FACTORS INFLUENCING DECISIONS FOR THE PREVENTION OF ZOONOTIC EMERGENCE AND SPILL-OVER FROM WILDLIFE FARMS

A SURVEY OF SIX PROVINCES IN VIET NAM

ONE HEALTH
VIET NAM ONE HEALTH PARTNERSHIP FOR ZOONOSES

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Table of Contents

Table of Contents

Part 1

RATIONALE

In Viet Nam, wildlife breeding has a long history and is associated with the production and business activities of a portion of the population in rural and mountainous areas. It has become a common and widespread practice nationwide, which not only provides livelihoods for local people but also contributes to the conservation of endangered, precious and rare species. However, wildlife breeding has posed many challenges to State management, perhaps most notably the control and traceability of the bred animals and the prevention of zoonoses.

According to the World Health Organization (WHO), up to 75% of new or emerging infectious diseases are of animal origin.[1] Viet Nam has been identified as one of the global "hot spots" posing a high risk of infectious pathogen emergence which includes diseases transmitted from pets, wild animals or ecosystems. The emerging infectious diseases recorded in Viet Nam recently include severe acute respiratory syndrome (SARS in 2003), bird flu (A/H5N1 in 2003) with a mortality rate of about 50%, and pandemic influenza (A/H1N1 in 2009). In addition to the above-mentioned emerging infectious diseases, Viet Nam is still facing long-term infectious diseases such as rabies. Currently, in Viet Nam, rabies is one of the most critical infectious diseases, with the number of deaths ranking first in the same group (i.e., over 90% of rabies cases are from rabid dogs). Furthermore, Streptococcus suis (typically from consumption of "blood pudding") is seeing increasing annual numbers of infection and death, in which complications from the pathogen often result in clinically severe human infections, expensive treatment, a high mortality rate, even if treated. All of these dangerous infectious diseases are recorded to derive from pathogens in wild animals. The illegal exploitation, processing, trade, and consumption of wild animals have been identified as one of the primary causes of the emergence and spread of zoonoses.

As such, the report **"Assessing the current status and factors affecting farm owners' decisions on zoonotic disease prevention measures"** is implemented.

1 https://www.who.int/docs/default-source/climate-change/qa-infectiousdiseases-who.pdf?sfvrsn=3a624917_3

Part 2

OBJECTIVES, CONTENTS, METHODS OF IMPLEMENTATION

2.1. Objectives

2.1.1. General objectives

To contribute to improving the effectiveness in the prevention and fight against zoonoses.

2.1.2. Specific objectives

- To assess the current status of implementing zoonotic disease prevention measures.
- To identify factors that affect farm owners' decisions on implementing zoonotic disease prevention measures.
- To propose measures to improve the effectiveness in the prevention and fight against zoonoses.

2.2. Contents

- ***Assessing the current status of farm owners' practical implementation of zoonotic disease prevention measures.***
- ***Assessing farm owners' awareness of the risks of zoonoses transmitted from captive wild animals to humans.***
- ***Assessing farm owners' attitudes to implementing zoonotic disease prevention measures transmitted from captive wild animals to humans.***
- ***Assessing factors which affect the practical implementation of zoonotic disease prevention measures transmitted from captive wild animals to humans.***
- ***Assessing capabilities to implement zoonotic disease prevention measures.***
- ***Proposing measures to improve the effectiveness in the prevention and combat against zoonoses.***

2.3. Methods of implementation

2.3.1. Methods of implementation

In order to mitigate the risks of zoonoses transmitted from captive wild animals to humans, captive wild animals are - first and foremost - required to be healthy and not carrying any pathogens, especially those with a high transmission risk to humans. Therefore, in order to prevent and combat zoonoses, it is necessary to take measures to protect captive wild animals from diseases. At the same time, breeding owners and animal caretakers must seriously implement zoonotic disease prevention measures.

Common measures to protect captive wild animals from diseases are:

1. Cleaning, disinfecting breeding areas, cages, and tools;
2. Isolating wild animals after sale and those which are sick or dead;
3. Selecting healthy breeds with no disease contraction (quarantine before sale);
4. Disinfecting before and after accessing breeding areas;
5. Not allowing domestic animals and unauthorised persons to access breeding areas;
6. Taking measures in case wild animals are infected and dead (asking veterinarians for diagnosis and treatment, destroying dead animals);
7. Vaccinating.

So far, there have not been any legal documents, technical regulations, or standards on zoonotic disease prevention measures. However, according to Dr. Phan Viet Lam[2], Dr. Vo Dinh Son[3] and Viet Nam CITES Management Authority[4], a number of zoonotic disease prevention measures include:

2 Instructions on breeding primates
3 Lecture on prevention of zoonoses, 2020 (ordered by Viet Nam CITES Management Authority)
4 Handbook of breeding and rearing a number of Vietnamese civets (2019) and Handbook of breeding some primates (2018).

1. Each breeding farm is required to adopt internal regulations and breeding processes, perform environmental sanitation and disease prevention and all employees and others concerned must strictly comply with these regulations and processes;
2. Employees who breed, take care of and manage wild animals must wash their hands (even when they wear gloves) with soap or liquid sanitiser before and after contact with wild animals, their foods, waste, and body fluids;
3. Animal caretakers must be equipped with labour protective clothing (hats, masks, gloves, boots) and must not be in direct contact with wild animals unless treatment is given;
4. Cages and farms must be cleaned and disinfected regularly;
5. Employees must wear protective clothing (masks, gloves, boots ...) when cleaning or feeding wild animals. These protective items must be discarded and washed daily. Unclean protective items are not allowed to be taken away from breeding areas. Cleaning tools are not allowed to be shared between cages;
6. Employees must comply with hygiene and quarantine regulations in breeding areas. Consuming food and drinks or smoking is not allowed in breeding areas, etc;
7. Animal caretakers must have their health checked periodically, generally every six months or whenever they contract diseases. Animal caretakers showing signs of a high fever, diarrhea or having open wounds must visit doctors and notify medical staff that they take care of and are in contact with wild animals;
8. Breeders/animal caretakers must always proceed with caution to avoid being attacked, bitten or scratched by wild animals. In case of being bitten or scratched, they must immediately notify medical staff, wash their wound(s) carefully with bactericidal soap and visit a medical facility in case exhibiting any illness/side effects from the wound(s). Rabies vaccination is strongly recommended if they are bitten by wild animals.

In order to prevent and combat zoonoses, it is critical that farm owners, managers and those related to wildlife breeding be proactive and voluntarily implement measures to prevent and combat zoonoses.

To achieve this, solutions must be appropriate to the economic conditions, current breeding status and awareness of farm owners. Therefore, it is necessary to assess the farm owners'/animal caretakers' awareness of the dangers and risks of zoonoses and their attitudes and views on zoonotic disease prevention measures. This shall help identify fundamental factors which affect farm owners' and managers' decisions on implementing zoonotic disease prevention measures as well as to identify and propose measures appropriate to reality.

Farm owners' decisions to select and adopt zoonotic disease prevention measures are based on one single or one group of the following factors:

1. Awareness of the dangers, risks of zoonoses arising from wildlife breeding activities;
2. Whether legal documents have clear, specific and detailed regulations;
3. Whether the guidance and recommendations of veterinary staff are implemented;
4. Whether inspection and supervision are carried out regularly and continuously;
5. Whether violations are strictly and timely handled;
6. Costs - benefits;
7. Existing facilities and their operational possibilities;
8. Past and potential consequences;
9. Habits and custom;
10. Other factors (guidance and recommendations by State agencies; training).

2.3.2. Methods of collecting and processing data

In order to assess the current status and factors affecting the practical implementation of zoonotic disease prevention measures, a semi-structural interview method with a prepared questionnaire is used. This offers many open questions to enhance the interaction between interviewers and interviewees so that a relatively comprehensive and specific assessment of the issue can be made (set of interview questions is attached in the Appendix 1) through surveying and interviewing farm owners in the provinces of Lam Dong, Binh Phuoc, Tay Ninh, Long An, Soc Trang, and Hau Giang (list of interviewees is attached in the Appendix 2).

Criteria for selecting surveyed breeding farms are:

- Breeding farms with wild animals which pose a higher risk of disease transmission to humans, namely primates, civets, hedgehogs, bamboo rats, wild boars and wild birds.
- Breeding farms which are scale-based relatively evenly from small scale (households) to large scale (farms) and very large scale (companies with over 1,000 animals).

