-
Prey Veng	40–6 500	60.0	40.0	-	-	-	-
Siem Reap	120–3 000	66.7	26.7	-	-	-	6.7
Takeo	30–1 800	16.3	69.7	13.9	-	-	-
Total	2 377 ± 606	52.1 (n = 75)	35.4 (n = 51)	9.7 (n = 14)	0.7 (n = 1)	1.4 (n = 2)	0.7 (n = 1)

Change of site

About 73.6 percent of duck farmers reported that they have no specific timing for moving their flocks to a new location; 21.5 percent have never changed to a new location (Table 17). Only 2.8 percent in Kampong Cham, Preah Sihanouk, Prey Veng and Takeo and 2 percent in Battambang, Preah Sihanouk, and Takeo said that they change to a new location annually and once every two years, respectively. High percentages of duck farmers without a specific time for changing sites were found in Kampong Cham, Phnom Penh, Preah Sihanouk, Prey Veng, Siem Reap and Takeo.

Table 17 Timing of site changes for duck farms (percentages)

Province	Once a year	Once every 2 years	No specific timing	Never change
Battambang	-	10.0	40.0	50.0
Kampong Cham	4.0	-	64.0	32.0
Kampong Chhnang	-	-	10.0	90.0
Phnom Penh	-	-	80.0	20.0
Preah Sihanouk	4.7	4.7	61.9	28.5
Prey Veng	10.0	-	90.0	-
Siem Reap	-	-	100	-
Takeo	2.3	2.3	93.0	2.3
Total	2.8 (n = 4)	2.1 (n = 3)	73.6 (n = 106)	21.5 (n = 31)

Among the duck farmers who move their farms to new sites the reasons for doing so are: 1) pollution (for 28.5 percent, except for in Siem Reap); 2) disease outbreaks nearby (for 22.2 percent in Preah Sihanouk, Prey Veng and Takeo); 3) high mortality (for 6.9 percent in Preah Sihanouk and Takeo); 4) common practice (for 27.8 percent, except for in Prey Veng); 5) no land for expanding the duck farm (for 23.7 percent, except for in Preah Sihanouk, Prey Veng and Takeo); and 6) feed and water availability in the field (for 12.5 percent in Preah Sihanouk, Siem Reap and Takeo) (Table 18).

Table 18 Reasons for changing the site of duck farms (percentages)

Province	Pollution	Disease outbreak nearby	High mortality	Common practice	No land for expanding	Feed and water availability
Battambang	40.0	-	-	10.0	50.0	-
Kampong Cham	12.0	-	-	60.0	45.8	-
Kampong Chhnang	10.0	-	-	10.0	60.0	-
Phnom Penh	40.0	-	-	20.0	10.0	-
Preah Sihanouk	33.3	23.8	9.5	19.0	-	4.7
Prey Veng	60.0	20.0	-	-	-	-
Siem Reap	-	-	-	26.7	66.7	6.7
Takeo	37.2	58.1	18.6	30.2	-	37.2
Total	28.5 (n = 41)	22.2 (n = 32)	6.9 (n = 10)	27.8 (n = 40)	23.7 (n = 33)	12.5 (n = 18)

Distance between farms

About 53 percent of duck farmers reported that their duck businesses are in rural areas with low population density, 31.9 percent are in isolated areas, and 15.3 percent in densely populated areas, except for Kampong Chhnang and Phnom Penh (Table 19). High percentages of farms situated in rural villages with low population density were found in Battambang, Kampong Chhnang, Phnom Penh and Prey Veng. Duck farmers establish their businesses close to villages for security reasons (fear of theft), or because their family farms are close to their homes.

The average distance between duck farms is 516 m. In most provinces, the longest distance between farms is between 1 500 and 8 000 m, and very short distances of 2 to 100 m were also found in all study provinces (Table 19). Some farmers keep their ducks far from their homes because they have land for this purpose, while those with duck farms very close to the village often have no choice. Those with duck farms far from the village also said that they can graze their ducks easily without being disturbed by domestic animals such as dogs and cats, or neighbours' crops. Some duck farmers reported that dogs chasing laying ducks can reduce egg production for the following day, while grazing of laying ducks near crops might lead to intoxication if the crops were sprayed with pesticide or insecticide the previous day.

Table 19 Duck farm locations and distances between farms

Province	Location (%)			Distance next farm (m)
	Densely populated area	Rural with low population density	Isolated area	
Battambang	20.0	60.0	20.0	10–2 000
Kampong Cham	36.0	52.0	12.0	2–1 500
Kampong Chhnang	-	90.0	10.0	100–8 000
Phnom Penh	-	60.0	40.0	20–1 000
Preah Sihanouk	4.7	38.1	57.1	10–3 000
Prey Veng	10.0	70.o	20.0	50–6 000
Siem Reap	26.7	53.3	20.0	50–2 000
Takeo	11.6	44.2	44.2	10–2 000
Total	15.3 (n = 22)	52.8 (n = 76)	31.9 (n = 46)	516 ± 88.5

Years in the duck business

About 51 percent of the farmers have between three and ten years experience in the duck business, while in Siem Reap and Kampong Chhnang more than 50 percent have more than ten years (Table 20).

Several of the duck farms in Siem Reap moved there from Takeo because farmers can find more and cheaper local feed resources in the biosphere of Tonle Sap Lake in Siem Reap. Prey Veng has a high proportion of farmers with only one or two years of experience. Farmers said that in the past they had to find water sources for raising ducks, or the birds would not produce or grew slowly, but new duck breeds such as Khaki Campbell can survive with less water. Takeo is recognized as an important province for supplying ducklings, eggs and embryonic eggs, but other provinces are starting to play a greater role.

Table 20 Years of experience of duck keeping (percentages)

Provinces	1–2 years	3–5 years	6–10 years	More than 10 years
Battambang	10.0	20.0	40.0	30.0
Kampong Cham	12.0	28.0	20.0	40.0
Kampong Chhnang	20.0	-	20.0	60.0
Phnom Penh	20.0	40.0	30.0	10.0
Preah Sihanouk	14.3	23.8	38.1	23.8
Prey Veng	40.0	50.0	-	10.0
Siem Reap	6.7	13.3	26.7	53.3
Takeo	25.5	25.5	27.9	20.9
Total	18.7 (n = 27)	25.0 (n = 36)	26.4 (n = 38)	29.8 (n = 43)

Months for starting duck keeping

Grower ducks

The most important months for farmers to start raising ducklings for meat are September t0 November. Of the duck meat farms, 26.1 to 34.8 percent reported that they start buying ducklings in September to November, while between 1 and 9 percent start at any time of the year (Table 21). In general, the period of raising depends on the availability of local feed resources, including insects, worms, aquatic plants and water. The reasons duck farmers gave for choosing a specific period to start raising ducks for meat are: 1) feed and water availability in the field (for 90.5 percent); 2) rain has stopped (for 4.8 percent in Kampong Cham); 3) they are less busy (for 4.8 percent in Prey Veng); and 4) so they can sell when market demand is high, to get a high price (for 14.3 percent in Preah Sihanouk and Takeo).

Table 21 Months for starting to keep grower ducks (percentages)

Province	Rainy season						Dry season					
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Battambang	-	-	-	-	-	-	-	-	-	-	-	-
Kampong Cham	-	-	-	-	-	50.0	50.0	-	-	-	-	-
Kampong Chhnang	-	-	-	-	-	-	-	-	-	-	-	-
Phnom Penh	-	-	-	-	-	50.0	25.0	-	-	-	25.0	-
Preah Sihanouk	-	-	-	-	50.0	-	50.0	-	-	-	-	-
Prey Veng	-	33.0	-	33.0	-	33.0	-	-	-	-	-	
Siem Reap	-	-	-	-	-	-		-	-	100	-	-
Takeo	-	-	-	-	36.4	27.2	36.4	-	-	-	-	-
Total		4.34	-	4.34	21.7	30.4	30.4	-	-	4.34	4.34	-
N		1		1	5	7	7			1	1	

Laying ducks

Farmers of laying ducks also tend to start the laying cycle between September and November. Some laying duck farmers buy six-month old females from other farmers to raise for eggs or to replace laying ducks that are two to three years old. Young laying ducks are bought mainly in the rainy season (Table 22).

The reasons for getting laying ducks between September and November are: 1) availability of feed and water in fields (for 63.1 percent of farmers); 2) to replace old ducks with low production and/or low egg prices (for 11.5 percent in Battambang, Kampong Cham, Siem Reap and Prey Veng); 3) availability of female ducks for replacement (for 6.6 percent in Battambang, Kampong Cham and Kampong Chhnang); 4) low feed costs due to the fish harvesting season (for 19.7 percent, except in Prey Veng); 5) farmers are less busy with other activities (for 2.5 percent in Kampong Cham and Prey Veng); 6) long-term family business planning (for 3.3 percent in Kampong Cham and Takeo); and 7) rain has stopped so it is easier to care for the ducks (for 12.7 percent in Kampong Chhnang, Phnom Penh, Preah Sihanouk, Prey Veng and Siem Reap).

Table 22 Months for starting to keep laying ducks (percentages)

Province	Rainy season						Dry season					
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Battambang	-	9.0	9.0	9.0	9.0	55.0	-	-	-	-	9.0	-
Kg Cham	18.0	5.0	25.0	5.0	8.0	8.0	8.0	-	18.0	5.0	-	-
Kg Chhnang	18.0	-	9.5	18.0	9.5	-	18.0	27.0	-	-	-	-
Phnom Penh	12.5	-	-	-	-	37.5	37.5	-	12.5	-	-	-
Preah Sihanouk	5.0	-	10.0	-	50.0	15.0	10.0	-	-	-	-	10.0
Prey Veng	-	11.0	34.0	22.0	22.0	11.0	-	-	-	-	-	-
Siem Reap	6.0	19.0	31.0	6.0	6.0	6.0	-	-	6.0	12.5	6.0	-
Takeo	3.0	6.0	-	12.0	6.0	18.0	40.0	6.0	6.0	3.0	-	-
Total	7.7	6.2	13.1	7.7	14.6	16.9	17.7	3.9	6.2	3.9	0.8	1.5
N	10	8	17	10	19	22	23	5	8	5	1	2

It was difficult to assess the period when farmers start to raise Muscovy ducks and geese because they keep them for pleasure and not for selling, although Muscovy ducks are kept mainly for home consumption. Some farmers said that they raise geese to produce eggs for the market.

Frequency and numbers of ducks raised

Grower ducks

Of the duck meat farmers, 78.3 percent reported that they raise ducks once a year, with an average of 633 ducks (Table 23). A few duck meat farmers (4.4 percent) in Prey Veng raise ducks twice a year, with 2 000 ducks, and 17.4 percent in Phnom Penh and Siem Reap raise them three times, with an average of 12 250 ducks. All duck farmers in Kampong Cham, Preah Sihanouk and Takeo raise ducks once a year, with 5 to 350 ducks in Kampong Cham, 230 to 1 500 in Takeo and 500 to 2 000 in Preah Sihanouk. Duck meat farmers in Phnom Penh and Siem Reap raise ducks four to five times a year because of the high market demand for duck meat in these provinces, due to higher incomes and tourists. Traders in Phnom Penh provide loans to duck farmers to make sure that the ducks are sold to them. The price of ducks is about 8 000 riel each, subject to change according to market demand.

Table 23 Frequencies and numbers of grower ducks raised

Province	Once a year (%)	No. of ducks	Twice a year (%)	No. of ducks	3 or more times a year (%)	No. of ducks
Battambang	-	-	-	-	-	-
Kampong Cham	100	5–350	-	-	-	-
Kampong Chhnang	-	-	-	-	-	-
Phnom Penh	25.0	400	-	-	75.0	10 000–20 000
Preah Sihanouk	100	500–2 000	-	-	-	-
Prey Veng	50.0	250	50.0	2 000	-	-
Siem Reap	50.0	2 000	-	-	50.0	7 000
Takeo	100	230–1 500	-	-	-	-
Total	78.3 (n = 18)	633 ± 136	4.4 (n = 1)	2 000 ± 0.0	17.4 (n = 4)	12 250 ± 2 780

Laying ducks

Of the laying duck farmers, 92.2 percent reported that they raise ducks once a year, with an average of 1 200 ducks; 7.8 percent of farmers in Kampong Cham, Phnom Penh and Takeo raise twice a year, with 1 650 ducks (Table 24). High proportions of farmers raising laying ducks once a year were found in Battambang (2 120 on average, ranging from 300 to 7 000), Kampong Cham (1 040 on average, ranging from 200 to 4 000), Kampong Chhnang (2 389 on average, ranging from 200 to 9 000), Preah Sihanouk (1 300 on average, ranging from 300 to 2 800), Prey Veng (1 219 on average, ranging from 430 to 3 800), Siem Reap (1 174 on average, ranging from 200 to 2 200) and Takeo (618 on average, ranging from 200 to 2 000). Farmers sell their ducks for culling once a year because they cannot afford to pay feed and other costs. Culled ducks cost 8 000 to 10 000 riel/head, depending on market demand and region.

Table 24 Frequencies and numbers of laying ducks raised

Province	Once a year (%)	No. of ducks	Twice a year (%)	No. of ducks
Battambang	100	300–7 000	-	-
Kampong Cham	87.5	200–4 000	12.5	600–3 000
Kampong Chhnang	90.0	200–9 000	10.0	5 500
Phnom Penh	50.0	250–3 000	50.0	250–700
Preah Sihanouk	100	300–2 800	-	-
Prey Veng	100	430–3 800	-	-
Siem Reap	100	200–2 200	-	-
Takeo	93.9	200–2 000	6.1	900–2 000
Total	92.2 (n = 119)	1 200 ± 116	7.8 (n = 11)	1 650 ± 522

Duck keeping since the HPAI outbreak

About 45 percent of duck farmers reported that their duck farming was not affected by the AI outbreak; 33.3 percent answered that owing to demand their duck production increased, 18.8 percent that their duck production decreased, and a few (2.6 percent) in Kampong Cham, Prey Veng and Takeo mentioned that their duck production was unstable (Table 25).