In order to determine the relationship between the factors affecting decisions on the practical implementation of zoonotic disease prevention measures, a statistical analysis method and Excel are used to calculate 02 indicators:

- Covariance (Cov): Cov (x, y) = SUM [(xi - xm) * (yi - ym)] / (n - 1)

xi = data value of x

xm = mean of x

yi = data value of y

ym = mean of y

n = number of data values.

Covariance tells if two (or more) variables correspond with each other or not. If the variables tend to show similar behaviour, the covariance is positive. In the opposite case - if the variables tend to show opposite behaviour - the covariance is negative.

– Pearson correlation coefficient (R):

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

The Pearson correlation coefficient (r) is a number between +1 and - 1 that measures the strength and direction of the relationship between two variables. The result is statistically significant when **the value sig. <0.05**

r < 0: Negative correlation. When one variable changes, the other variable changes in the opposite direction

r=0: No correlation. There is no relationship between the variables

r > 0: Positive correlation. When one variable changes, the other variable changes in the same direction.

Part 3

FINDINGS

3.1. The current status of implementing zoonotic and other diseases prevention measures

The survey results in 41 wildlife breeding farms in Lam Dong (08 farms), Tay Ninh (09 farms), Binh Phuoc (04 farms), Long An (07 farms), Soc Trang (10 farms), and Hau Giang (03 farms) on farm owners' measures to protect wild animals from diseases and zoonoses are listed in Table 01.

Table 01. The current status of implementing zoonotic and other diseases prevention measures

Measures	The percentage of surveyed breeding farms with measures (%)					
	L. Đong	T. Ninh	B. Phuoc	L. An	S. Trang	H. Giang
Detoxifying, disinfecting cages, breeding areas and tools periodically	100	100	100	85.7	90	100
Detoxifying, disinfecting cages, breeding areas and tools when wild animals are sick, dead	83.3	100	100	71.4	100	100
Isolating wild animals when they are taken to breeding farms or when they contract diseases	100	88.9	25	85.7	30	33.3
Requesting animal quarantine on purchase	71.4	55.6	50	28.6	0	66.7
Disinfecting before and after accessing animal cages	12.5	11.1	75	42.9	30	33.3
Not allowing domestic animals to access breeding areas	100	100	100	85.7	80	100
Not allowing unauthorised persons to access breeding areas	75	100	100	85.7	60	100
Destroying wild animals that die from unknown causes	100	88.9	100	100	70	66.7
Vaccinating wild animals	50	44.4	25	42.9	30	33.3
Keeping cages far from family accommodation	75	88.9	75	57.1	30	66.7
Using protective clothing in cleaning cages, taking care of wild animals	87.5	62.5	100	100	50	66.7
Not consuming food, drinks, smoking in breeding areas	100	75	100	85.7	80	66.7
Handling protective clothing after cleaning cages, taking care of wild animals	37.5	22.2	50	42.9	10	66.7
Handling cleaning tools after use	71.4	77.8	75	85.7	60	100

The results of assessing measures against diseases and zoonoses in the surveyed provinces show that the implementation of these measures in the same breeding farm and between various breeding farms are different. Specifically:

3.1.1. Cleaning, detoxifying, and disinfecting

The survey results show that cleaning, detoxifying, and disinfecting cages and breeding areas at surveyed farms is conducted by farm owners proactively and periodically. The percentage of breeding farms which clean, detoxify, and disinfect cages and breeding areas in surveyed provinces is shown in Figure 01.

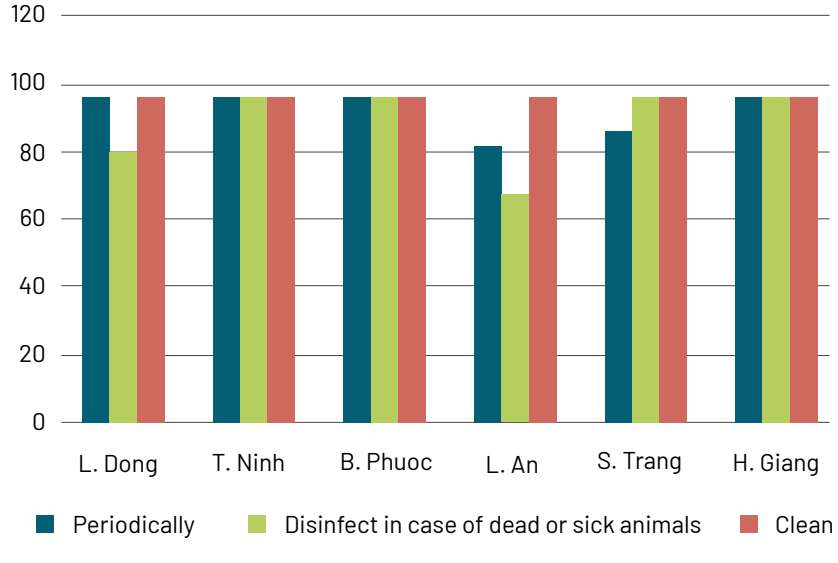


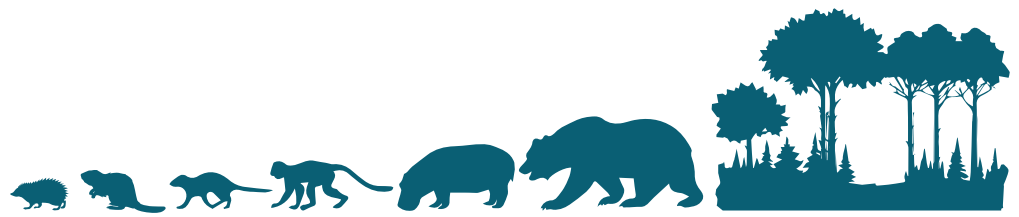
Figure 01: The percentage of breeding farms which clean, detoxify, disinfect cages and breeding areas

- Cleaning cages and farms: The survey results show that 100% of the surveyed farms clean animal cages and breeding areas proactively and periodically, 01 time per day on average, even 02 to 03 times per day at certain breeding farms.
- Cleaning methods: Some farms only use mops to sweep floors, collect waste and leftovers, while some others only use faucets to spray cages, floors. Others use both methods, as mentioned above.
- Treating livestock waste: The treatment of waste and wastewater in wildlife breeding activities is done by the locals from their own experience, lessons learnt from other breeding farms or from the guidance of local veterinary agencies. Some farms collect dung and waste to incubate with probiotic yeasts for fertilizing plants; a number of farms discharge dung, waste and wastewater into manholes before discharging them into the environment; Some others discharge them directly into the environment (home gardens, fishponds).
- Detoxifying, disinfecting cages and tools (feed troughs, drinking troughs, cleaning tools, etc.) are done periodically, every 07 to 15 days on average by farm owners, depending on their breeding scales and species. The detoxification, disinfection of cages and breeding areas, when animals are sick and dead, are also well implemented. The interview results show that 35 out of 41 cases will clean and disinfect cages and breeding areas if animals are sick and dead; only 03 out of 41 breeding farms in Long An and Soc Trang say that they do not perform detoxification and disinfection when animals are sick and dead, and 03 farms have no answer because there have not been any identifiable cases of sick or dead animals at their farms before. The reason why detoxification, disinfection of cages is not implemented by certain breeding farms is that they are afraid that these chemicals may negatively affect the health, growth, and fertility of their wild animals.
- Chemicals used for disinfection, detoxification is mainly Chloramine B, purchased by farm owners at veterinary drugstores, while some others are provided by local veterinary agencies. Some farms also use flame throwers to destroy bacteria and viruses in cages.

According to farm owners, proactively cleaning, detoxifying, disinfecting cages, breeding areas, and tools are to ensure environmental sanitation, keep cages constantly clean, and protect wild animals from diseases. In addition, some breeding farms say they also clean, detoxify, and disinfect cages according to the instructions of local veterinary agencies.

3.1.2. Quarantining and isolating wild animals

Requesting to quarantine wild animals on purchase and isolating them when they are sick or are taken to breeding farms from other places is one of the most critical preventive measures. However, measures taken by farm owners in surveyed localities are very different. The percentage of farm owners surveyed to make requests for animal quarantine on purchase and to isolate wild animals when they are taken to breeding farms or when they contract diseases are shown in Figure 02.



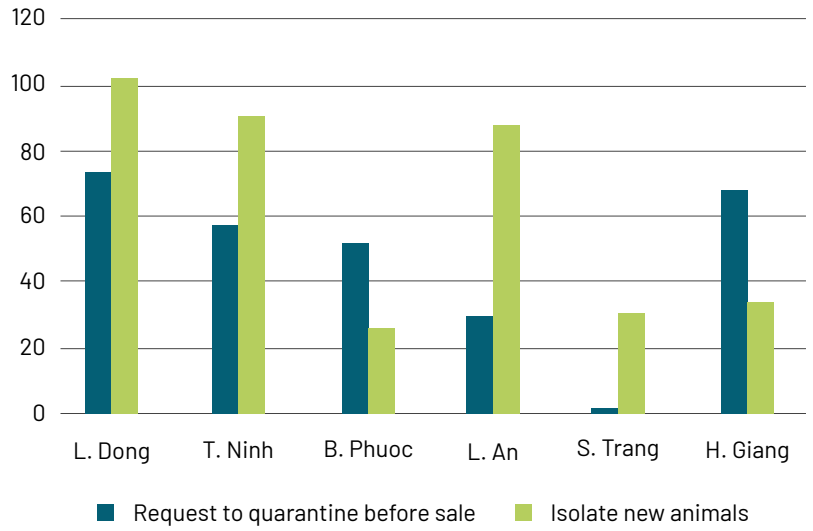
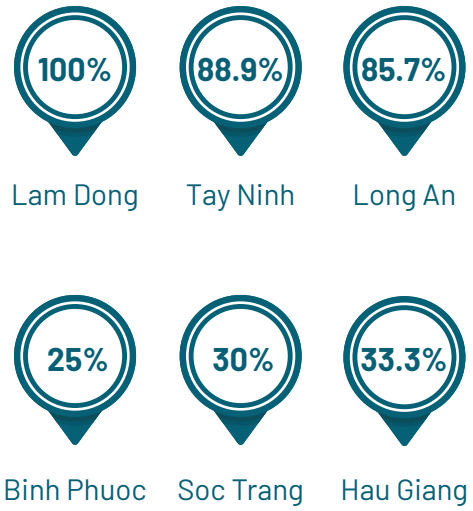


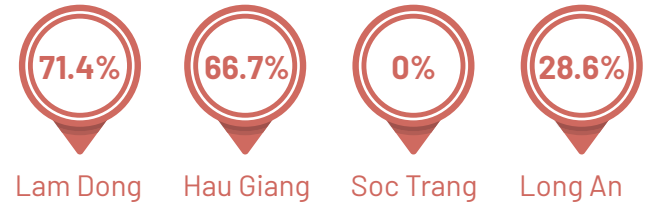
Figure 02: The percentage of farm owners making requests for animal quarantine, isolating wild animals when they are taken to breeding farms or when they contract diseases.

- Isolation of wild animals when they are taken to breeding farms from other places or when they contract diseases is well implemented by farm owners in provinces such as Lam Dong (100% of the surveyed farms), Tay Ninh (88.9% of the surveyed farms) and Long An (85.7% of the surveyed farms). Meanwhile, farm owners appear generally less interested in taking these measures in Binh Phuoc (25% of the surveyed farms), Soc Trang (30% of the surveyed farms) and Hau Giang (33.3% of the surveyed farms).



- According to some farm owners, wild animals are often healthier and less likely to contract diseases than domestic animals, so there is no need to isolate them when they are taken to breeding farms from other places. Some breeding farms do not have cages and isolation areas for cases when wild animals are newly bought and/or sick. Some farms believe that they have not received guidance or requests from any competent agencies for isolating newly bought/sick wild animals. Those who perform isolation believe that it is essential to isolate newly bought/sick wild animals to ensure that diseases do not spread to healthy wild animals in their farms. The varying percentage of breeding farms which isolate newly bought/sick wild animals between localities shows a disparity in farm owners' awareness of the importance of animal isolation. Besides, it also reflects different roles of local veterinary agencies in guiding farm owners to take measures to protect wild animals from diseases.

- Requests by buyers to quarantine wild animals when they are transported out of the province are very different between localities. The provinces of Lam Dong (71.4% of the farms) and Hau Giang (66.7% of the farms) have a larger number of buyers requesting sellers to quarantine wild animals, while the provinces of Soc Trang (0% of the farms) and Long An (28.6%) have a small number of buyers requesting animal quarantine.



The survey results of 41 wildlife breeding farms show that only 16 farms request sellers to quarantine animals (accounting for 39%), 24 farms do not request sellers to quarantine animals (accounting for 60%), and 01 farm has no opinion. Of the 16 farms that request quarantine, only 05 of them say wild animals must be quarantined by law when they are transported out of the province and must be free from diseases; the remaining 11 farms say that quarantine is to ensure that the wild animals they buy for breeding do not contract diseases. Of 25 farms that do not request sellers for animal quarantine (accounting for 51%), they are of the opinion that wild animals are healthy and unlikely to contract diseases. They have also not heard of the regulations on animal quarantine when transporting wild animals out of the province.

16
farms request sellers to quarantine animals **(accounting for 39%)**

24
farms do not request sellers to quarantine animals **(accounting for 60%)**

01
farm has no opinion

- Justification for not quarantining wild animals when transporting them out of the province includes:
  + Many wildlife breeding farms are unaware of the regulations on quarantining wild animals when they are transported out of the province (36 out of 41 farms have not heard of the regulations). Some others say that because there are so many procedures to follow, buyers may no longer want to make their purchase after the origin and completed quarantine of wild animals are verified.
  + Local veterinary agencies do not have a comprehensive list of breeding farms, transactions and transportation records of wild animals, and the locals do not have requests for quarantine.
  + Veterinary officers of the Husbandry and Veterinary Sub-departments have neither experience nor expertise in wild animal diseases nor enough machinery and equipment for sampling, analysis and testing. Therefore, if there is any quarantine of wild animals, it mainly involves clinical diagnosis, not sampling for analysis and testing.
  + Lack of inspection and handling of cases failing to comply with the regulations on wild animal quarantine has not yet been paid due attention.

3.1.3. Disinfecting before and after access wild animal cages and breeding areas

Disinfecting before and after accessing wild animal cages and breeding areas constitutes an important measure in preventing pathogens from entering breeding farms to and from other places. However, the survey results show that this measure is scarcely implemented by farm owners in surveyed provinces.

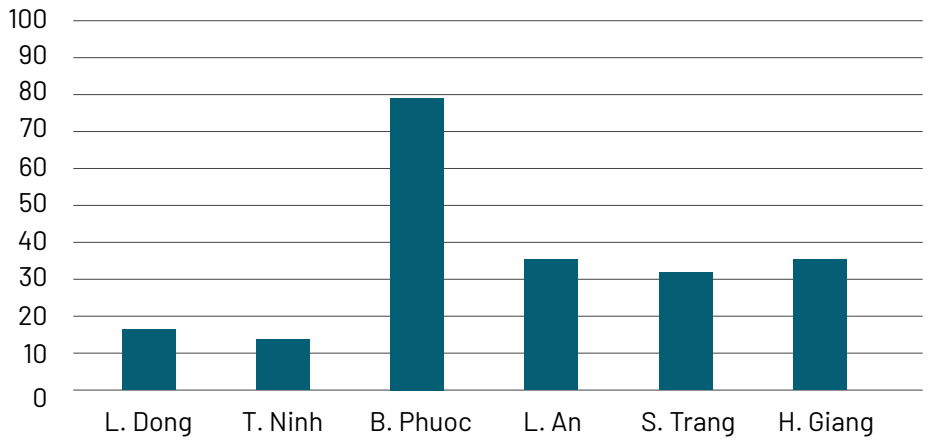


Figure 03: The percentage of surveyed breeding farms with antiseptic pits

The survey results show that most of the surveyed farms do not have antiseptic pits located at the entrance to wild animal cages, nor is disinfection performed before and after accessing breeding areas. Only 12 out of 41 surveyed farms have antiseptic pits or perform disinfection with alcohol before and after accessing cages/breeding areas. In provinces surveyed, Binh Phuoc has the highest percentage of farms performing disinfection (75% of the farms), while Tay Ninh has the lowest percentage (11.1% of the farms).