The reasons given for increasing duck production are: 1) greater profits from duck production (for 72.1 percent); 2) unconcerned about HPAI outbreak (for 4.7 percent); 3) availability of sufficient labour to care for and manage the ducks (for 4.7 percent); 4) wide knowledge and experience in duck production (for 9.3 percent); 5) favourable conditions without disease outbreak (for 4.7 percent); 6) easy to sell the products (for 2.4 percent); and 7) easy to raise (for 2.3 percent).

The reasons for decreasing duck production are: 1) low price for eggs (for 11.5 percent); 2) concern about AI (for 11.5 percent); 3) consumers preferred other food items (for 3.8 percent); 4) fear of other duck disease outbreaks (for 46.2 percent); 5) reduced income from duck production (for 15.4 percent); and 6) high price of feed (for 11.5 percent). The reasons for unstable duck production are: 1) unstable price for eggs (for 33.3 percent); and 2) unstable price of feed (for 66.7 percent).

Table 25 Duck keeping since the HPAI outbreak (percentages)

Province	Same	Increased	Decreased	Unstable
Battambang	44.4	11.1	44.4	-
Kampong Cham	27.2	63.6	4.5	4.5
Kampong Chhnang	50.0	50.0	-	-
Phnom Penh	62.5	25.0	12.5	-
Preah Sihanouk	44.4	27.8	27.8	-
Prey Veng	83.3	-	-	16.7
Siem Reap	14.3	50.0	35.7	-
Takeo	59.4	18.7	18.7	3.1
Total	45.3 (n = 53)	33.3 (n = 39)	18.8 (n = 22)	2.6 (n = 3)

Supply of ducks

Categories of duck

The category of duck that a farmer obtains to start raising depend very much on the farmer's resources and experience of keeping ducks. About 54 percent reported that they buy layers to raise, while 40.2 percent purchase ducklings, and a few (6.2 percent) in Preah Sihanouk, Prey Veng and Takeo buy growers (Table 26). High percentages of farmers in Kampong Chhnang, Phnom Penh, Preah Sihanouk and Siem Reap buy layers, while large percentages in Battambang, Kampong Cham and Prey Veng buy ducklings.

Table 26 Categories of duck purchased by farmers (percentages)

Province	Ducklings	Growers	Layers
Battambang	80.0	-	20.0
Kampong Cham	52.0	-	48.0
Kampong Chhnang	20.0	-	80.0
Phnom Penh	30.0	-	70.0
Preah Sihanouk	14.3	19.0	66.7
Prey Veng	70.0	20.0	10.0
Siem Reap	20.0	-	80.0
Takeo	44.2	6.9	48.8
Total	40.2 (n = 58)	6.3 (n = 9)	53.5 (n = 77)

Sources of ducklings

Overall, 67 percent of duck farmers reported that they purchase ducklings from breeding farms, while 18.9 purchase from hatcheries, and 12.1 percent from dealers (Table 27). A few farmers (3.4 percent) buy ducklings from neighbours or markets. The farms that get ducklings

from dealers and neighbours are generally small with fewer than 100 ducks kept mainly for meat, and occasionally for laying, with eggs sold in the village.

Table 27 Sources of ducklings (percentages)

Province	Breeding farm	Dealer	Neighbour	Market	Hatchery
Battambang	62.5	-	-	-	37.5
Kampong Cham	69.2	-	-	-	46.1
Kampong Chhnang	100	-	-	-	-
Phnom Penh	66.7	66.7	-	-	-
Preah Sihanouk	66.7	-	33.3	-	-
Prey Veng	57.1	42.8	-	-	-
Siem Reap	33.3	-	-	-	66.7
Takeo	73.7	10.5	5.2	10.5	-
Total	67.2 (n = 39)	12.1 (n = 7)	3.4 (n = 2)	3.4 (n = 2)	18.9 (n = 11)

Sources of growing ducks

Only some of the farmers in Preah Sihanouk, Takeo and Prey Veng buy growing ducks. The sources of these ducks are breeding farms, dealers, neighbours and own production. Reasons for buying growers are: 1) lower price (for 71.4 percent); 2) easier to care for than ducklings (for 85.7 percent); 3) shorter time for raising (for 42.9 percent, except for in Preah Sihanouk); and 4) experience of starting with grower ducks.

Sources of laying ducks

About 41.5 percent of the farmers buy layers from breeding farms, 32.9 percent purchase from dealers, and 25.9 percent from neighbours (Table 28). Only 14.3 percent of the farmers in Takeo buy layers from markets, while 12.5 percent in Kampong Chhnang and 4.7 percent in Takeo use their own production.

The reasons for buying laying ducks are: 1) egg production starts sooner (for 94.8 percent); 2) they are easy to care for (for 14.7 percent, except in Battambang and Kampong Cham); 3) neighbours/relatives have had good results from doing so (for 2.7 percent in Kampong Cham and Preah Sihanouk); 4) the farmer lacks experience of keeping ducklings (for 2.7 percent in Kampong Chhnang and Takeo); 5) know good sources of layers (for 5.3 percent in Phnom Penh, Preah Sihanouk and Takeo); and 6) lower mortality than ducklings (for 2.7 percent in Takeo).

Table 28 Sources of laying duck supplies (percentages)

Province	Breeding farm	Dealer	Neighbour	Market	Own production
Battambang	50.0	50.0	-	-	-
Kampong Cham	66.7	-	46.1	-	-
Kampong Chhnang	87.5	12.5	-	-	12.5
Phnom Penh	28.5	85.7	-	-	-
Preah Sihanouk	57.1	38.5	7.6	-	-
Prey Veng	100	-	-	-	-
Siem Reap	41.7	58.3	-	-	-
Takeo	-	23.8	61.9	14.3	4.7
Total	41.5 (n = 32)	32.9 (n = 25)	25.9 (n = 20)	3.9 (n = 3)	2.6 (n = 2)

Practices with new birds

When introducing new birds to their farms, 50.0 percent of farmers reported that they confine the new birds before releasing them into the flock, 38.9 percent clean and disinfect the farm before the new birds arrive, and 29.2 percent have no special programme for new birds (Table 29). About 5.6 percent of duck farmers in Phnom Penh, Preah Sihanouk and Takeo mentioned that they mix the new birds with their existing flocks. Some of the interviewed farmers are not concerned about disease transmission from new birds to existing flocks, but they confine new ducks for a few days so that they can get to know the farm and adapt before being released into the flock.

Some duck farmers said that they observe the health of the ducks before buying them, and therefore that they should be healthy and ready to be mixed with their existing flocks.

Table 29 Practices for introducing new birds into farms (percentages)

Province	Clean and disinfect farm before arrival	Confine new birds	Mix with existing flock	No special programme
Battambang	50.0	40.0	-	40.0
Kampong Cham	40.0	40.0	-	28.0
Kampong Chhnang	20.0	30.0	-	50.0
Phnom Penh	50.0	30.0	20.0	20.0
Preah Sihanouk	71.4	66.7	14.3	14.3
Prey Veng	50.0	40.0	-	40.0
Siem Reap	26.7	46.7	-	26.7
Takeo	23.2	62.8	6.9	30.2
Total	38.9 (n = 56)	50.0 (n = 72)	5.6 (n = 8)	29.2 (n = 42)

Health and care

Sources of farmers' knowledge

Overall, 33.3 percent of the duck farmers reported that they receive knowledge of duck farming from their parents, 54.1 percent learn from neighbours, 3.5 percent from government officers, 5.6 percent from duck/duckling suppliers, 5.6 percent from nobody, 5.6 percent from relatives, and 2.8 percent from friends (Table 30). Only 0.7 percent of farmers in Kampong Chhnang and 1.4 percent in Battambang learned from NGOs and feed suppliers. Farmers in

Cambodia share their knowledge and experience in animal keeping and business activities with their children.

Government programmes concentrate mainly on large animals, including cattle and buffaloes, with an annual programme for disease control and vaccination; few efforts have been directed towards duck farmers. However, ducks eggs are a very important source of food for millions of Cambodians, because of their affordable price and ease of packing when travelling; they are sold at most bus and train stations.

Table 30 Sources of farmers' knowledge on duck keeping (percentages)

Province	Parents	Neigh-bours	Govern-ment officials	NGOs	Duck/ duckling suppliers	Feed suppliers	Nobody	Relatives	Friends
Battambang	10.0	30.0	20.0	-	-	20.0	10.0	20.0	-
Kg Cham	40.0	56.0	-	-	12.0	-	4.0	-	8.0
Kg Chhnang	40.0	10.0	-	10.0	-	-	20.0	10.0	10.0
Phnom Penh	10.0	80.0	20.0	-	20.0	-	-	-	-
Preah Sihanouk	33.3	61.9	-	-	-	-	-	9.5	-
Prey Veng	20.0	70.0	10.0	-	10.0	-	10.0	-	-
Siem Reap	20.0	46.7	-	-	6.7	-	6.7	20.0	6.7
Takeo	46.5	58.1	-	-	2.3	-	4.6	-	-
Total	33.3 (n= 48)	54.1 (n=78)	3.5 (n =5)	0.7 (n= 1)	5.6 (n = 8)	1.4 (n= 2)	5.6 (n = 8)	5.6 (n = 8)	2.8 (n = 4)

Problems in duck production

A small number of duck farmers reported problems in their duck businesses. The main problems, mentioned by 8 to 13 percent of the farmers, affect mainly laying ducks, such as disease, weak legs and lack of water (Table 31). Weak legs can be linked to the ducks' diet. Generally, duck farmers make their own concentrates, but poor knowledge about duck nutrition and lack of advice mean that they mix all the ingredients they have access to. Laying ducks are very sensitive to diet; any imbalance of nutrients or a rapid change of diet can affect their laying immediately.

Village animal health workers (VAHWs) are present in most villages, but their capacity for advising on diseases, nutrition and management is still very limited. Most of their training has been on disease prevention for large animals, and they have very little knowledge of poultry.

Table 31 Problems faced by farmers in their duck production (percentages)

Problem	Ducklings	Growers	Layers
Duck plague	2.8 (n = 4)	4.9 (n = 7)	9.0 (n = 13)
Fowl cholera	4.9 (n = 7)	4.2 (n = 6)	11.8 (n = 17)
Avian influenza	3.5 (n = 5)	8.3 (n = 12)	12.5 (n = 18)
Weak legs	10.4 (n = 15)	4.2 (n = 6)	13.2 (n = 19)
Poison in water	0.7 (n = 1)	2.1 (n = 3)	0.7 (n = 1)
Poison in feed	2.1 (n = 3)	2.8 (n = 4)	4.2 (n = 6)
Too warm	2.1 (n = 3)	0.7 (n = 1)	3.5 (n = 5)
Too hot	3.5 (n = 5)	4.9 (n = 7)	9.7 (n = 14)
Lack of water	1.4 (n = 2)	1.4 (n = 2)	9.0 (n = 13)

Assistance for duck production

About 35.4 percent of duck farmers reported that they receive assistance when problems occur with their duck production (Table 32), while farmers in Phnom Penh said that they do not receive any assistance. The assistance is mainly for disease control, mentioned by 96.2 percent of the farmers. About 12 percent of farmers in Battambang, Preah Sihanouk and Takeo said that they receive advice on duck feeding, while 13.2 percent of farmers in Preah Sihanouk, Prey Veng and Takeo receive advice on care and management, and 2 percent in Preah Sihanouk are also helped with marketing their ducks.

Table 32 Assistance for duck production (percentages)

Province	Receive assistance	Type of assistance received			
		Disease control	Feeding	Care and management	Marketing
Battambang	40.0	100	25.0	-	-
Kampong Cham	4.0	100	-	-	-
Kampong Chhnang	10.0	100	-	-	-
Phnom Penh	-	-	-	-	-
Preah Sihanouk	85.7	100	11.1	15.7	5.6
Prey Veng	40.0	50.0	-	50.0	-
Siem Reap	20.0	100	-	-	-
Takeo	46.5	100	15.0	9.5	-
Total	35.4 (n = 51)	96.2 (n = 49)	11.7 (n = 6)	13.2 (n = 7)	1.96 (n = 1)

Regarding the sources of assistance, 50.9 percent of duck farmers receiving assistance (except for those in Battambang) reported that district vets help them, 25.5 percent get help from provincial vets, 15.4 percent from VAHWs, 1.9 percent from NGOs, and 3.9 percent from private vets (Table 33). In Battambang, Preah Sihanouk, Prey Veng and Takeo, 85 percent of farmers receive assistance from feed suppliers.

District vets sell animal medicines at the district level and are important sources of advice and assistance when duck farmers have problems with their ducks. District vets could therefore play double roles as government agents and advisers to farmers who come to their shops. This consultation is free, but vet shop owners encourage farmers to purchase feed, medicine, vaccines, etc. Feed suppliers such as CP Group have marketing agents who move around the country to sell their products and advise farmers. These agents generally have a veterinary background.

Table 33 Sources of help with duck farmers' problems (percentages)

Province	District vets	Provincial vets	VAHWs	NGOs	Private vets	Feed suppliers
Battambang	-	25.0	20.0	-	-	75.0
Kampong Cham	100	-	-	-	-	-
Kampong Chhnang	100	-	-	-	-	-
Phnom Penh	-	-	-	-	-	-
Preah Sihanouk	38.9	61.1	-	-	-	94.4
Prey Veng	75.0	-	25.0	-	-	100
Siem Reap	33.3	33.3	-	-	33.3	-
Takeo	65.0	-	30.0	5.0	5.0	95.4
Total	50.9 (n = 26)	25.5 (n = 13)	15.4 (n = 8)	1.96 (n = 1)	3.9 (n = 2)	84.9 (n = 45)

Registration of duck farms

The Department of Animal Health and Production at the Ministry of Agriculture, Forestry and Fisheries encourages all livestock farmers to register their farms, but so far few of them have done so. Only 5.6 percent of the duck farmers interviewed said they were registered with a local authority, such as the village authority, the commune council or the district agriculture office (Table 34). No farms in Battambang, Kampong Cham, Kampong Chhnang and Siem Reap are registered. The reasons why duck farmers do not want to register are: 1) concern about their tax position; 2) unofficial payments are requested when registering; and 3) they are unsure of the benefits of registration.