12/41 surveyed farms have antiseptic pits or perform disinfection with alcohol before and after access cages, breeding areas

Binh Phuoc **75%** of the farms performing disinfection

Tay Ninh **11.1%** of the farms performing disinfection

According to the farm owners and managers, their breeding farms do not have antiseptic pits because the breeding scale is small, wild animals are unlikely to contract diseases, and no state agencies have requested or guided them to do so. Some breeding farms do not want to dig antiseptic pits for fear that chemical disinfectants may negatively affect the health and growth of their wild animals.

Figure 04: Disinfection at some breeding farms

3.1.4. Not allowing domestic animals, unauthorized persons to access wildlife breeding areas

Survey results in 41 wildlife breeding farms in the provinces of Lam Dong, Tay Ninh, Binh Phuoc, Long An, Soc Trang, and Hau Giang record that only 03 farms (02 in Soc Trang and 01 in Long An) allow domestic animals to freely access breeding areas, and 05 farms allow strangers to access breeding areas (04 in Soc Trang and 01 in Long An). The percentage of surveyed wildlife breeding farms which do not allow domestic animals and strangers to access breeding areas is shown in Figure 05.

03 farms allow domestic animals to freely access breeding areas

05 farms allow strangers to access breeding areas

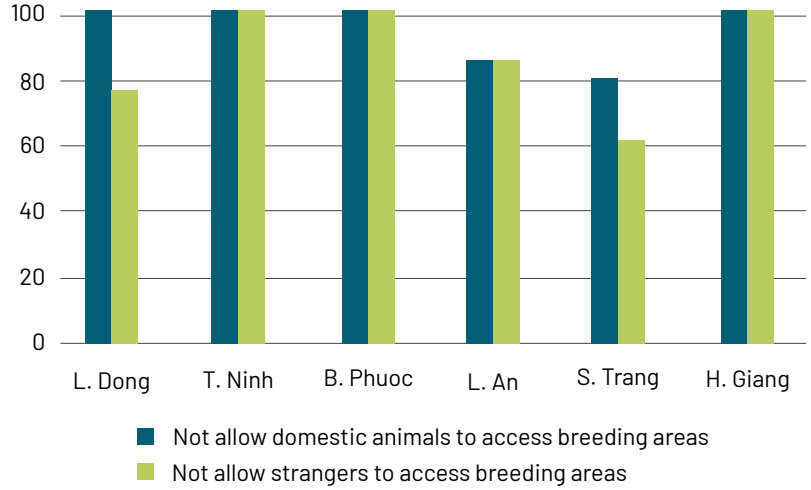


Figure 05: The percentage of wildlife breeding farms which do not allow domestic animals and strangers to access breeding areas

Figure 06: Wildlife breeding areas are locked to prevent domestic animals and unauthorized persons from access

According to farm owners, the reason for not allowing domestic animals to access wildlife breeding areas is not only to prevent them from attacking or causing stress to wild animals but also to help mitigate cross-infection between domestic and wild animals, thus reducing the risk of zoonoses transmitted from wild animals to humans. Also, farm owners do not allow strangers to access breeding areas for fear that they may spread diseases to their wild animals.

3.1.5. Vaccinating wild animals

Vaccinating wild animals is an important measure to protect them from diseases, thereby contributing to reducing the risk of zoonoses. However, the survey results at breeding farms in the provinces of Lam Dong, Tay Ninh, Binh Phuoc, Long An, Hau Giang, and Soc Trang indicate a very low percentage of farms which vaccinate wild animals. Of 41 surveyed farms, only 16 vaccinate wild animals, in which Lam Dong has the highest vaccination percentage (50%) and Binh Phuoc has the lowest (25%). The percentage of surveyed breeding farms which vaccinate wild animals in the provinces of Lam Dong, Tay Ninh, Binh Phuoc, Long An, Hau Giang, and Soc Trang is shown in Figure 07.

16/41
farms vaccinate wild animals

50%
Lam Dong has the highest vaccination percentage

25%
Binh Phuoc has the lowest vaccination percentage

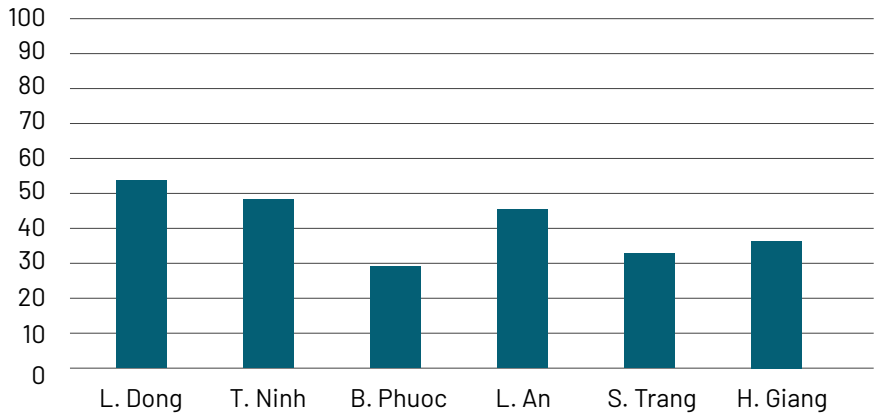


Figure 07: The percentage of surveyed breeding farms which vaccinate wild animals

The percentage of farms that vaccinate captive wild animals is low because, according to farm owners and officers from Husbandry and Veterinary Sub-departments, wild animals are currently free from diseases and often healthier than domestic animals. Another reason for this is that farm owners are not required to vaccinate wild animals by local veterinary agencies. Additionally, there is no singular vaccine for wild animals. Also, some farms fear that vaccination may negatively affect the health of their wild animals.

3.1.6. Locating wild animal cages

The location of animal cages is thought to affect the level and frequency of contact between humans and wild animals. The closer animal cages are to human accommodation, the more frequent the contact – both direct and indirect – between the occupants and wild animals becomes, thereby increasing the risk of zoonoses.

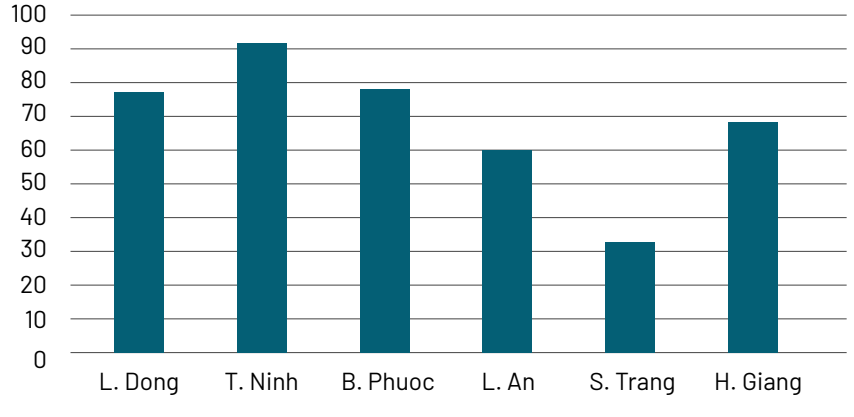


Figure 08: The percentage of surveyed breeding farms whose animal cages are kept separate from human accommodation areas

The survey results show that only 26 of 41 surveyed breeding farms (accounting for 63.4%) have animal cages kept separate from human accommodation areas, whereas 15 of them have animal cages located within human accommodation areas. Among the surveyed provinces, Tay Ninh has the highest percentage of breeding farms whose animal cages are kept separate from human accommodation areas (88.9 %), and Soc Trang has the lowest (30%). The percentage of surveyed breeding farms whose animal cages are kept separate from human accommodation areas is shown in Figure 08.

26/41

Surveyed breeding farms have animal cages kept separate from human accommodation areas

88.9%

Tay Ninh has the highest

30%

Soc Trang has the lowest

percentage of breeding farms whose animal cages are kept separate from human accommodation areas

Figure 09: Wild animal cages are located within human accommodation areas

3.1.7. Using protective equipment in cleaning animal cages and taking care of wild animals

Using protective clothing while cleaning animal cages and taking care of wild animals helps to protect farm owners and animal caretakers from zoonoses. The survey results of breeding farms in the provinces of Lam Dong, Tay Ninh, Binh Phuoc, Long An, Hau Giang, and Soc Trang record a relatively high percentage of breeding farms which use protective equipment for cleaning and taking care of wild animals at 30 out of 41 farms (73.1%). Yet, protective pieces of equipment are relatively simple, mainly masks. In a few farms, workers wear boots and raincoats while cleaning cages or feeding animals. Long An, Binh Phuoc and Lam Dong provinces have a high percentage of farm owners who use protective equipment for cleaning and taking care of wild animals, while the provinces of Tay Ninh and Soc Trang have a lower percentage. The percentage of surveyed farms which use protective equipment while cleaning animal cages and taking care of wild animals is shown in Figure 10.

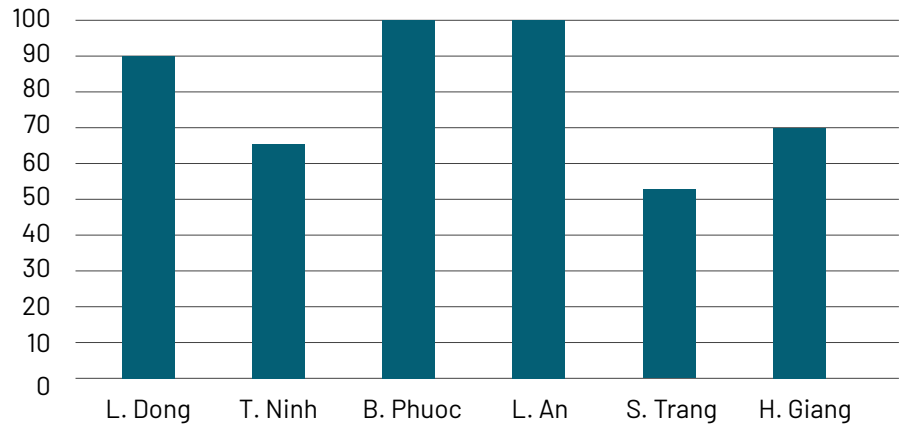


Figure 10: The percentage of surveyed farms which use protective equipment in cleaning animal cages and taking care of wild animals

3.1.8. Handling protective clothing and washing cleaning tools after use

The handling of protective clothing, such as washing and drying clothes, boots, gloves; washing cleaning tools and drying them; discarding used masks, etc., after animal care is not only to ensure hygiene conditions but also to reduce the risk of spreading pathogens from wildlife breeding areas to humans both directly and indirectly. The survey results show that:

- The percentage of surveyed wildlife breeding farms which adequately handle protective clothing after animal care is very low. Only 13 out of 41 surveyed breeding farms adopt measures to adequately handle protective clothing (31.7% of the total number of surveyed farms). However, the methods of handling by farm owners and animal caretakers remain quite basic — mainly the discarding of used masks. Very few farms regularly wash protective clothing. Across surveyed provinces, Hau Giang (66.7% of the surveyed farms) has a high percentage of farms which adequately handle protective clothing, while Tay Ninh (22.2%) has the lowest percentage.
- The percentage of wildlife breeding farms which adequately handle cleaning tools after use is relatively high. 30 out of 40 surveyed breeding farms wash cleaning tools after use (75% of the total number of farms on average). Across surveyed provinces, Hau Giang has the highest percentage of cleaning tools after use (100%), while Soc Trang has the lowest percentage (60%). According to farm owners, it is not necessary to wash cleaning tools immediately after use because wild animals are unlikely to contract diseases.
- The percentage of breeding farms which adequately handle protective clothing and wash cleaning tools after use is shown in Figure 11.

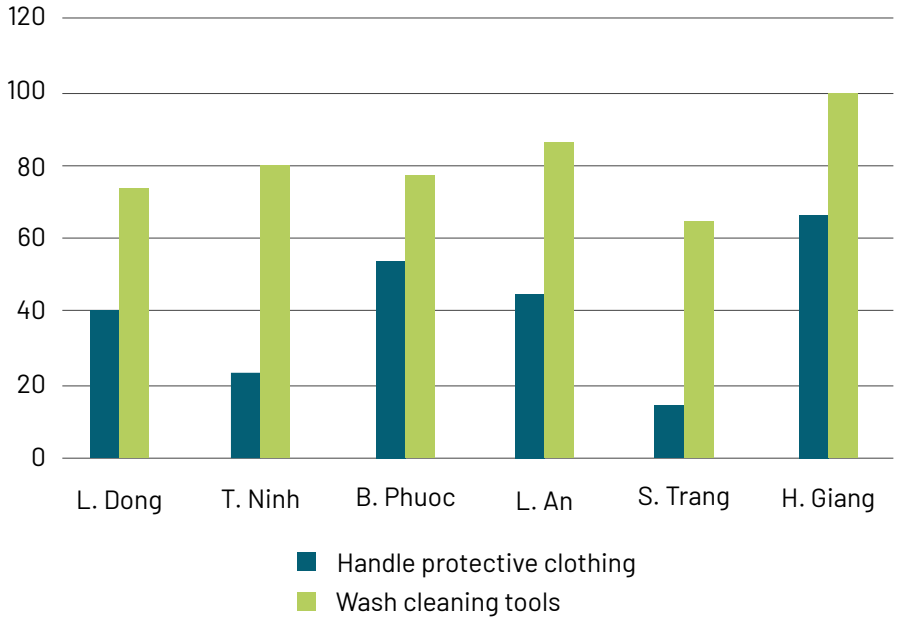


Figure 11: The percentage of breeding farms which handle protective clothing and wash cleaning tools after animal care

3.1.9. Not consuming foods, drinks or smoking in wildlife breeding areas

Consuming food and drinks or smoking in wildlife breeding areas is not only unsanitary but is also attributed to an increased risk of transmission of zoonoses. The survey results show that 34 out of 41 wildlife breeding farms do not allow farm owners, animal caretakers, or managers to consume food and drinks or to smoke in animal cages and breeding areas (82.9 % of the farms). Across surveyed provinces, Lam Dong and Binh Phuoc have the highest percentage of farm owners, animal caretakers, and managers who do not consume food and drinks or smoke in animal cages, wildlife breeding areas (100% of the farms), while Hau Giang has the lowest percentage (66.7%). The percentage of surveyed farms which do not allow farm owners, animal caretakers, and managers to consume food and drinks or smoke in animal cages, wildlife breeding areas is shown in Figure 12.

34/41 Wildlife breeding farms do not allow farm owners, animal caretakers, or managers to consume food and drinks or smoke in animal cages and breeding areas

100% Lam Dong and Binh Phuoc have the highest percentage of farm owners, animal caretakers, and managers who do not consume foods and drinks or smoke in animal cages, wildlife breeding areas

66.7% Hau Giang has the lowest

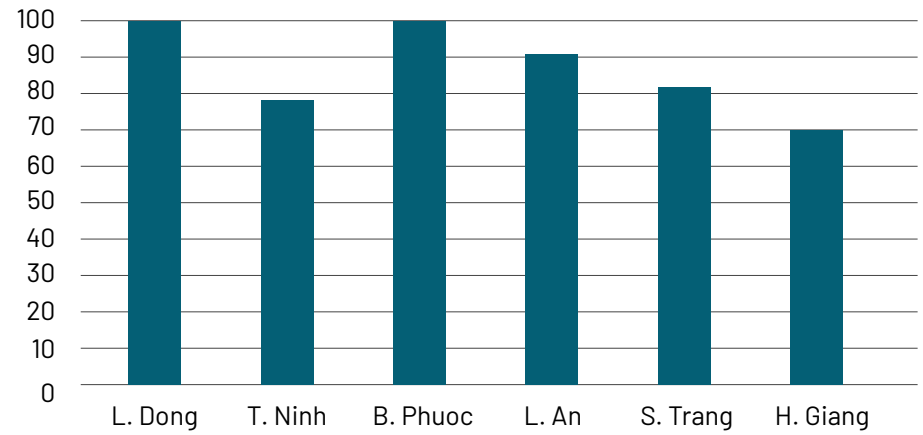


Figure 12: The percentage of surveyed farms which do not allow farm owners, animal caretakers, and managers to consume foods and drinks or smoke in wildlife breeding areas

The survey results also show that farm owners, animal caretakers, farm managers do not consume food and drinks or smoke in wildlife breeding areas because it is unsanitary. They are not aware of the fact that consuming food and drinks or smoking in breeding areas may increase the risk of transmission of zoonoses.