Table 34 Registration of duck farms with institutions (percentages)

Province	Registered	With which institution?		
		Village authority	Commune council	District agriculture office
Battambang	-	-	-	-
Kampong Cham	-	-	-	-
Kampong Chhnang	-	-	-	-
Phnom Penh	10.0	100	-	-
Preah Sihanouk	4.7	-	100	-
Prey Veng	50.0	40.0	-	60
Siem Reap	-	-	-	-
Takeo	2.3	-	100	-
Total	5.6 (n = 8)	37.5 (n = 3)	25.0 (n = 2)	37.5 (n = 3)

Practices with sick ducks

About 44 percent of duck farmers said they get assistance from veterinarians, and 11.8 percent are assisted by VAHWs. Regarding what they do if their ducks get sick, most duck farmers (97.2 percent) reported that they treat their sick birds with medicines bought from animal pharmacies/markets, 38.2 percent quarantine them, 18.7 percent move them to new locations, 18.0 percent sell them, and 8.3 percent slaughter them (Table 35). Although veterinary medicines are not available in villages, livestock keepers can buy them at commune and district markets. Vaccines may decline in quality, as farmers generally keep them on ice due to the absence of electricity.

Table 35 Farmers' practices with sick ducks (percentages)

Province	Get help from vets	Get help from VAHWs	Quarantine sick ducks	Treat them with medicines	Sell them	Slaughter them	Move them to other locations
Battambang	30.0	-	40.0	90.0	30.0	-	-
Kampong Cham	32.0	-	32.0	100	16.0	4.0	4.0
Kampong Chhnang	40.0	-	40.0	100	10.0	-	10.0
Phnom Penh	-	-	60.0	80.0	10.0	10.0	20.0
Preah Sihanouk	80.9	19.0	42.8	100	14.3	23.8	28.6
Prey Veng	70.0	30.0	50.0	100	-	10.0	40.0
Siem Reap	40.0	6.7	53.3	100	33.3	-	-
Takeo	41.8	20.9	25.6	97.7	20.9	9.3	30.2
Total	43.7 (n=63)	11.8 (n=17)	38.2 (n=55)	97.2 (n = 140)	18.0 (n=26)	8.3 (n = 12)	18.7 (n = 27)

Practices with dead duck

About 90 percent of duck farmers said that they burn and bury their dead ducks (Photos 7 and 8), while only 11.1 percent use them as food (Table 36). A few (1.4 percent) in Kampong Cham and Takeo reported that they allow pets to eat the dead ducks, or mix them with manure to make compost. Most parts of Cambodia now have access to both TV and radio, and information regarding AI was broadcasted almost daily during the peak of the AI outbreak, so most people are aware of the disease, but their actions are still questionable. In 2008, a CelAgrid baseline survey in Takeo, Kandal and Pursat provinces reported that more than 75 percent of farmers said that television and radio were their main sources of AI information, with VAHWs also playing a significant role.

Table 36 Farmers' practices with dead ducks (percentages)

Province	Bury or burn them	Allow pets to eat them	Mix with manure	Use them
Battambang	80.0	-	-	40.0
Kampong Cham	96.0	-	4.0	4.0
Kampong Chhnang	100	-	-	-
Phnom Penh	100	-	-	-
Preah Sihanouk	85.7	-	-	14.3
Prey Veng	90.0	-	-	10.0
Siem Reap	100	-	-	6.7
Takeo	83.7	2.3	-	13.9
Total	90.3 (n = 130)	0.7 (n = 1)	0.7 (n = 1)	11.1 (n = 16)

Photo 7 Dead ducks on a farm in Baribo district, Kampong Chhnang.

Photo 8 A boy buries a dead duck without protection, Baribo district, Kampong Chhnang.

Impact of AI on duck farms

Only 13.2 percent of duck farmers in Kampong Cham, Preah Sihanouk, Siem Reap and Takeo reported that their ducks died during the AI outbreak (Table 37), but they were not sure whether the deaths were caused by H5N1, and many of them did not report to the concerned authority. About 5.3 percent of farmers in Takeo informed VAHWs and district vets, 5.3 percent in Siem Reap informed provincial vets, and 84.2 percent in Kampong Cham, Preah Sihanouk, Siem Reap and Takeo did not tell anybody. The reason for not informing anybody was because they thought that the concerned authority would come and cull all their ducks. The Cambodian government does not have a compensation policy for culled birds.

Table 37 Suspected ducks losses from HPAI (percentages)

Province	Poultry died	No losses	Whom did you inform about the bird deaths?			
			VAHWs	District vets	Provincial vets	Nobody
Battambang	-	100	-	-	-	-
Kg Cham	4.0	96.0	-	-	-	100
Kg Chhnang	-	100	-	-	-	-
Phnom Penh	-	100	-	-	-	-
Preah Sihanouk	14.3	85.7	-	-	-	100
Prey Veng	-	100	-	-	-	-
Siem Reap	26.7	73.3	-	-	25.0	75.0
Takeo	25.6	74.4	9.1	9.1	-	81.8
Total	13.2 (n = 19)	86.8 (n= 125)	5.3 (n = 1)	5.3 (n = 1)	5.3 (n = 1)	84.2 (n = 16)

Hygiene and cleaning

About 88 percent of duck farmers reported that they clean their duck sheds (Table 38). Of these, 42.8 percent clean while the ducks are outside, 24.6 percent when the ducks are in the shed, and 32.5 percent when they see that the shed is dirty. Duck farmers in Cambodia commonly leave dirt on the floor, which soon becomes muddy because duck faeces are liquid. Farmers who always confine their ducks have space near the shed, where they release the ducks during the day, when the shed can be cleaned and dried.

Table 38 Cleaning of duck shed (percentages)

Province	Clean	If yes, when?		
		After ducks removed	In presence of ducks	When needed
Battambang	90.0	55.6	33.3	11.1
Kampong Cham	84.0	38.1	52.4	9.5
Kampong Chhnang	80.0	12.5	87.5	-
Phnom Penh	100	100	-	-
Preah Sihanouk	90.5	26.3	-	73.7
Prey Veng	90.0	55.6	-	44.4
Siem Reap	80.0	16.7	83.3	-
Takeo	88.4	47.4	-	52.6
Total	87.5 (n = 126)	42.8 (n = 54)	24.6 (n = 31)	32.5 (n = 41)

About 94.4 percent of the duck farmers said they clean the shed with a broom to remove manure and feathers from the floor. This type of cleaning is of little use for disease control, as the floors of duck sheds are commonly dirty. 15.9 percent of respondents use water for cleaning, but no farmers in Battambang and Prey Veng do this. The sheds of farmers who clean with water have concrete floors. Of the 144 duck farmers, 21.4 percent clean their duck sheds with disinfectant after they have sold their ducks. None of the farmers in Kampong Chhnang use disinfectant. High percentages of duck farmers use brooms in Kampong Cham, Preah Sihanouk, Prey Veng and Takeo. High percentages of farmers using disinfectants are in Battambang and Preah Sihanouk (Table 39).

Table 39 Farmers' practices for duck shed cleaning (percentages)

Province	Broom	Water	Disinfectant
Battambang	88.9	-	44.4
Kampong Cham	95.0	4.7	14.3
Kampong Chhnang	87.5	12.5	-
Phnom Penh	80.0	20.0	20.0
Preah Sihanouk	100	36.8	63.1
Prey Veng	100	-	11.1
Siem Reap	91.7	8.3	25.0
Takeo	97.4	21.0	5.3
Total	94.4 (n = 118)	15.9 (n = 20)	21.4 (n = 27)

Duck litter

About 70.8 percent of duck farmers use duck litter as fertilizer for their crops, 36.1 percent sell it to other people, one farmer in Prey Veng feeds it to fish, and four in Prey Veng and Takeo burn it (Table 40). Most duck farmers in Kampong Cham, Phnom Penh, Preah Sihanouk and Takeo use litter on their own crops. Duck manure is very watery, so farmers use a lot of rice husk to collect the manure and keep the shed clean. In Treang district, Takeo province, chicken litter is sold at the farm-gate for 5 500 riel/bag; in Kampong Cham a bag of duck litter (of about 50 to 60 kg) sells for 3 000 riel. The duck farmer who uses duck manure to feed fish does so because the ducks have direct access to the fishpond. Litter removed from the shed floor contains a high percentage of rice husks, which might not be good to feed to fish directly but could be used to fertilize the pond for the production of plankton, which are then eaten by the fish.

Table 40 Farmers' practices for duck litter disposal (percentages)

Province	Fertilize paddy rice/crop	Store and sell	Use as feed for fish	Burn
Battambang	55.5	55.6	-	-
Kampong Cham	90.3	50.0	-	-
Kampong Chhnang	44.4	62.5	-	-
Phnom Penh	60.0	40.0	-	-
Preah Sihanouk	63.1	36.8	-	-
Prey Veng	25.5	11.1	11.1	22.2
Siem Reap	46.7	80.0	-	-
Takeo	89.4	5.3	-	5.3
Total	70.8 (n = 93)	36.1 (n = 47)	0.8 (n = 1)	3.1 (n = 4)

Pest control

Rats are the main pest problem, particularly when ducks are still small and cannot escape from the rats. Farmers must therefore build very good protection when they have young ducks. Of the 144 duck farmers interviewed, 43.7 percent use traps and 18.7 percent use poison to kill rats, while 40.9 percent said that they do not have problems with pests (Table 41). In the rainy season, problems with rats can increase because duck farms are generally established on raised ground, which is where rats and other pests go to escape floods. Poison is not the best option for farmers, but sometimes they have no choice.

Table 41 Farmers' practices for pest control (percentages)

Province	Poison	Traps	No pests
Battambang	-	80.0	20.0
Kampong Cham	16.0	40.0	52.0
Kampong Chhnang	-	10.0	90.0
Phnom Penh	30.0	50.0	20.0
Preah Sihanouk	14.3	9.5	76.2
Prey Veng	20.0	30.0	50.0
Siem Reap	20.0	53.3	33.3
Takeo	27.9	60.4	16.3
Total	18.7 (n = 27)	43.7 (n = 63)	40.9 (n = 59)

HPAI information and sources

Interestingly, all 144 duck farmers received information on AI (Table 42), for which radio and television were the main sources (mentioned by 100 percent). Other important sources of AI information were neighbours (for 25.7 percent), district vets (for 21.5 percent) and VAHWs (for 14.6 percent). This demonstrates that when getting information across to duck farmers, efforts should be made to develop clear messages. Much effort has been given to developing posters and leaflets for distribution to the target audience, but none of the interviewed farmers mentioned these.

This is an important indication of the mass media's significant role in informing farmers and contributing towards AI control. Much of Cambodia is accessible to the mass media, especially radio. The information that respondents mentioned they had received from radio and television was about quarantining new birds, keeping animal species separate, practising biosecurity and washing hands after being in contact with poultry, using masks when working in bird pens, not eating dead and sick birds, cooking birds well before eating, etc.

Table 42 AI information received and its sources (percentages)

Province	AI info. received	Sources							
		Radio/ TV	Local authority	VAHWs	District vets	Feed suppliers	Breed suppliers	NGOs	Neighbours
Battambang	100	100	10.0	20.0	30.0	10.0	-	-	-
Kampong Cham	100	100	-	20.0	28.0	16.0	8.0	4.0	4.0
Kampong Chhnang	100	100	-	-	10.0	10.0	10.0	10.0	20.0
Phnom Penh	100	100	-	-	20.0	-	-	-	40.0
Preah Sihanouk	100	100	14.3	14.3	28.6	4.7	-	-	-
Prey Veng	100	100	30.0	30.0	30.0	10.0	-	30.0	50.0
Siem Reap	100	100	6.7	20.0	26.7	20.0	20.0	-	33.3
Takeo	100	100	11.6	11.6	11.6	6.9	4.6	6.9	46.5
Total	100 (n = 144)	100 (n=144)	9.0 (n = 13)	14.6 (n= 21)	21.5 (n=31)	9.7 (n=14)	5.6 (n = 8)	5.6 (n=8)	25.7 (n= 37)

Regarding the importance of the various AI control practices, from a score of 1 to 5 (with 1 being the lowest importance and 5 the highest), respondents gave a high score (of 4) to hand washing after touching ducks, to prevent the spread of H5N1 to humans (Table 43). They also gave vaccination of birds 4 points. In fact no vaccine is yet available in Cambodia, but respondents based their score on their experience of using other vaccines to control diseases such as duck plague. Respondents also gave high scores to knowing the origin of birds, not introducing new birds to farms, disinfecting animal pens, etc.

Table 43 Farmers' average scores for the importance of various HPAI control measures (out of 5)

Province	Restrict visitors' entry to farms	Avoid contact with wild birds	Avoid mixing of species	Wash hands after touching birds	Dis-infection	Know origin of ducklings	Avoid bringing new birds to farms	Vaccination
Battambang	3.1	2.6	2.9	4.3	3.7	3.6	3.9	4.3
Kg Cham	2.2	2.5	2.6	3.5	3.0	3.3	3.8	4.1
Kg Chhnang	2.7	2.9	1.8	3.9	2.5	3.8	2.5	2.7
Phnom Penh	2.7	3.0	3.6	4.3	2.2	3.3	3.6	3.0
Preah Sihanouk	2.3	2.2	2.9	4.3	4.3	3.9	3.5	5.0
Prey Veng	2.9	2.6	3.6	4.5	3.1	3.4	3.4	4.3
Siem Reap	3.3	2.2	2.3	3.8	3.3	3.5	3.6	4.1
Takeo	2.3	2.7	2.9	4.0	3.5	3.5	3.1	4.4
Total	2.54 ± 0.10	2.56 ± 0.10	2.83 ± 0.11	4.03 ± 0.08	3.33 ± 0.11	3.55 ± 0.09	3.40 ± 0.09	4.17 ± 0.09

Suggestions for improving duck farming

Between 28.5 and 31.2 percent of the respondents consider that access to services for disease prevention and control and for duck care and management would help improve duck farming (Table 44). In this connection, about 24 percent of respondents said that they should have access to reliable medicines and vaccines for their ducks. In duck farming, success or failure depends greatly on mortality during the growing or laying stage. Experienced duck farmers reported that some ducklings die during the early stages of their growth, but mortality is also high later on, and vaccination against duck plague helps to reduce this risk. About 19 percent of respondents are concerned about importing ducks and their products from other countries, as this makes their own businesses difficult; 15.3 percent suggested that the government should help control the price of eggs.

Table 44 Farmers' suggestions for improving duck farming after AI (percentages)

Province	Intervention								
	I	II	III	IV	V	VI	VII	VIII	IX
Battambang	40.0	-	10.0	10.0	10.0	10.0	10.0	-	20.0
Kg Cham	16.0	16.0	8.0	-	12.0	12.0	40.0	24.0	16.0
Kg Chhnang	30.0	30.0	20.0	-	-	20.0	20.0	-	20.0
Phnom Penh	30.0	30.0	20.0	-	30.0	-	30.0	-	-
Preah Sihanouk	33.3	28.5	-	-	28.5	61.9	-	-	9.5
Prey Veng	45.4	27.3	-	-	27.3	45.4	9.1	9.1	-
Siem Reap	14.3	28.5	14.3	-	7.1	7.1	14.3	21.4	7.1
Takeo	30.2	51.1	-	6.9	39.5	4.6	6.9	-	6.9
Total	28.5 (n =41)	31.2 (n=45)	6.3 (n = 9)	2.8 (n = 4)	23.6 (n= 34)	18.7 (n= 27)	15.3 (n= 22)	6.9 (n= 10)	9.7 (n=14)

Notes: I = diseases prevention and control services, particularly for AI; II = duck care, management and feeding services; III = loan provision; IV = provision of materials to prevent AI spread to humans; V = access to reliable medicines/vaccines for ducks, particularly for AI; VI = control of duck products from outside; VII = control of egg price; VIII = lower food supply costs; IX = no answer.

Impact of AI on duck production

Regarding the effects of the AI outbreak on their farms, 47.6 percent of the duck farmers said that they had difficulty selling eggs, 31.9 percent had difficulty selling ducks, and 17.4 had difficulties with restrictions on the movement of ducks to markets (Table 45). Nearly 15 percent of duck farmers in Battambang, Preah Sihanouk and Takeo mentioned that it was difficult to obtain ducklings, and 11.8 percent in Kampong Cham, Preah Sihanouk and Takeo spent more money on fencing and feeding after the outbreak of AI. It should be noted that Takeo and Kampong Cham were among the first seven provinces with confirmed outbreaks of H5N1. In the period between 2004 and 2006, people in Cambodia – particularly in large towns and cities – reduced their consumption of poultry meat and products because of concerns about human infection and death to H5N1; during this period, the government had to make TV and radio announcements that it was safe to consume poultry meat and products. 28.5

percent of respondents reported that they did not face problems in duck farming after the outbreak of AI.

Table 45 Effects of the AI outbreak on duck production (percentages)

Province	Difficult to sell ducks	Difficult to sell eggs	Difficult to get ducklings	More investment on fencing and feed	Restricted movement of ducks to markets	Restricted movement of ducks for grazing	No problems
Battambang	-	70.0	10.0	-	-	-	30.0
Kampong Cham	20.0	48.0	-	4.0	8.0	-	44.0
Kampong Chhnang	-	50.0	-	-	20.0	-	50.0
Phnom Penh	10.0	40.0	-	-	10.0	-	60.0
Preah Sihanouk	38.1	57.1	23.8	23.8	33.3	9.5	14.3
Prey Veng	36.3	36.3	-	-	9.1	18.2	36.3
Siem Reap	42.8	28.5	-	-	14.3	-	42.8
Takeo	51.1	48.8	34.9	25.6	23.2	9.3	6.9
Total	31.9 (n = 46)	47.6 (n = 71)	14.6 (n = 21)	11.8 (n = 17)	17.4 (n = 25)	5.6 (n = 8)	28.5 (n = 41)

Markets for ducks and eggs

Buyers of ducks

Duck meat and eggs

Regarding the buyers of ducks for meat, 82.6 percent of the producers interviewed reported that they sell to intermediaries, 30.4 percent sell to villages, 26.1 percent to traders, and 13.0 percent each to market sellers and restaurants (Table 46). Most duck farmers in Kampong Cham, Phnom Penh, Preah Sihanouk and Takeo provinces sell all their ducks to intermediaries. According to CelAgrid and FAO (2008)[1], more than 62 percent of the poultry, including chickens, ducks and eggs, sold in Cambodian markets is sold by traders; 52.8 percent by smallholder producers, mainly as live poultry; and only 5.2 percent directly by farmers. Duck farmers in Takeo have more diverse buyers than in the other seven provinces and they are the main suppliers of duck eggs, particularly embryonic eggs, to Phnom Penh and nearby provinces. Takeo, particularly Tramkak district, has a tradition and skill in producing ducklings and embryonic eggs.

Table 46 Buyers of duck meat (percentages)

Province	Villagers	Intermediaries	Traders	Market sellers	Restaurants
Battambang	-	-	-	-	-
Kampong Cham	-	100	-	50.0	-
Kampong Chhnang	-	-	-	-	-
Phnom Penh	-	100	-	-	-
Preah Sihanouk	100	100	-	-	-
Prey Veng	-	50.0	50.0	-	50.0
Siem Reap	-	-	-	-	100
Takeo	45.4	90.9	45.4	18.2	-
Total	30.4 (n = 7)	82.6 (n = 19)	26.1 (n = 6)	13.0 (n = 3)	13.0 (n = 3)

Similar to duck meat farmers, the majority (66.4 percent) of duck egg farmers sell to intermediaries, 28.9 percent sell to market sellers, 25.0 percent to villagers and small village shops buying for daily consumption, 21.1 percent to market sellers, and 13.4 percent to hatchery operators (Table 47). It is sometimes difficult to distinguish the business of traders from that of intermediaries because they often play similar roles (Photos 9 and 10). Farmers in

[1] CelAgrid and FAO. 2008. Assessment of poultry markets and sellers in 24 provinces and cities in Cambodia. Phnom Penh

Kampong Cham said that they receive loans from hatchery operators and in return sell their eggs at the market price to them.

Table 47 Buyers of duck eggs (percentages)

Province	Villagers	Intermediaries	Traders	Market sellers	Restaurants	Hatchery operators
Battambang	-	50.0	30.0	40.0	-	20.0
Kampong Cham	12.5	50.0	25.0	25.0	-	41.7
Kampong Chhnang	20.0	60.0	30.0	70.0	-	-
Phnom Penh	62.5	50.0	12.5	62.5	-	-
Preah Sihanouk	25.0	70.0	5.0	25.0	-	-
Prey Veng	40.0	70.0	20.0	20.0	-	10.0
Siem Reap	-	61.5	-	30.7	7.7	33.3
Takeo	39.4	87.9	33.3	12.1	-	-
Total	25.0 (n = 32)	66.4 (n = 85)	21.1 (n = 27)	28.9 (n = 37)	0.8 (n = 1)	13.4 (n = 17)

Photo 9 Intermediary with motorbike buying eggs supply to market, Siem Reap district, Siem Reap.

Photo 10 Intermediary with a motorbike buying eggs to supply to a hatchery, Siem Reap district, Siem Reap.

Locations of duck meat and egg buyers

Thirty percent of respondents said that the buyers of ducks and eggs are from the same province, 34.7 percent from the same district, 18.7 percent from the same commune, and 11.1 percent from the same village (Table 48). Few buyers come from other provinces, but this does not mean that the products are used only within the province; buyers transport eggs and meat to places where there is high demand, such as Phnom Penh, Siem Reap and Preah Sihanouk.

Table 48 Location of duck and egg buyers (percentages)

Provinces	Same village	Same commune	Same district	Same province	Other province
Battambang	10.0	-	30.0	60.0	-
Kampong Cham	16.0	16.0	44.0	16.0	8.0
Kampong Chhnang	20.0	10.0	30.0	20.0	20.0
Phnom Penh	20.0	50.0	10.0	20.0	-
Preah Sihanouk	-	4.7	23.8	66.7	4.7
Prey Veng	27.3	18.2	27.3	18.2	9.1
Siem Reap	-	28.5	64.3	7.1	-
Takeo	9.3	23.2	34.9	30.2	2.3
Total	11.1 (n= 16)	18.7 (n = 27)	34.7 (n = 50)	30.5 (n = 44)	4.9 (n = 7)

Duck farmers use two types of delivery system for selling their ducks and eggs: 1) 70.1 percent sell at the farm-gate, with buyers coming regularly to buy eggs and special arrangements made between the producer and the buyer for duck sales (Table 49); and 2) 29.8 percent deliver ducks and eggs to markets or collecting points. High percentages of farmers in Takeo, Siem Reap, Prey Veng and Kampong Cham sell their ducks and eggs at the farm-gate, while in Kampong Chhnang most sell at markets and collecting points.

Table 49 Mode of delivery for duck and egg sales (percentages)

Province	Farm-gate	Delivered to market/collection point
Battambang	50.0	50.0
Kampong Cham	68.0	32.0
Kampong Chhnang	20.0	80.0
Phnom Penh	60.0	40.0
Preah Sihanouk	47.6	52.4
Prey Veng	72.7	27.3
Siem Reap	78.5	21.4
Takeo	97.6	2.3
Total	70.1 (n = 101)	29.8 (n = 43)

Selling arrangements

Of the 144 duck farmers, only 9.0 percent make contracts with buyers (Table 50); normally farmers have only verbal agreements as they trust each other in their businesses. Contracts are for: 1) buying all ducks and eggs (for 58.3 percent of farmers in Battambang, Kampong Chhnang and Takeo); 2) buying only healthy ducks (for 45.4 percent in Battambang, Phnom Penh, Siem Reap and Takeo); and 3) buying only ducks that are of adequate weight for the market (for 9.0 percent in Phnom Penh). None of the ducks and eggs sold at markets are controlled by veterinarians.

Table 50 Contracts between farmers and buyers (percentages)

Provinces	Make contracts	Type of contract			
		Buy all ducks/eggs	Buy only healthy ducks	Buy ducks of market weight	Certification by vets
Battambang	20.0	50.0	100	-	-
Kampong Cham	-	-	-	-	-
Kampong Chhnang	10.0	100	-	-	-
Phnom Penh	10.0	-	100	100	-
Preah Sihanouk	-	-	-	-	-
Prey Veng	-	-	-	-	-
Siem Reap	7.1	-	100	-	-
Takeo	18.6	71.4	28.5	-	-
Total	9.0 (n=13)	58.3 (n = 7)	45.4 (n = 5)	9.1 (n = 1)	0.0

Market demand for specific breeds of duck

Only about 8 percent of duck farmers in Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk, Prey Veng and Takeo reported that duck markets demand specific breeds of duck (Table 51). Sampauv was mentioned by 27.2 percent of respondents in Kampong Chhnang and Takeo, and Khaki Campbell by 72.8 percent in Battambang, Kampong Cham, Preah Sihanouk and Prey Veng.

The reasons for selecting Sampauv are: 1) the red colour of the meat (for 33.3 percent); and 2) consumers' preference when selling culled ducks (for 66.7 percent). Sampauv is a local breed with white feathers, and is kept mainly for meat.
Demand for Khaki Campbell is due to: 1) consumers' preference (for 50.0 percent); and 2) its high meat production (for 50.0 percent).

Table 51 Market demand for specific duck breeds (percentages)

Province	Demand for breed	If yes, what breed?				
		I	II	III	IV	V
Battambang	10.0	-	-	-	100	-
Kg Cham	4.0	-	-	-	100	-
Kg Chhnang	10.0	100	-	-	-	-
Phnom Penh	-	-	-	-	-	-
Preah Sihanouk	14.3	-	-	-	100	-
Prey Veng	27.3	-	-	-	100	-
Siem Reap	-	-	-	-	-	-
Takeo	4.6	100	-	-	-	-
Total	7.63 (n = 11)	27.2 (n = 3)	0.0	0.0	72.8 (n = 8)	0.0

Notes: I = Sampauv; II = Angkam; III = long-neck Krolas; IV = Khaki Campbell; V = Peking.

Duck and egg sales before and after the AI outbreak

The numbers of ducks and eggs sold per year increased after the AI outbreak. Consumption may have decreased among better-off families in the cities, but poultry and eggs continue to be valuable protein sources for poor rural families. Only one farm in Kampong Cham reported a decline in business because of low demand for ducklings.

Before the AI outbreak, duck farmers in Kampong Cham and Phnom Penh sold 597 ducks a year, increasing to an average of 923 after the AI outbreak in Kampong Cham, Phnom Penh, Preah Sihanouk, Prey Veng, Siem Reap and Takeo (Table 52). Only Kampong Cham and Phnom Penh raised ducks for meat before AI, but more farmers keep ducks for meat since the AI outbreak. However, these figures cannot be used to draw conclusions regarding the numbers of duck farms before and after the AI outbreaks.

There were no significant changes in the number of laying ducks after the AI outbreaks. Before the outbreak, an average of 1 099 layers a year were sold, rising to 1 197 after the outbreak. The highest numbers of laying ducks sold both before and after the AI outbreaks

were found in Kampong Chhnang, which is located on Tonle Sap river where farmers can benefit from the open water and – more important – the seasonal fish harvest – a good source of protein for ducks.

As already mentioned, Takeo used to be an important supplier of duck eggs to cities and towns, but a shortage of natural resources (small fish, shrimps, snails, etc.) and open water has driven some duck farmers to move their farms to Tonle Sap Lake, where they can reduce the costs of inputs, especially for feed as ducks can eat naturally occurring feed. With good management, the ducks can lay eggs at a rate of 70 to 80 percent of the total layer flock. Before the AI outbreak, each laying farm sold an average of 211 633 eggs a year, rising to 279 543 after AI. A significant increase in the number of eggs sold was found in Siem Reap, where it rose from 151 200 to 960 000 eggs a year before AI to 12 600 to 6 480 000 eggs after.