3.1.10. Handling when bitten by wild animals

When humans are bitten by wild animals, there is a high risk of transmission of zoonoses, especially with rabies, through the injury. To prevent rabies when humans are bitten by wild animals, according to the WHO, it is critical that the injury be washed and treated promptly. It must be washed immediately with soap and running tap water within 10-15 minutes. If there is no soap, it must be washed with clean running tap water continuously for 15 minutes. This is the most effective first-aid method to combat rabies. The wounded area should be washed thoroughly with alcohol by volume (ABV) of 70% or iodine if possible. Bitten patients must then be taken to medical facilities for treatment as soon as possible. (WHO[5], Department of Preventive Medicine [6])

The survey results of measures implemented by farm owners, animal caretakers, and farm managers when humans are bitten at breeding farms are listed in Table 02.

5 https://www.vinmec.com/vi/tin-tuc/thong-tin-suc-khoe/sau-khi-bi-dong-vat-can-co-can-tiem-phong-benh-dai-khong/ #:~:text=V%E1%BA%ADt%20nu%C3%B4i%20hay%20th%C3%BA%20hoang,trong%20v%C3%B2ng%202%20%2D%203%20th%C3% A1ng.

6 https://vncdc.gov.vn/hoi-dap-ve-benh-dai-nd13756.html.

Table 02: The percentage of breeding farms with treatment when humans are bitten by wild animals

Measures	The percentage of surveyed breeding farms with treatment (%)					
	L. Dong	T. Ninh	B. Phuoc	L. An	S. Trang	H. Giang
Washing and sterilising the injury when bitten by wild animals	75	100	66.7	57.1	60	66.7
Having the injury examined and treated according to the instructions of medical staff	37.5	12.5	0	28.6	20	0
Monitoring health after being bitten by wild animals	37.5	62.5	33.3	14.3	40	0
Having periodic health examination	71.4	62.5	100	42.9	30	0

The survey results show that measures to be taken after humans are bitten by wild animals are different in one single farm and amongst different ones.

– Washing and disinfecting the injury when bitten: Generally, bitten people often sterilise the injury. 28 out of 40 surveyed farms say they wash and sterilise the injuries (70% of the farms) of which Tay Ninh has the highest percentage of farms following this measure (100%) and Long An has the lowest (57.1%).

28/40

Surveyed farms have washed and sterilized the injury **(equal to 70% of the farms)**

100%

Tay Ninh has the highest percentage of farms with this measure

57.1%

Long An has the lowest

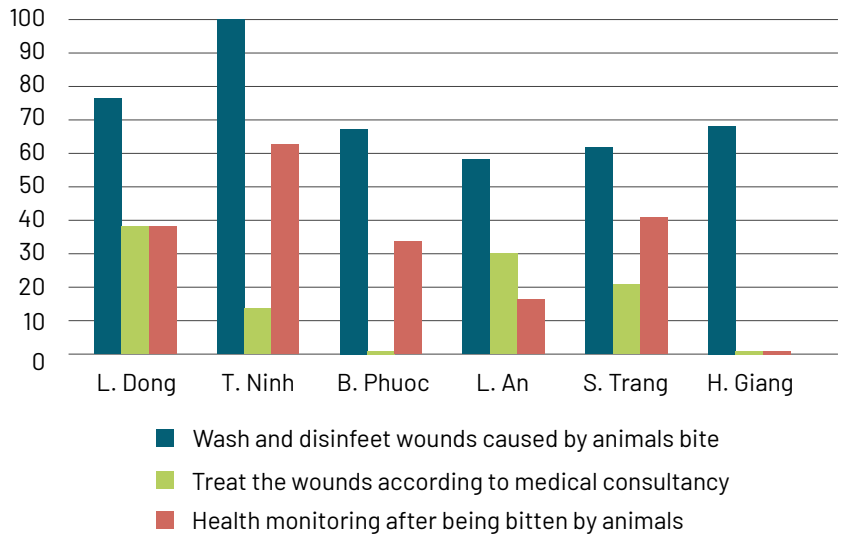


Figure 13: The percentage of respondents with injury treatment and health monitoring after being bitten by wild animals

– Having the injury examined and treated according to the instructions of medical staff: At surveyed wildlife breeding farms, the percentage of people who are bitten by wild animals and visit medical facilities for examination and treatment is very low. Only 8 out of 40 surveyed farms (20%) say that bitten people visit medical facilities for examination and treatment according to the instructions of medical staff, of which Tay Ninh has the highest percentage of visitors to medical facilities (37.5%) while Binh Phuoc and Hau Giang have not had any cases of bitten people pay visits to medical facilities (0%).

8/40

Surveyed farms say that bitten people visit medical facilities for examination and treatment according to the instructions of medical staff **(equal to 20%)**

37.5%

Tay Ninh has the highest percentage of visitors to medical facilities

0%

Binh Phuoc and Hau Giang have not had any cases of bitten people to visit medical facilities

– Monitoring health after being bitten by wild animals: At surveyed wildlife breeding farms, the percentage of people with health monitoring activities after being bitten by wild animals is relatively low. Only 14 out of 40 surveyed farms (35%) say that bitten people monitor their health, of which Tay Ninh has the highest percentage (62.5%), while Hau Giang has not recorded any cases of bitten people with health monitoring (0%).

14/40
Surveyed farms say that bitten people monitor their health

62.5%
Tay Ninh has the highest percentage

0%
Hau Giang has not recorded any case s of bitten people with health monitoring

According to interviewed farm owners and animal caretakers, they do not have their injuries examined and treated as instructed by medical staff nor monitor their health after being bitten by wild animals because they do not suppose that wild animals can spread diseases to humans.

3.1.11. Handling sick animals

Sick captive wild animals require care and treatment to ensure they are in good health, thereby contributing to reducing the risk of zoonoses. The survey results on measures taken by farm owners when wild animals are sick are shown in Table 03.

Table 03: The percentage of surveyed wildlife breeding farms with measures for sick wild animals

Measures	The percentage of breeding farms with measures for sick animals (%)					
	L. Đong	T. Ninh	B. Phuoc	L. An	S. Trang	H. Giang
Asking veterinarians to give examinations and treatment to sick wild animals	42.9	0	25	14.3	20	0
Farm owners give sick wildlife treatment on their own	57.1	100	100	42.9	88.9	100
Taking other measures	0	22.2	0	14.3	0	0
Taking no measures	0	0	0	0	0	0

The survey results show that most breeding farms buy veterinary medicine and give treatment to sick wild animals on their own. 31 out of 40 surveyed farms give treatment to sick wild animals on their own (accounting for 77.5%), of which the provinces of Tay Ninh, Binh Phuoc and Hau Giang have the highest percentage (100%), while Long An has the lowest (42.9%). The percentage of breeding farms which ask veterinarians to give medical examinations and treatment to wild animals is very low. Only 07 out of 40 surveyed breeding farms say that they will ask veterinarians to give medical examinations and treatment to wild animals (17.5%). According to farm owners and the Animal Husbandry and Veterinary Sub-department, farm owners often give treatment to sick wild animals on their own because *local veterinarians currently have no expertise and experience in the treatment of wild animal diseases.* Besides, some breeding farms say that they consult with local medical agencies about the treatment for their sick wild animals before buying veterinary medicine. Others notify the local Forest Protection Department of the event.