Table 52 Numbers of ducks and eggs sold annually before and after AI outbreak

Province	Before AI outbreak			After AI outbreak		
	Growers	Layers	Eggs (thousand)	Growers	Layers	Eggs (thousand)
Battambang	-	300–3 500	121–972	-	300–4 500	114–900
Kampong Cham	300	150–2 000	5.54–2 448	350–1 500	200–4 000	1.2–2 448
Kampong Chhnang	-	300–12 000	1.68–903	-	300–12 000	1.68–1 275
Phnom Penh	400-700	300–350	21.6–72	2 000	250–1 200	2.4–2 270
Preah Sihanouk	-	700–2 800	16.8–1 800	2 500	300–4 000	1.68–1 800
Prey Veng	-	430–3 800	27–243	1 700	430–3 800	21–243
Siem Reap	-	600–4 000	151.2–960	1 000	500–3 000	12.6–6 480
Takeo	-	200–2 000	18–126	210–1 500	180–2 000	18–500
Average	597 ± 107	1 099 ± 141	211 633 ± 34 146	923 ± 171	1 197 ± 126	279 543 ± 57 693

Expenditures for duck production

Over the 12 months preceding the survey, 81.3 percent of duck farmers spent on the construction of duck pens; 9.0 percent in Battambang, Kampong Cham, Preah Sihanouk, Prey Veng and Takeo spent on digging ponds; 59.7 percent spent on fencing; 66.4 percent spent on equipment such as feed and water troughs and containers, washing materials and pumping machines; 13.9 percent, except for in Kampong Chhnang and Takeo, spent on water supply; and 82.6 percent spent on medicines and vaccines. All duck farmers also spent on feed and labour; as labour is provided by family members, opportunity cost is used to calculate this expense. The normal daily wage rate in the villages is 10 000 to 12 000 riel.

On average, the farmers spent 1.2 million on constructing duck pens, for which the greatest expenses were found in Battambang (2.9 million riel on average, ranging from 0.4 to 12 million), Phnom Penh (4.0 million riel on average, ranging from 0.05 to 8 million) and Preah Sihanouk (3.0 million riel on average, ranging from 0.1 to 15 million) (Table 53). Farmers with few resources in Takeo and Prey Veng use plastic sheeting and bamboo poles to provide shelter for their ducks during the day.

An overall average of 4 million riel was spent on constructing ponds, on which Prey Veng spent the most. Expenses on fencing were 0.5 million riel, with the highest in Battambang (2.2 million riel on average, ranging from 0.02 to 6 million) and Preah Sihanouk (1.5 million riel on

average, ranging from 0.05 to 20 million). Most duck farms use nylon netting for fencing. Fences are about 0.5 m high and the area fenced depends on the number of ducks.

Farmers reported that most capital investment is for feed supply. On average, the farmers spent about 47 million riel on feed over the previous 12 months. The highest expenditures for feed were found in Battambang (92.34 million riel on average, ranging from 7.9 to 216 million), Kampong Cham (88.6 million riel on average, ranging from 0.6 to 396 million), Preah Sihanouk (69 million riel on average, ranging from 1.6 to 288 million) and Siem Reap (65.5 million riel on average, ranging from 1.96 to 144 million). On average, farmers spent about 0.4 million riel on farming equipment/tools. Due to water shortage, duck farmers also spend money to get water for their ducks in the dry season.

Table 53 Farmers' expenditures for duck production over the 12 months preceding the survey (million riel)

Province	Sheds	Ponds	Fences	Feed	Equipment	Water	Labour	Other
Battambang	0.4–12	6–20	0.02–6	7.920-216	0.01–0.3	1.8	1.4–5.4	0.01–1
Kg Cham	0.012–4	1–20	0.01–20	0.58–396	0.05–0.2	2.16	1.08–7.2	0.05-1.62
Kg Chhnang	0.05–2.5	-	0.07–1.2	2.52–162	0.02–0.1	-	1.08–7.4	0.02–4.8
Phnom Penh	0.05–8	-	0.03-0.112	1.8–96	0.4	1.2	1.26–7.2	0.025–4.8
Preah Sihanouk	0.01–15	0.5-16	0.05–20	1.551–288	0.05–8	0.1–7.2	1.2–9.6	0.15–1.7
Prey Veng	0.03–2	20	0.05–0.2	1–72	0.03–0.13	-	1.2–7.2	0.15–1.7
Siem Reap	0.1–2.6	-	0.1–0.8	1.96–144	0.05–0.6	0.36–0.96	0.24–9.36	0.05–4
Takeo	0.05–1	15	0.03–0.4	1.184–47.45	0.01–2.55	-	0.14–9.6	0.027–2
Average	1.205	4.033	0.503	47.114	0.429	1.312	3.335	0.785
±	0.217	2.109	0.245	5.653	0.098	0.362	0.161	0.887

Sources of capital for investment

Regarding the sources of capital for duck farming, 72.9 percent of farmers answered that they use their own resources, 49.3 percent borrow from banks, and 29.4 percent borrow from private money lenders (Table 54). A few (3.5 percent) in Prey Veng and Takeo borrow from relatives. High percentages of farmers use their own resources in Battambang, Kampong Cham, Kampong Chhnang, Prey Veng and Siem Reap, while high percentages of loans from banks were recorded in Battambang, Kampong Cham, Preah Sihanouk and Takeo.

There are no agents and microfinance institutions at the commune and district levels. The available microfinance institutions are ACLEDA, AMRET, PRASAC, etc., and farmers can borrow up to US$10 000 at an interest rate of 1.5 to 2 percent per month. In the villages there are private money lenders with very high interest rates, generally of about 5 percent per month.

Table 54 Sources of capital for duck farming (percentages)

Province	Bank loan	Private loan	Own resources	Borrow from relatives
Battambang	50.0	60.0	90.0	-
Kampong Cham	52.0	48.0	80.0	-
Kampong Chhnang	40.0	10.0	100	-
Phnom Penh	30.0	40.0	50.0	-
Preah Sihanouk	66.7	9.5	61.9	-
Prey Veng	36.4	45.4	81.8	18.2
Siem Reap	28.6	7.1	92.8	-
Takeo	55.8	26.2	60.4	7.0
Total	49.3 (n = 71)	29.4 (n = 42)	72.9 (n = 105)	3.47 (n = 5)

Plans for duck production

About 55 percent of duck farmers reported that they plan to increase the scale of their production over the next 12 months, 31.2 percent plan to move to a new location, 22.3 percent to change their duckling supplier, 7.7 percent to change the marketing of their ducks for meat and eggs, 14.2 percent to improve their production techniques, and 6.2 percent to stop raising ducks (Table 55). High percentages of duck farmers in Kampong Chhnang, Phnom Penh and Takeo plan to increase the scale of their production.

The reasons for duck farmers to increase the scale of production are: 1) to increase their families' incomes (for 88.9 percent); 2) because labour is available (for 2.5 percent); 3) they have resources to invest (for 1.2 percent); 4) they are experienced in duck keeping (for 1.2 percent); and 5) feed is available in the fields (for 6.2 percent).

The reasons for improving production are: 1) to increase income (for 43.8 percent); and 2) commercial feed is available and they have experience in producing homemade concentrate (for 56.2 percent).

Reasons for changing the supply of ducklings are to get: 1) healthier ducklings (for 23.3 percent); 2) reasonably priced ducklings (for 33.3 percent); 3) good laying breeds (for 30.0 percent); and 4) timely supplies (for 13.3 percent).

Reasons for changing the marketing of their ducks and eggs are to: 1) get better prices (for 75.0 percent); and 2) transport products to markets with higher demand (for 25.0 percent).

Reasons for moving to the new location are: 1) concerns about disease outbreaks, as they have raised in the same location for a long time (for 22.0 percent); 2) end of land rental contract (for 2.4 percent); 3) they have land available (for 9.8 percent); and 4) the feed supply available in the fields (for 65.9 percent).

Reasons for stopping duck production are: 1) lack of labour supply, mainly for elderly farmers whose family members are not willing to continue duck farming (for 66.7 percent); 2) declining profits from production because of unstable egg prices and high feed costs (for 11.1 percent); and 3) to concentrate on other businesses (for 22.2 percent).

Table 55 Farmers' plans for changes over the next 12 months (percentages)

Province	Increase scale of prod.	Improve prod.	Change supply of ducklings	Change marketing products	Move to new location	Stop duck prod.
Battambang	30.0	-	30.0	-	40.0	-
Kg Cham	44.0	16.0	20.0	24.0	8.0	8.0
Kg Chhnang	60.0	10.0	20.0	22.2	10.0	-
Phnom Penh	80.0	10.0	33.3	30.0	20.0	10.0
Preah Sihanouk	57.1	-	23.8	-	4.7	4.7
Prey Veng	54.5	27.3	45.4	9.1	81.8	9.1
Siem Reap	50.0	0	14.3	21.4	7.1	7.1
Takeo	62.8	4.7	16.3	12.2	58.1	6.9
Total	55.5 (n = 80)	7.7 (n = 11)	22.3 (n = 32)	14.2 (n = 20)	31.2 (n = 45)	6.3 (n = 9)

Requirements for duck production

In the priority rating of requirements for improving duck production, farmers scored each need from 1 (lowest) to 5 (highest). Among the priorities identified by the farmers and listed in Table 56, the highest scores were awarded to technical advice, and the lowest to better access to credit. The other factors all scored fairly high. Feed and drug suppliers normally provide duck farmers with advice. However, many sellers do not have a veterinary or animal production background, and have generally learned from their main suppliers of drugs and feed. Although VAHWs have been trained, they too have limitations, including their level of general education. Most VAHWs can help organize vaccination campaigns, collect information about diseases, and report to provincial and national authorities about disease outbreaks.

Table 56 Farmers' requirements for improving duck production (scores out of 5)

Province	Technical advice	Better supply of ducklings and feed	Better access to credit	Better marketing of products	Better health services	Access to land for construction
Battambang	4.2	3.5	3.7	3.4	4.1	3.5
Kg Cham	3.8	3.0	2.9	3.8	3.7	2.8
Kg Chhnang	4.2	4.2	2.7	4.1	3.8	4.2
Phnom Penh	4.2	4.1	3.7	4.1	3.7	3.6
Preah Sihanouk	4.5	3.4	2.7	3.1	3.8	3.5
Prey Veng	4.7	4.4	3.4	4.3	4.1	3.4
Siem Reap	3.4	3.4	2.1	4.1	4.1	3.4
Takeo	4.4	3.7	3.1	3.5	3.6	3.7
Total	4.21 ± 0.07	3.64 ± 0.10	2.98 ± 0.10	3.71 ± 0.08	3.80 ± 0.08	3.49 ± 0.11

Observations and impression of duck farms

General

General observations were made on the 144 duck farms where interviews were carried out, and data on 14 practices were recorded (Tables 57 and 58):

Proper fencing at entrances: 65.2 percent overall, with high percentages in Battambang, Preah Sihanouk and Takeo.
Proper closable gates (Photo 11): 65.9 percent overall, with high percentages in Battambang, Preah Sihanouk, Siem Reap and Takeo.
Signs warning of the presence of poultry: 6.9 percent in Kampong Cham, Preah Sihanouk, Prey Veng and Takeo.
Free-ranging animals near farms: 68.7 percent overall, with high percentages in Battambang, Kampong Cham, Kampong Chhnang, Phnom Penh, Preah Sihanouk, Prey Veng and Siem Reap.
Free-ranging animals and pets on farms (Photo 12): 70.1 percent overall, with high percentages in Battambang, Kampong Cham, Kampong Chhnang, Phnom Penh, Preah Sihanouk, Prey Veng and Siem Reap.
Wild birds prevented from entering duck pens: 15.3 percent in Kampong Cham, Preah Sihanouk and Takeo.
Proper manure disposal: 28.4 percent in Kampong Cham, Phnom Penh, Preah Sihanouk, Siem Reap and Takeo.

Table 57 General observations of duck farms I (percentages)

Province	Proper fencing at entrance	Proper closable gate	Poultry warning signs	Free-ranging animals near farm	Free-ranging animals and pets on farm	Prevention of wild bird entry	Proper manure disposal
Battambang	80.0	80.0	-	100	100	-	-
Kg Cham	52.0	48.0	4.0	80.0	80.0	8.0	32.0
Kg Chhnang	30.0	30.0	-	100	100	-	-
Phnom Penh	30.0	30.0	-	100	70.0	-	30.0
Preah Sihanouk	80.9	90.5	14.3	66.7	80.9	28.6	28.6
Prey Veng	54.5	45.4	9.1	81.8	63.6	-	-
Siem Reap	57.1	64.3	-	71.4	78.6	-	21.4
Takeo	83.7	83.7	11.6	37.2	44.2	32.5	48.8
Total	65.2 (n = 94)	65.9 (n = 95)	6.9 (n = 10)	68.7 (n = 99)	70.1 (n = 101)	15.3 (n = 22)	28.4 (n = 41)

Photo 11 Proper fencing and closable gate at the entrance of a duck farm, Cheung Prey district, Kampong Cham.

Photo 12 Presence of dog on a farm, Boribo district, Kampong Chhnang.

Other observations (Table 58):

Uncovered feed storage: 50.0 percent overall, with high percentages in Preah Sihanouk and Takeo.

Pets entering farm houses: 62.5 percent overall, with high percentages in Battambang, Kampong Cham, Kampong Chhnang, Phnom Penh, Prey Veng and Siem Reap.

Birds left over from previous flocks: 54.8 percent overall, with high percentages in Battambang, Kampong Cham, Kampong Chhnang, Phnom Penh, Prey Veng and Siem Reap.

Open-air feed storage in farmyard: 72.2 percent overall, with high percentages in Battambang, Kampong Cham, Kampong Chhnang, Phnom Penh and Siem Reap.

Outdoor feeding (Photo 13): 21.5 percent overall, except in Kampong Chhnang where ducks are fed inside pens.

Outdoor water supply: 34.3 percent overall, with high percentages in Battambang and Takeo.

Slaughtering on farms (Photo 14): 14.6 percent overall, except in Battambang and Kampong Cham.