31/40
Surveyed farms give treatment to sick wild animals on their own **(equal to 77.5%)**

100%
Tay Ninh, Binh Phuoc and Hau Giang have the highest percentage

42.9%
Long An has the lowest percentage

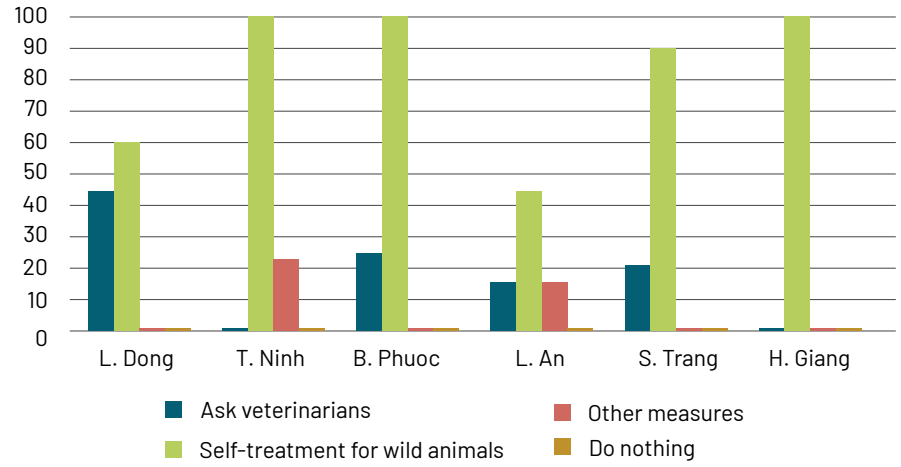


Figure 14: The percentage of breeding farms with medical treatment for sick wild animals

3.1.12. Handling captive wild animals which die from unknown causes

Handling wild animals which die from unknown causes is not only an important measure to protect healthy individuals in breeding farms from diseases but also to contribute to reducing the risk of transmission of zoonoses.

A number of measures taken by farm owners when their wild animals die from unknown causes in some wildlife breeding farms in the provinces of Lam Dong, Tay Ninh, Binh Phuoc, Long An, Hau Giang, and Soc Trang are listed in Table 04.

Table 04: The percentage of breeding farms with measures for wild animals which die from unknown causes

Measures	The percentage of surveyed breeding farms (%)					
	L. Đong	T. Ninh	B. Phuoc	L. An	S. Trang	H. Giang
Notifying local Forest Protection Department	83.3	87.5	100	85.7	80	66.7
Notifying local authority/veterinary agencies	33.3	0	0	50	20	0
Selling dead wild animals	0	0	0	0	0	0
Destroying dead animals on their own	100	100	100	100	80	100
Consuming dead wild animals for food	0	0	0	0	10	0
Other measures	0	0	0	0	0	0
Taking no measures	0	0	0	0	0	0

– Reporting on wild animals' death: According to Clause 1, Article 19 of the 2015 Law on Veterinary medicine and Clause 1, Article 7 of Circular No. 07/2016/TT-BNNPTNT, animals which die unexpectedly and from unknown causes (including captive wild animals) must be reported to veterinary staff at the commune level, the People's Committee of the commune or the nearest veterinary management agencies. However, the survey results indicate that this provision is not well implemented by farm owners. Only 07 out of 38 surveyed breeding farms say that they notify veterinary agencies, local authorities of the event (18.4 %), and up to 31 breeding farms have not and will not notify veterinary agencies or local authorities (81.6%). Meanwhile, farm owners often notify local Forest Protection Department of the event, although the law on forestry does not specify a regulation on reporting when wild animals die.

7/38 surveyed breeding farms say that they will notify veterinary agencies, local authorities of the event **(equal to 18.4%)**

31/38 breeding farms have not and shall not notify veterinary agencies or local authorities **(equal to 81.6%)**

Of 38 surveyed farms, 32 farms will notify the Forest Protection Department of a wild animal's death (84.2%), and only 06 farms will not notify the local Forest Protection Department (15.8%). This reflects a general lack of farm owners' knowledge of the law on veterinary medicine as well as the limited role of the Animal Husbandry and Veterinary Sub-department in the State's wildlife management. The percentage of surveyed farms which notify Forest Protection and veterinary agencies/local authorities of wild animals which die from unknown causes is shown in Figure 15.

32/38 farms will notify Forest Protection Department of wild animals' death **(equal to 84.2%)**

06 farms will not notify local Forest Protection Department **(equal to 15. 8%)**

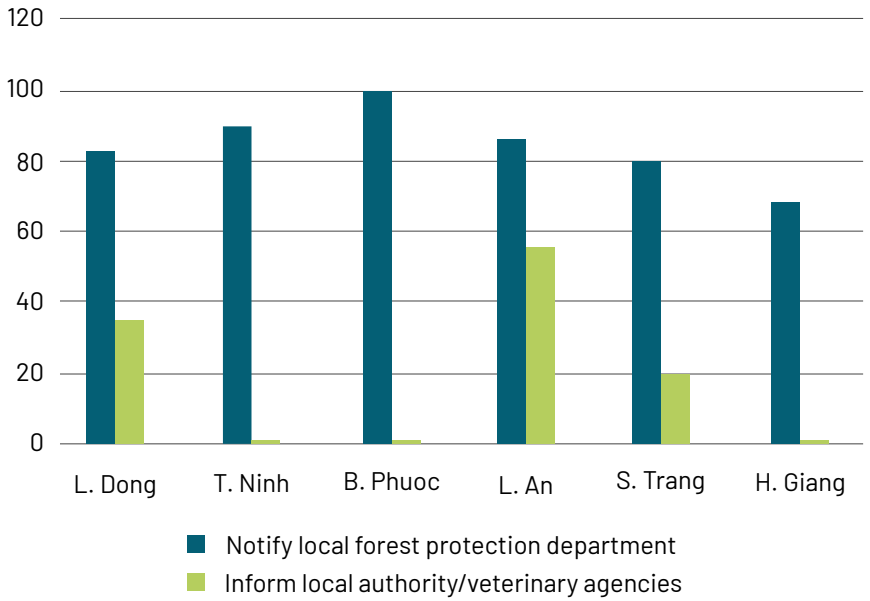


Figure 15: The percentage of breeding farms with notification of wild animals' death

Handling wild animals which die from unknown causes: The survey results show that in case wild animals at breeding farms are dead, they are often destroyed. 35 out of 38 surveyed farms say that they bury wild animals which die from unknown causes (92.1%). Only 02 farms say that they consume dead wild animals for food (5.3%). None of the farms sell dead wild animals or take other measures to handle dead wild animals (0%). The percentage of surveyed farms which take measures to handle wild animals which die from unknown causes is shown in Figure 16.

35/38

farms surveyed say that they destroy wild animals which die from unknown causes **(equal to 92.1%)**

02/38

farms say that they consume dead wild animals for food **(equal to 5.3%)**

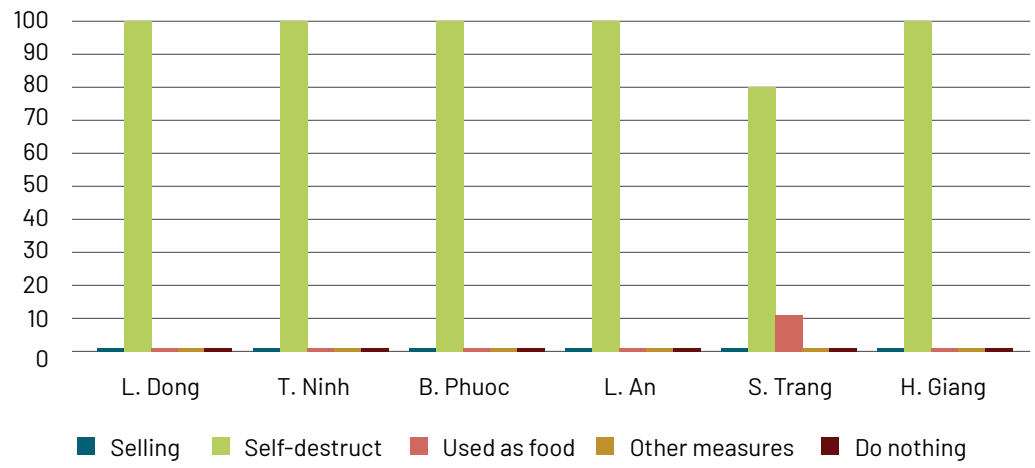


Figure 16: The percentage of surveyed farms with measures to handle wild animals which die from unknown causes

3.2. Farm owners' awareness of the dangers and risks of zoonoses

Farm owners' awareness and opinions of the dangers and risks of zoonoses play an important role in successfully prompting them to implement zoonotic disease prevention measures.