Table 58 General observations of duck farms II (percentages)

Province	Uncovered feed storage	Pets entering farm houses	Birds left over from previous flocks	Open-air feed storage in farmyard	Outdoor feeding	Outdoor water supply	Slaughtering on farms
Battambang	20.0	90.0	100	90.0	10.0	40.0	-
Kampong Cham	28.0	60.0	68.0	76.0	28.0	36.0	-
Kampong Chhnang	20.0	100	100	100	-	30.0	10.0
Phnom Penh	20.0	100	80.0	90.0	10.0	10.0	10.0
Preah Sihanouk	71.4	42.8	33.3	61.9	9.5	9.5	9.5
Prey Veng	45.4	63.6	63.6	63.6	18.2	36.4	9.1
Siem Reap	28.6	64.3	71.4	92.8	21.4	21.4	7.1
Takeo	81.4	48.8	23.2	55.8	34.9	54.7	34.8
Total	50.0 (n = 72)	62.5 (n = 90)	54.8 (n = 79)	72.2 (n = 104)	21.5 (n= 31)	34.3 (n = 49)	14.6 (n = 21)

Photo 13 Indoor feed and feeding, Steung Hav district, Preah Sihanouk.

Photo 14 Duck slaughtering facilities on a farm, Siem Reap district, Siem Reap.

General impressions of farmyards

Only 8.3 percent of the farmyards in Kampong Cham, Preah Sihanouk, Prey Veng, Siem Reap and Takeo were observed to be clean, 78.5 percent could do better, and 13.2 percent of farmyards in Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk and Takeo were dirty (Table 59). The survey teams observed high percentages of farms that could do better in Battambang, Kampong Chhnang, Phnom Penh, Preah Sihanouk, Prey Veng, Siem Reap and Takeo.

Table 59 General impressions of farmyards (percentages)

Province	Clean	Could do better	Dirty
Battambang	-	70.0	30.0
Kampong Cham	16.0	64.0	20.0
Kampong Chhnang	-	70.0	30.0
Phnom Penh	-	100	-
Preah Sihanouk	14.3	76.2	9.5
Prey Veng	9.1	90.9	-
Siem Reap	7.1	71.4	21.4
Takeo	6.9	86.0	6.9
Total	8.33 (n = 12)	78.5 (n = 113)	13.2 (n = 19)

Quality of duck housing

Observation on all farms led to the conclusion that 18.7 percent of duck farms have good-quality housing (Photo 15), except in Battambang (Photo 16) and Phnom Penh. 64.6 percent are of medium quality and 16.7 percent are poor (Table 60). High percentages of medium-quality housing were observed in Battambang, Kampong Cham, Kampong Chhnang, Prey Veng, Siem Reap and Takeo.

Table 60 Observations of housing quality (percentages)

Provinces	Good	Medium	Poor
Battambang	-	80.0	20.0
Kampong Cham	20.0	68.0	12.0
Kampong Chhnang	10.0	70.0	20.0
Phnom Penh	-	50.0	50.0
Preah Sihanouk	38.1	42.8	19.0
Prey Veng	9.1	81.8	9.1
Siem Reap	14.3	78.6	7.1
Takeo	23.2	62.8	13.9
Total	18.7 (n = 27)	64.6 (n = 93)	16.7 (n = 24)

Photo 15 Good-quality duck housing, Siem Reap district, Siem Reap.

Photo 16 Poor duck housing, Ek Phnom district, Battambang.

Water supply

Only 18 percent of duck farms have good water supplies, and none in Battambang and Kampong Chhnang, while 74.3 percent are of intermediate quality, and 7.6 percent are bad (Table 61). Ducks drink water from the ponds where they swim, and most of these ponds look polluted with duck manure.

Table 61 Observations of the water supply (percentages)

Province	Good	Intermediate	Bad
Battambang	-	100	-
Kampong Cham	32.0	52.0	16.0
Kampong Chhnang	-	90.0	10.0
Phnom Penh	10.0	80.0	10.0
Preah Sihanouk	38.1	52.4	9.5
Prey Veng	9.1	90.9	-
Siem Reap	7.1	85.7	7.1
Takeo	16.3	79.0	4.6
Total	18.0 (n = 26)	74.3 (n = 107)	7.6 (n = 11)

Duck hatcheries

General information on duck hatchery operators

Age and income classification of hatchery operators

The average age of hatchery operators was 43.6 years, ranging from 25 to 68 years (Table 62). Of the 39 hatchery operators interviewed, 66.7 percent are poor, and 30.7 percent are medium-income. All hatchery operators in Phnom Penh are medium-income, and only one hatchery owner in Takeo is rich.

Table 62 Ages and income classifications of hatchery operators

Province	Age (years)	Income classification (%)			
		Very poor	Poor	Medium	Rich
Battambang	49.5	-	83.3	16.7	-
Kampong Cham	39.8	-	83.3	16.7	-
Phnom Penh	47.8	-	-	100	-
Prey Veng	45.0	-	100	-	-
Siem Reap	37.0	-	80.0	20.0	-
Takeo	43.7	6.7	60.0	33.3	6.7
Total	43.6±1.49	2.56 (n = 1)	66.7 (n = 60)	30.7 (n = 12)	2.6 (n = 1)

When asked to rank their livelihood activities according to importance, most hatchery owners reported that their hatchery businesses and sale of labour are very important, followed by village shops and trading, and duck keeping (Table 63).

Of the hatchery owners in Battambang, Kampong Cham and Takeo, 51.3 percent gave high importance to rice cultivation, and 7.7 percent to government work. In Battambang and Takeo, 5.1 percent of hatchery owners earn income from vegetables and fruit trees, 7.7 percent from cattle/buffaloes, and 33.3 percent from pigs. 30.8 percent of hatcheries in Battambang, Kampong Cham, Prey Veng and Takeo have good incomes from chickens, and 20.5 percent in Battambang, Kampong Cham and Phnom Penh earn additional income from duck production.

Table 63 Main sources of income of hatchery operators (percentages)

Activity	Very important	Important	Less important
Rice	60.0 (n = 12)	40.0 (n = 8)	-
Vegetables	-	75.0 (n = 3)	25.0 (n = 1)
Fruit trees	-	16.7 (n = 1)	83.3 (n = 5)
Cattle/buffaloes	7.7 (n = 1)	69.2 (n = 9)	23.1 (n = 3)
Pigs	7.1 (n = 1)	64.3 (n = 9)	28.6 (n = 4)
Chickens	-	54.5 (n = 6)	45.5 (n = 5)
Ducks	75.0 (n = 6)	25.0 (n = 2)	-
Aquaculture	-	66.7 (n = 2)	33.3 (n = 1)
Village shop	83.3 (n = 5)	-	16.7 (n = 1)
Selling labour	100 (n = 1)	-	-
Government work	-	100 (n = 3)	-
Trading	83.3 (n = 5)	16.7 (n = 1)	-
Hatchery operations	97.4 (n = 38)	2.6 (n = 1)	-

Responsibilities and decisions in hatchery operations

As in duck production, labour is important for hatchery operations, and is either supplied by operators' families or hired from outside. In addition to family labour 23.1 percent of the hatcheries in Battambang, Phnom Penh, Siem Reap and Takeo hire labour from outside.

Of the 39 hatcheries interviewed, 94.9 percent of husbands, 64.1 percent of wives, 15.4 percent of sons and 5.2 percent of daughters are involved in buying eggs for incubation (Table 64). Sons do not participate in egg buying in Kampong Cham and Siem Reap, and daughters in Kampong Cham, Phnom Penh, Prey Veng and Siem Reap are not involved in duck activities. Husbands have the most responsibility and decision-making about hatchery operations, apart

from sales of embryonic and infertile eggs, where wives have most decision and other responsibilities. Sons are involved mainly in buying eggs, cleaning incubators, warming eggs in the sun, cleaning eggs before incubation, placing eggs in the incubator and caring for eggs during hatching. Sons are also sometimes involved in other tasks related to incubating eggs. Daughters' involvement in egg incubation is slight, and mainly for cleaning eggs before incubating, placing eggs in the incubator and caring for eggs during hatching. This means that they share the work done by sons. Hired labour is used mainly for cleaning incubators, warming eggs in the sun, cleaning eggs before incubating, placing eggs in the incubator and caring for eggs during hatching. Hired workers are not involved in decision-making and product sales.

Table 64 Responsibilities and decisions in hatchery operations (percentages)

Activity/decision	Husband	Wife	Son	Daughter	Worker
Buying eggs	94.9 (n = 37)	64.1 (n = 25)	15.4 (n = 6)	5.2 (n = 2)	-
Cleaning the incubator	74.4 (n = 29)	64.1 (n = 25)	17.9 (n = 7)	7.7 (n = 3)	23.1 (n = 9)
Warming eggs in the sun	74.4 (n = 29)	64.1 (n = 25)	17.9 (n = 7)	7.7 (n = 3)	23.1 (n = 9)
Cleaning eggs before incubating	71.8 (n = 28)	61.5 (n = 24)	30.8 (n = 12)	17.9)n = 7)	23.1 (n = 9)
Placing eggs in the incubator	82.1 (n = 32)	61.5 (n = 24)	39.5 (n = 14)	17.9 (n = 7)	23.1 (n = 9)
Caring for eggs during hatching	74.4 (n = 29)	59.0 (n = 23)	25.6 (n = 10)	15.4 (n = 6)	23.1 (n = 9)
Selling ducklings	64.1 (n = 25)	59.0 (n = 23)	7.7 (n = 3)	2.6 (n = 1)	-
Selling embryonic eggs	76.9 (n = 30)	89.7 (n = 35)	7.7 (n = 3)	5.1 (n = 2)	-
Selling unfertile eggs	71.8 (n = 28)	92.3 (n = 36)	2.6 (n = 1)	2.6 (n = 1)	-

Hatchery operations

Hatching capacity and numbers

About 70 to 80 percent of the hatcheries produce embryonic eggs, and 50 to 60 percent produce ducklings. On average, 5 500 eggs are incubated at one time (Table 65), to produce 4 164 embryonic eggs or 3 560 ducklings. The demand and supply of embryonic eggs does not normally change much over time, but the demand for ducklings varies from season to season. High percentages of hatcheries with large capacities were found in Phnom Penh, incubating an average of 12 000 eggs at one time (ranging from 3 000 to 20 000), and Prey Veng, with an average of 16 000 eggs (ranging from 3 000 to 40 000).

Table 65 Hatching capacities and numbers among hatchery operators

Province	Eggs/time	Ducklings produced/time	Embryonic eggs produced/time
Battambang	2 000–8 000	1 000–4 000	1 400–5 600
Kampong Cham	700–7 500	450–4 900	560–5 600
Phnom Penh	3 000–20 000	2 100–16 000	2 400–18 000
Prey Veng	3 000–40 000	2 100–32 000	2 200–36 000
Siem Reap	1 300–3 000	700–1 800	900–2 500
Takeo	3 000–6 000	1 200–3 600	500–4 500
Total	5 500 ± 1 087	3 560 ± 865	4 164 ± 917

The numbers of embryonic eggs and ducklings produced each year were calculated. An average of 515 616 eggs a year are incubated, producing 380 600 embryonic eggs or 295 375 ducklings (Table 66). Large numbers of embryonic eggs are produced every year in Battambang (445 250 on average, ranging from 63 000 to 1 260 000) and Phnom Penh (613 250 on average, ranging from 392 000 to 1 260 000), while large numbers of ducklings are produced in Kampong Cham (120 519 on average, ranging from 20 075 to 252 000), Phnom Penh (180 000 on average), Prey Veng (125 400 on average, ranging from 10 800 to 240 000) and Siem Reap (120 750 on average, ranging from 21 000 to 220 500).

Table 66 Hatching capacity and numbers per year among hatchery operators

Province	Eggs/year (thousand)	Ducklings/year (thousand)		Embryonic eggs/year (thousand)	
		Mathematic calculation[1]	Actual production[2]	Mathematic calculation	Actual production
Battambang	30-1 800	54–1 080	18–270	63–1 260	63–1 260
Kampong Cham	17-720	10–504	20–252	13–576	13–576
Phnom Penh	360–1 800	288–1 080	180	329–1 260	392–1 260
Prey Veng	72–720	6–576	11–240	70–648	70–324
Siem Reap	117–1 000	63–600	21–221	81–830	81–830
Takeo	72–1 680	12.5–920	4.17–294	13.6–1 176	14–1 176
Total	516 ± 86	295 ± 49	99 ± 18	381 ± 61	349 ± 56

[1] Mathematic calculation is based on the actual number of eggs hatched and the percentages of ducklings and embryonic eggs that can be expected.
[2] Actual productions is the actual number of ducklings and embryonic eggs produced.

Incubator types

Of the 39 hatcheries, 79.5 percent use traditional incubators (Photo 17) and 20.5 percent electric incubators (Photo 18) (Table 67). All the hatcheries in Takeo and Battambang use traditional incubators, while all those in Phnom Penh use electric ones. Electric incubators are less labour-intensive but depend on the availability of electricity. In addition, electricity costs are twice as high in the provinces as in Phnom Penh and Siem Reap (US$0.7/kW vs. US$0.37/kW). A hatchery owner in Siem Reap province said that the consumers of embryonic eggs prefer eggs that have been incubated in traditional incubators, and pay more for them (610 to 620 riel, compared with 580 to 590 riel for embryonic eggs from electric incubators).

Table 67 Types of incubator used by hatchery operators (percentages)

Province	Traditional	Electric
Battambang	100	-
Kampong Cham	83.3	16.7
Phnom Penh	-	100
Prey Veng	66.7	33.3
Siem Reap	60.0	40.0
Takeo	100	-
Total	79.5 (n = 31)	20.5 (n = 8)

Photo 17 Traditional incubator, Prey Chor district, Kampong Cham.

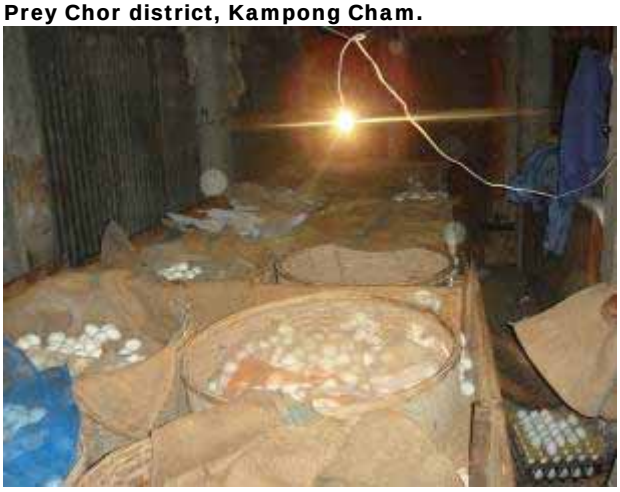


Photo 18 Electric incubator, Cheung Prey district, Kampong Cham.

Sources of eggs for hatcheries

Regarding the sources of eggs for their hatcheries, 5.6 percent of hatchery owners in Battambang and Kampong Cham get them from their own ducks, 18.2 percent in Battambang,

Kampong Cham and Takeo get them from neighbours, 66.7 percent purchase them from breeding farms, 9.0 percent in Prey Veng and Takeo purchase from dealers, and only 0.4 percent in Siem Reap get them from a duck farm under contract farming (Table 68).

Table 68 Sources of eggs for hatchery operations (percentages)

Province	Own production	Neighbours	Breeding farm	Dealer	Other
Battambang	13.3	8.3	78.3	-	-
Kampong Cham	20.0	53.3	26.7	-	-
Phnom Penh	-	-	100	-	-
Prey Veng	-	-	66.7	33.3	-
Siem Reap	-	-	96.6	-	3.4
Takeo	1.3	16.1	59.3	16.7	-
Total	5.6 ± 3.02	18.2 ± 5.27	66.7 ± 6.63	9.0 ± 3.85	0.4 ± 0.43

Selection of eggs for hatching

About 97 percent of hatchery operators reported that they select the eggs for hatching (Table 69). Selection criteria are: 1) size (for 82.0 percent); 2) shape (for 66.7 percent); 3) fertility (for 53.8 percent, except for in Phnom Penh); 4) survival rate of hatched ducklings (for 30.8 percent, except for in Kampong Cham and Phnom Penh); 5) breed with high market demand (for 17.9 percent in Battambang and Takeo); 6) cleanliness (for 15.3 percent, except for in Phnom and Takeo); and 7) the presence of male ducks in the supplier's flock (for 12.8 percent in Phnom Penh and Siem Reap). For criteria that are not obvious from examining the eggs (such as fertility and survival rate of hatched ducklings) farmers rely on their previous experience of the egg supplier.

Table 69 Selection of eggs for hatching (percentages)

Province	Egg supply selection	Criteria						
		Size	Shape	Fertility	Survival of hatched ducklings	Breed with high demand	Cleanliness of eggs	Male in supplier's flock
Battambang	100	66.7	66.7	50.0	16.7	16.7	16.7	-
Kg Cham	100	66.7	66.7	66.7	-	-	33.3	-
Phnom Penh	100	100	-	-	-	-	-	100
Prey Veng	100	66.7	66.7	33.3	33.3	-	66.7	-
Siem Reap	100	80.0	80.0	80.0	40.0	-	20.0	20.0
Takeo	93.3	93.3	80.0	60.0	53.3	40.0	-	-
Total	97.4 (n = 38)	82.0 (n = 32)	66.7 (n = 26)	53.8 (n = 21)	30.8 (n = 12)	17.9 (n = 7)	15.3 (n = 6)	12.8 (n = 5)

Hatchery customers

Of the hatcheries interviewed, 76.0 percent incubate eggs to produce ducklings for immediate sale to duck farms; one hatchery in Battambang produces ducklings for its own duck farm. About 23.9 percent of the ducklings produced are sold to collectors/intermediaries and 76.0 percent directly to duck raisers (Table 70). High percentages of direct sales to duck raisers were observed in Battambang, Phnom Penh, Prey Veng and Siem Reap.

Table 70 Recipients of ducklings from hatchery operators (percentages)

Province	Own farm	Collectors/ intermediaries	Duck raisers
Battambang	0.2	10.7	89.2
Kampong Cham	-	35.0	65.0
Phnom Penh	-	-	100
Prey Veng	-	-	100
Siem Reap	-	10.0	90.0
Takeo	-	33.6	66.4
Total	0.03 ± 0.03	23.9 ± 6.24	76.0 ± 6.24

Some 97.4 percent of the hatcheries also produce embryonic eggs, which 57.9 percent of hatchery owners sell to collectors/intermediaries (Photo 19), 40.8 percent sell at markets, (Photo 20) and only 1.3 percent – in Siem Reap – sell on the road (Table 71). High percentages of sales to collectors/intermediaries were found in Battambang, Prey Veng and Takeo, and high percentages of sales at market in Kampong Cham and Siem Reap.

Table 71 Recipients of embryonic eggs from hatchery operators (percentages)

Province	Collectors/ intermediaries	Markets	Road seller
Battambang	68.3	31.7	-
Kampong Cham	25.0	75.0	-
Phnom Penh	57.5	42.5	-
Prey Veng	76.7	23.3	-
Siem Reap	8.0	82.0	10.0
Takeo	81.4	18.6	-
Total	57.9±6.30	40.8±6.11	1.3±1.31

Photo 19 Truck transporting embryonic eggs to a market in Phnom Penh from a hatchery in Batheay district, Kampong Cham.

Photo 20 Market seller buying embryonic eggs at a hatchery in Prey Chor district, Kampong Cham.

Location of hatchery customers

Hatchery products include embryonic eggs, ducklings and infertile eggs. The demand for embryonic eggs and, particularly, ducklings is seasonal, while infertile eggs are also sold to roadside food shops. About 17.2 percent of the intermediaries/collectors in Battambang, Phnom Penh, Prey Veng and Takeo are from the same district, 27.6 percent in Battambang, Kampong Cham, Prey Veng and Takeo are from the same province, and 48.3 percent, except for in Prey Veng, are from other provinces (Table 72). Only two hatcheries in Takeo said that their collectors/intermediaries live in the same village. High percentages of collectors/intermediaries from other provinces were found in Kampong Cham, Phnom Penh and Siem Reap. For ducklings, 9 percent of collectors/intermediaries come from the same village, 36.4 percent from the same district, and 36.4 percent from the same province. For embryonic

eggs, 8.3 percent come from the same village, 45.8 percent from the same district and 41.7 from the same province.

Table 72 Origin of collectors/intermediaries for ducklings and embryonic eggs (percentages)

Province	Same village	Same district	Same province	Other provinces
Battambang	-	33.3	16.7	50.0
Kampong Cham	-	-	25.0	75.0
Phnom Penh	-	25.0	-	75.0
Prey Veng	-	50.0	50.0	-
Siem Reap	-	-	-	100
Takeo	16.7	8.3	41.7	33.3
Total	6.89 (n = 2)	17.2 (n = 5)	27.6 (n = 8)	48.3 (n = 14)

Duckling production throughout the year

None of the visited hatcheries produces ducklings between February and April. Although 10 to 20 percent start their operation from May to August, the most common period for starting is September to December. Hatchery owners in Battambang and Takeo start their operations earlier than those in the other provinces, hatcheries in Phnom Penh concentrate their duckling production in November and December, and those in Siem Reap continue into January (Table 73). This is owing to duck farms' demand for ducklings when water recedes to the lakes and they can benefit from natural resources, including water, for their ducks.

Table 73 Hatchery operators' duckling production throughout the year (percentages)

Province	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Battambang	-	-	-	-	33.3	33.3	16.7	-	50.0	83.3	100	50.0
Kampong Cham	-	-	-	-	-	33.3	50.0	50.0	66.7	66.7	33.3	-
Phnom Penh	-	-	-	-	-	-	-	-	-	-	25.0	25.0
Prey Veng	-	-	-	-	-	-	-	33.3	33.3	33.3	66.7	66.7
Siem Reap	20.0	-	-	-	-	20.0	20.0	20.0	20.0	40.0	40.0	40.0
Takeo	-	-	-	-	13.3	13.3	13.3	20.0	60.0	86.7	73.3	33.3
Total	2.6 n=1				10.2 n=4	17.9 n=7	17.9 n=7	20.5 n= 8	46.1 n=18	64.1n =25	61.5 n= 24	33.3 n= 13

Embryonic egg production throughout the year

Almost all the hatcheries in the study produce embryonic eggs throughout the year to supply consumers. The percentages of hatcheries producing embryonic eggs each month range from 87 to 95 percent (Table 74). Only in Prey Veng do hatcheries reduce their embryonic egg production from June to November.

Table 74 Hatchery operators' embryonic egg production throughout the year (percentages)

Province	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Battambang	-	-	-	-	33.3	33.3	16.7	-	50.0	83.3	100	50.0
Kampong Cham	-	-	-	-	-	33.3	50.0	50.0	66.7	66.7	33.3	-
Phnom Penh	-	-	-	-	-	-	-	-	-	-	25.0	25.0
Prey Veng	-	-	-	-	-	-	-	33.3	33.3	33.3	66.7	66.7
Siem Reap	20.0	-	-	-	-	20.0	20.0	20.0	20.0	40.0	40.0	40.0
Takeo	-	-	-	-	13.3	13.3	13.3	20.0	60.0	86.7	73.3	33.3
Total	2.6 n= 1				10.2 n=4	17.9 n=7	17.9 n=7	20.5 n= 8	46.1 n= 18	64.1 n=25	61.5 n=24	33.3 n= 13

The reasons why hatcheries reduce embryonic egg production are: 1) insufficient egg supplies (for 5.2 percent in Kampong Cham and Prey Veng); and 2) low demand for embryonic eggs

(for one hatchery in Takeo). Hatchery owners in Phnom Penh said that the demand for embryonic eggs has increased since there have been more garment factories around Phnom Penh. After work, garment workers eat boiled embryonic eggs from roadside stalls or buy them to cook at home.

Management of infertile eggs

Of the hatchery owners interviewed, 92.3 percent sell infertile eggs to markets, 15.4 percent in Battambang, Kampong Cham and Takeo feed them to pigs and fish, 10.2 percent in Siem Reap and Battambang throw them away, and 12.8 percent in Takeo give them to neighbours (Table 75). Most hatcheries in Phnom Penh, Prey Veng, Siem Reap and Takeo sell infertile eggs to markets.

Table 75 Hatchery operators' practices for infertile eggs (percentages)

Province	Feed to pigs/fish	Sell	Throw away	Give to neighbours
Battambang	16.7	83.3	33.3	-
Kampong Cham	50.0	66.7	-	-
Phnom Penh	-	100	-	-
Prey Veng	-	100	-	-
Siem Reap	-	100	40.0	-
Takeo	13.3	100	-	33.3
Total	15.4 (n = 5)	92.3 (n = 36)	10.2 (n = 4)	12.8 (n = 5)

Management of eggshells

About 63 percent of hatcheries reported that they sell or give away the eggshells, 23.3 percent in Battambang, Kampong Cham and Takeo use them as fertilizer, 10 percent in Prey Veng and Takeo burn them, and 3.3 throw them away (Table 76). It was observed that a hatchery owner in Kampong Cham throws the eggshells away behind the family's house, while in Takeo they are used to fertilize banana plants behind the house (Photos 21 and 22).

Table 76 Hatchery operators' practices for eggshells (percentages)

Province	Sell/give away	Throw away	Use as fertilizer for paddy field/crop	Burn
Battambang	66.7	-	33.3	-
Kampong Cham	50.0	25.0	25.0	-
Phnom Penh	100	-	-	-
Prey Veng	50.0	-	-	50.0
Siem Reap	100	-	-	-
Takeo	60.0	-	26.7	13.3
Total	63.3 (n = 19)	3.3 (n = 1)	23.3 (n = 7)	10.0 (n = 3)

Disinfection of incubators

Of the 39 hatcheries, 62.5 percent in Phnom Penh and Siem Reap reported that they disinfect their electronic incubators, along with 54.8 percent of traditional hatchery operators in Battambang, Kampong Cham, Prey Veng and Takeo (Table 77). The disinfecting practices are: 1) removing and burning rice husks (for 42.3 percent in Kampong Cham, Prey Veng and Takeo); and 2) removing all residues (for 73.1 percent). Only two hatcheries in Takeo dry new rice husk in the sun before replacing the old. All the hatcheries in Battambang, Phnom Penh, Prey Veng and Siem Reap remove all residues.

It was observed that almost all the traditional incubators spray insecticide inside and outside their incubators to kill insects and mosquitoes.

Photo 21 Eggshells behind a hatchery owner's house, Tramkak district, Takeo.

Photo 22 Eggshells behind a hatchery owner's house, in Tramkak district, Takeo

Table 77 Disinfection of incubators (percentages)

Province	Electronic incubation disinfection	Traditional incubation disinfection	Ways of disinfection		
			Remove and burn rice husks	Remove all residues	Dry new rice husks
Battambang	-	83.3	-	100	-
Kampong Cham	-	40.0	50.0	50.0	-
Phnom Penh	75.0	-	-	100	-
Prey Veng	-	50.0	100	100	-
Siem Reap	100	-	-	100	-
Takeo	-	60.0	90.0	40.0	20.0
Total	62.5 (n = 5)	54.8 (n = 17)	42.3 (n = 11)	73.1 (n = 19)	7.7 (n = 2)

Disinfection of eggs

Only 25.6 percent of hatcheries in Battambang, Phnom Penh and Takeo disinfect the eggs before putting them into the incubators. They spread lime over the eggs in Phnom Penh, while 90.0 percent in Battambang and Takeo dry the eggs in the sun for about an hour (Photos 23 and 24).

Some 74.4 percent of hatcheries do not disinfect the eggs before putting this into the incubators. The reasons for this are: 1) tradition, as they have practised for a long time without problems (for 37.9 percent, except for in Takeo); 2) lack of knowledge about how to disinfect the eggs (for 31.0 percent, except for in Kampong Cham and Phnom Penh); and 3) disinfection with water/liquid would spoil the eggs (for 58.6 percent).

Photo 23 Drying eggs before putting them into a traditional incubator, Siem Reap district, Siem Reap.

Photo 24 Drying eggs before putting them into a traditional incubator, Banon district, Battambang.

Hatchery operations since the AI outbreak

About 15.4 percent of the visited hatcheries reported that the AI outbreak did not affect their business, or even that it has improved. 48.7 percent said that their business is stable and 33.3 percent that it is declining (Table 78). Only one hatchery in Takeo indicated that the business is unstable. High percentages of stable hatcheries were recorded in Kampong Cham, Phnom Penh and Takeo, while high percentages in Battambang and Siem Reap reported declining business.

The reasons for hatchery businesses to improve are: 1) high consumer demand for embryonic eggs (for 83.3 percent); and 2) no AI outbreak in the region (for 16.7 percent). Reasons for stable hatchery business are: 1) the supply satisfies the demand (for 55.6 percent); 2) no AI outbreak (for 39.8 percent); and 3) the good quality of the embryonic eggs produced (for 5.6 percent). Reasons for declining business are: 1) reduced market demand (for 69.1 percent); 2) lack of labour to assist in hatchery operations (for 23.1 percent); and 3) consumers' concerns about AI (for 23.1 percent).

Table 78 Situation of hatchery businesses after AI outbreak (percentages)

Province	No change/increased	Stable	Decreased	Unstable
Battambang	16.7	33.3	50.0	-
Kampong Cham	-	66.7	33.3	-
Phnom Penh	25.0	50.0	25.0	-
Prey Veng	33.3	33.3	33.3	-
Siem Reap	20.0	40.0	40.0	-
Takeo	13.3	53.3	26.7	6.7
Total	15.4 (n = 6)	48.7 (n = 19)	33.3 (n = 13)	2.6 (n = 1)

Hatchery owners' future plans

Over the next 12 months, 43.5 percent of hatchery owners aim to increase the scale of production; 25.6 percent, except for in Phnom Penh, plan to change their incubators; 25.6 percent, except for in Siem Reap, to change their egg suppliers; 25.6 percent, except for in Prey Veng and Phnom Penh, to increase their own egg production; and 10.2 percent in Kampong Cham, Phnom Penh and Takeo to stop their hatching businesses (Table 79).

The reasons for increasing the scale of production are: 1) to increase income (for 88.2 percent); and 2) high demand (for 11.8 percent). The reasons for changing incubator are to: 1) reduce the labour required (for 85.7 percent); 2) reduce the space required (for 7.1 percent); and 3) increase performance (for 7.1 percent). Reasons for changing egg supplier are to: 1) improve egg quality (for 54.5 percent); 2) find new breeds with high egg yields (for 18.2 percent); and 3) find reasonably priced eggs for incubating (for 27.3 percent). Reasons for increasing own egg production are to: 1) increase income (for 100 percent); 2) guarantee good-quality eggs for incubating (for 11.1 percent); and 3) ensure a timely supply for hatching

(for 11.1 percent). Reasons for stopping hatchery operations are: 1) lack of labour support (for 75.0 percent); and 2) worry about disease risk for human health (for 25.0 percent).

Table 79 Hatchery owners' plans for the next 12 months (percentages)

Provinces	Increase scale of prod.	Change incubator	Change egg supplier	Increase own egg production	Stop hatching business
Battambang	50.0	33.3	16.7	16.7	-
Kampong Cham	33.3	50.0	50.0	66.7	33.3
Phnom Penh	25.0	-	75.0	-	25.0
Prey Veng	66.7	66.7	66.7	-	-
Siem Reap	20.0	20.0	-	20.0	-
Takeo	53.3	13.3	6.7	26.7	6.7
Total	43.5 (n = 17)	25.6 (n = 10)	25.6 (n = 10)	25.6 (n = 10)	10.2 (n = 4)

Requirements for improved hatchery operations

When asked to rank the importance of various factors for improving hatchery operations on a scale of 1 (lowest) to 5 (highest), the hatchery operators gave average scores of 3.8 to better marketing of ducklings, 3.7 to more technical advice, 3.5 to better supply of eggs, and 2.6 to better access to credit (Table 80). Hatcheries in Prey Veng and Takeo gave high scores of 4.7 and 4.3 to more technical advice, while those in Phnom Penh and Prey Veng gave a score of 4.0 for better egg supply.

Table 80 Hatchery operators' requirements for improving hatchery businesses (marks out of 5)

Province	More technical advice	Better supply of eggs	Better access to credit	Better marketing of ducklings
Battambang	3.0	2.7	2.2	3.7
Kampong Cham	3.8	3.8	2.5	4.7
Phnom Penh	2.8	4.0	1.8	3.8
Prey Veng	4.7	4.0	3.3	5.0
Siem Reap	3.0	3.2	2.6	4.0
Takeo	4.3	3.6	2.9	3.3
Total	3.74 ± 0.21	3.51 ± 0.18	2.61 ± 0.20	3.82 ± 0.19

The hatchery owners made the following suggestions for improving their businesses:

Provide technical support for hatchery operations.
Set stable prices for eggs and embryonic eggs.
Provide loans with reasonable interest rates.
Help egg producers to supply good-quality eggs for hatching.
Stop or control imports of eggs from neighbouring countries.
Reduce taxes.

Observations

General

Tables 81 and 82 give the observations made by interviewers as they visited the 39 hatcheries:

Clean incubators and sites: 87.2 percent.
Eggs cleaned before incubation: 48.7 percent.
Proper placement of ducklings: 51.5 percent.
Signs warning of the presence of poultry at the incubation site: 35.9 percent.
Wild birds prevented from entering the site: 61.5 percent.
Good storage conditions for eggs: 71.8 percent.
Proper placement of eggshells: 35.3 percent.

Proper placement of unhatched eggs: 48.7 percent.
Proper placement of embryonic eggs: 64.1 percent.

Table 81 General observations of hatchery operations I (percentages)

Province	Clean incubator and site	Eggs cleaned before incubation	Proper placement of ducklings	Poultry warning signs	Prevention of wild bird entry
Battambang	83.3	33.3	33.3	50.0	50.0
Kampong Cham	100	16.7	20.0	50.0	50.0
Phnom Penh	100	-	33.3	-	100
Prey Veng	100	33.3	50.0	33.3	100
Siem Reap	60.0	60.0	50.0	40.0	20.0
Takeo	86.7	80.0	73.3	33.3	66.7
Total	87.2 (n = 34)	48.7 (n = 19)	51.5 (n = 17)	35.9 (n = 14)	61.5 (n = 24)

Table 82 General observations of hatchery operations II (percentages)

Province	Good storage conditions for eggs	Proper placement of eggshells	Proper placement of unhatched eggs	Proper placement of embryonic eggs
Battambang	33.3	33.3	33.3	50.0
Kampong Cham	66.7	-	16.7	33.3
Phnom Penh	75.0	-	75.0	75.0
Prey Veng	66.7	-	66.7	33.3
Siem Reap	60.0	66.7	40.0	60.0
Takeo	93.3	53.3	60.0	86.7
Total	71.8 (n = 28)	35.3 (n = 12)	48.7 (n = 19)	64.1 (n = 25)

General impressions of the farmyards

The interviewers' impressions of farmyards were that 33.3 percent were clean, except for in Battambang and Siem Reap, 64.1 percent could do better, and a few hatcheries (2.6 percent in Takeo) were dirty (Table 83).

Table 83 General impressions of hatchery operation farmyards (percentages)

Province	Clean	Could do better	Dirty
Battambang	-	100	-
Kampong Cham	16.7	83.3	-
Phnom Penh	75.0	25.0	-
Prey Veng	33.3	66.7	-
Siem Reap	-	100	-
Takeo	53.3	40.0	6.7
Total	33.3 (n = 13)	64.1 (n = 25)	2.6 (n = 1)

Interviewers also observed the housing quality at the hatcheries: 35.9 percent was of good quality, and 64.1 percent of medium quality.

AI awareness

Interviewers observed the hatchery operators' activities for AI control. The results are presented in Table 84:

Ask reasons for other people's entry to their farms: 92.3 percent.
Report their own visits to other farms: 12.8 percent.
Use precautionary measures: 23.1 percent.
Provide boots/clothing during visits: 2.6 percent.
Provide good-quality information: 61.5 percent.
Wash their hands before/after handling ducklings/eggs: 33.3 percent.
Allow others to enter poultry house without special boots/clothes: 92.3 percent.

Table 84 Hatchery operators' awareness of AI control as observed by interviewers (percentages)

Province	Ask reasons for visit	Report own visits	Provide boots/clothes during visit	Provide good-quality info.	Use precautionary measures	Wash hands before/after handling ducklings/ eggs	Allow entry to poultry house without boots/ clothes
Battambang	100	-	-	50.0	16.7	-	100
Kampong Cham	50.0	-	-	33.3	-	-	50.0
Phnom Penh	100	-	-	75.0	-	-	100
Prey Veng	100	-	-	66.7	66.7	66.7	100
Siem Reap	100	-	20.0	20.0	40.0	-	100
Takeo	100	33.3	-	86.7	26.7	73.3	100
Total	92.3 (n =36)	12.8 (n = 5)	2.6 (n = 1)	61.5 (n = 24)	23.1 (n = 9)	33.3 (n = 13)	92.3 (n = 36)

Needs and opportunities

The needs and opportunities for hatchery operators to improve their businesses are (Table 85):

Proximity to duck producers: 41.0 percent.
Duckling cages: 50.0 percent.
Egg supply: 28.2 percent.
Product marketing: 33.3 percent.
Biosecurity measures: 51.2 percent.
Improved knowledge: 87.2 percent.

Table 85 Needs and opportunities for hatchery operations (percentages)

Provinces	Proximity to duck producers	Duckling cages	Egg supply	Product marketing	Biosecurity	Knowledge
Battambang	16.7	50.0	-	-	50.0	83.3
Kampong Cham	16.7	25.0	33.3	16.7	33.3	100
Phnom Penh	25.0	-	25.0	50.0	-	100
Prey Veng	33.3	50.0	33.3	33.3	33.3	100
Siem Reap	40.0	-	-	20.0	60.0	60.0
Takeo	66.7	66.7	46.7	53.3	73.3	86.7
Total	41.0 (n = 16)	50.0 (n = 15)	28.2 (n = 11)	33.3 (n = 13)	51.2 (n = 20)	87.2 (n = 34)

Duckling suppliers in Cambodia

The study team interviewed one duckling distributor/dealer, who may partly rely on other traders bringing ducklings from Viet Nam. The team approached a second duck distributor, who did not want to talk about his business. The distributor interviewed has been in the duckling business for about ten years. As well as getting ducklings from Viet Nam to supply to duck raisers, he also collects growing ducks for distribution to markets and restaurants in Phnom Penh. All of the ducklings are from Viet Nam.

Every week the distributor gets a total of 1 000 to 2 000 ducklings from traders from Viet Nam. The imported breed is Peking, which is popular for duck raisers for meat production. This breed was also imported before the AI outbreak.

Before agreeing a price with the traders, the duck distributor assesses the purity of the breed, weight, age, health, etc. The price set is also based on negotiations between him and the trader. There is high demand for ducklings in the dry season (Table 86), when distributors can sell 2 000 ducklings per week at 3 500 to 4 000 riel each. In the low season they can sell 1 000 ducklings for 3 000 riel each.

Table 86 High and low seasons for duckling supplies

Demand	Season	Duration (months)	ducklings/week (no.)	Price/duckling (riel)
High	Dry season	6	2 000	3 500–4 000
Low	Rainy season	6	1 000	3 000

Imported ducklings are sold to producers around Phnom Penh and other provinces. Deliveries are made in two ways: 1) producers from the provinces come to collect the ducklings from the distributor; and 2) the distributor delivers ducklings to producers in Phnom Penh. There are no formal contracts between sellers and buyers, just verbal agreements. The distributor said that his duckling business had declined for three to four months after the AI outbreak, but recovered thereafter.

Conclusions and recommendations

Duck farming is considered an important source of income for the household. The outbreaks of AI in Cambodia and the region have had no affect on the duck business, including duck farming and hatchery operations. Both duck farmers and hatchery operators should receive more technical information to reduce risk, make duck farming more productive and control diseases.

Traditional duck keeping methods are of concern as regards AI risk; about 56 percent of duck farmers practise free-range systems. Practical solutions are needed to ensure that duck farmers and hatchery operators continue to benefit from their businesses while controlling and managing diseases in ways that prevent affects on humans. One solution is to raise ducks in the confinement system, practising biosecurity.

Many duck farmers use paddy rice to feed their laying ducks, as is traditional in Cambodia. They believe that ducks fed paddy rice will produce dark-yellow yolks. In the past, there was more open water such as lakes and ponds, with small fish, shrimps, snails, etc. that the ducks could eat; paddy rice was fed as a supplement. Now, however, ducks rely mostly on feed provided by farmers, and paddy rice alone is not nutritionally rich enough to allow laying ducks to produce as many eggs throughout the year. Farmers should look for additional protein sources when prices are low, and require technical advice on how to produce their own nutritious duck feed.

No duck farms are registered with technical institutions such as provincial offices of animal health and production or district-level branch offices, but some are registered with the local authority. Duck farmers do not want to register their businesses because they are afraid of having to pay taxes and of the unofficial payments that may be requested. It is important to help duck farmers understand the reasons for and benefits of registering their duck farms.

The floors of duck sheds are commonly earth; duck farmers remove duck manure using only brooms and water, and most of them do not wear masks or gloves when working inside the sheds. It is important to demonstrate the need to use disinfectants such as TH4 to disinfect duck farms, and to provide farmers with masks and gloves to test.

All duck farms received AI information, mainly from radio and television. It is therefore important to develop effective messages that will reach duck farmers, hatchery operators and dealers. The suggested time for broadcasting would be between 18:00 and 20:00 hrs, when farmers are resting and watching television after eating. Radio broadcasting can be effective at any time as most people have a small radio; popular channels should be used.

Due to a lack of electricity in most of the hatcheries visited, they use traditional methods in which rice husk are the most important material for providing heat to the eggs. This traditional system needs daily intensive work to warm the rice husks and turn the eggs. These farmers

are also hampered by the lack of electric incubators in Cambodia. Those who want to buy electric incubators need to contact producers or suppliers in Viet Nam and Thailand.

There are strong linkages between duck producers and hatcheries. Hatcheries buy eggs for incubation from duck farms, while duck farms buy ducklings from hatcheries. When both sides practise good disease control and prevention systems, the risk of spreading diseases can be minimized. When duck farms produce good-quality eggs that are free of diseases, the hatcheries produce healthy ducklings to sell back. Technical assistance is needed for both hatcheries and duck farms.

As imports of poultry and poultry products are not allowed, traders and distributors were unwilling to provide the survey teams with clear information about their activities, because they were afraid it would affect their businesses.