Survey results in the provinces of Lam Dong, Binh Phuoc, Tay Ninh, Long An, Hau Giang, and Soc Trang show that only 24.4% of the total number of breeding farms think that there is a risk of zoonoses. Up to 75.5% of the total number of breeding farms think that there is no risk of zoonoses, which is attributed to the supposition of farm owners and animal caretakers that wild animals are unlikely to contract diseases, and that farm owners and animal caretakers themselves – and their counterparts in other breeding farms – have not suffered from zoonoses before. Additionally, there is a very low number of breeding farms which have had zoonotic disease prevention training and effective communication about the dangers and risks of zoonoses. Only 36.6% of the total number of surveyed farms say that they are informed by local veterinary and forest agencies – or through their own research – about zoonoses as well as preventative measures.

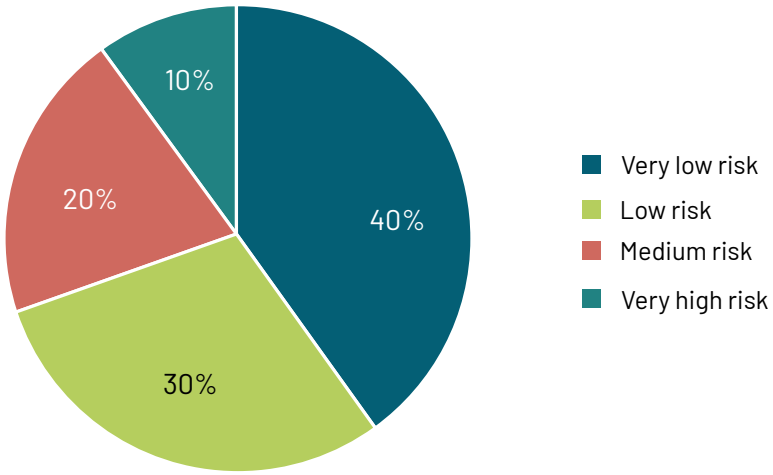


Figure 17: The percentage of the risk of zoonoses from farm owners' perspective

Of the breeding farms that suppose there is a risk of zoonoses, 40% of them think that the risk is very low, 30% believe the risk is low, 20% think the risk is medium, and 10% think the risk is very high. According to farm owners' and managers' perspectives, the percentage of the risk of zoonoses in surveyed provinces is shown in Figure 17.

3.3. Farm owners' attitudes towards implementing zoonotic disease prevention measures

Farm owners' attitudes towards implementing zoonotic disease prevention measures is one of the important indicators to identify their preferred measures as well as the reasons for not taking other measures. This can therefore help in proposing policies and measures that can appropriately meet their needs and expectations.

In order to assess farm owners' attitudes towards the need of taking zoonotic disease prevention measures, 04 approaches have been adopted as follows:

1. Disinfecting animal cages before and after access and isolating sick or newly bought wild animals;
2. Using personal protective clothing in cleaning and taking care of wild animals;
3. Vaccinating wild animals;
4. Keeping wildlife breeding areas far from human accommodation.

The attitudes of farm owners, animal caretakers towards each particular approach above are then divided into 05 levels:

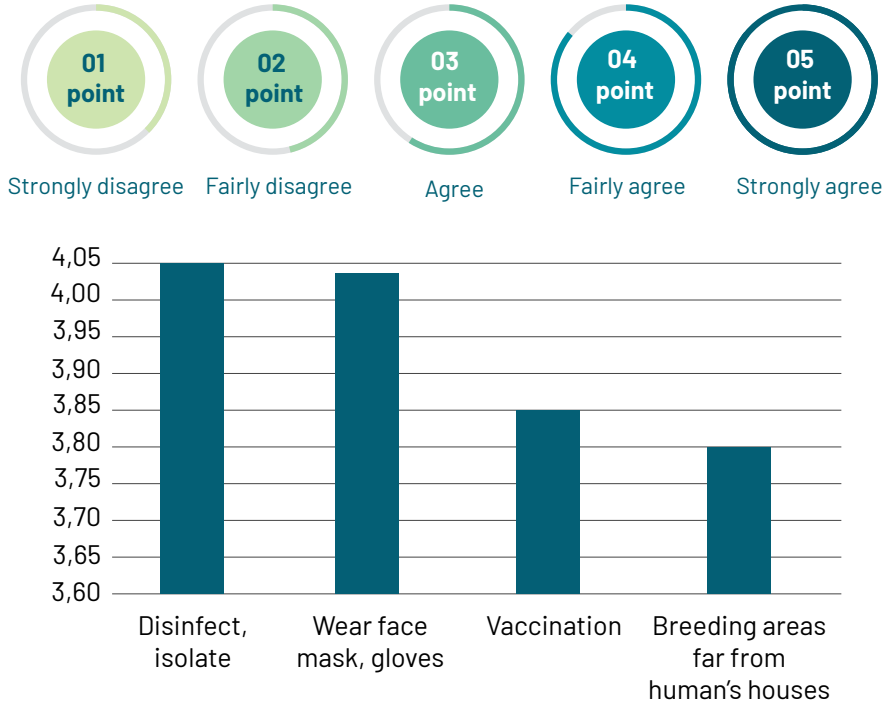


Figure 18: Farm owners' attitudes to a number of zoonotic disease prevention measures

The survey results show that the locals principally support zoonotic disease prevention measures, as mentioned above. In particular, disinfecting animal cages before and after access is the favoured measure among farm owners and animal caretakers, with an average of 4.05 points, which is followed by using protective clothing, with an average of 4.02 points. These two measures receive strong support from farm owners and animal caretakers because they come at low cost, are easy to carry out, and are effective in protecting both humans and wild animals from diseases. Keeping wild animal cages/breeding areas from human accommodation has the lowest score with an average of 3.78 points because this measure, according to farm owners, requires building new cages and breeding areas, which incurs high costs. However, despite implementation of this measure, farm owners will still have direct contact with wild animals when feeding them and cleaning their cages. The results of assessing the attitudes of farm owners, animal caretakers towards the above-mentioned measures at surveyed wildlife breeding farms in the provinces of Lam Dong, Binh Phuoc, Tay Ninh, Long An, Hau Giang, and Soc Trang are shown in Figure 18.

3.3.1. Disinfecting animal cages and isolating wild animals

The results from assessing surveyed farm owners' attitudes towards the need to disinfect animal cages before and after access, and isolate sick or newly bought animals are shown in Figure 19.

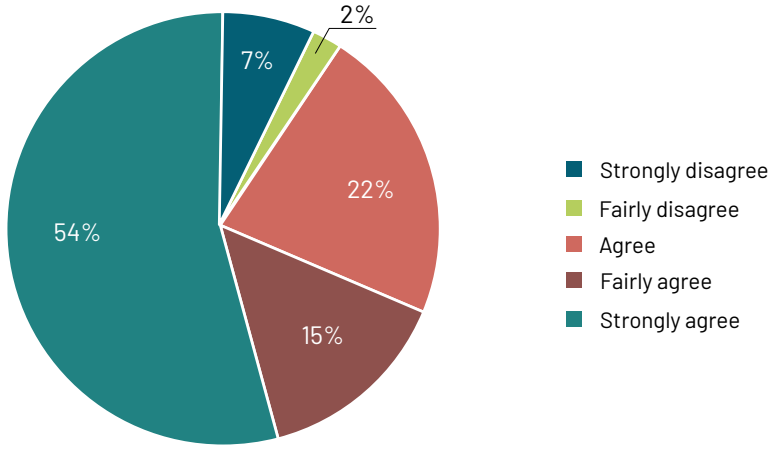


Figure 19: Farm owners' attitudes to the disinfection of animal cages before and after access and the isolation of sick or newly bought animals

The survey results show that 54% of surveyed breeding farms strongly agree, 22% agree, 15% somewhat agree, only 7% strongly disagree, and 2% somewhat disagree about the need to take the measures of disinfecting animal cages and breeding areas in the process of farming, disinfecting before and after access to animal cages, and isolating sick wild animals or those newly bought from other breeding farms.

According to farm owners, animal caretakers, the measures of detoxifying, disinfecting animal cages, breeding tools and isolating newly bought wild animals are often taken to protect wild animals from diseases, and these measures are inexpensive. However, the survey results also indicate that very few breeding farms have antiseptic pits placed at the entrance to wild animal cages because they are not guided to do so by local veterinary agencies. Some farm owners assume that this is not necessary because wild animals are less likely to contract diseases.

3.3.2. Using personal protective equipment

The results of assessing farm owners' attitudes towards the need to use protective equipment in taking care of wild animals and cleaning their cages are shown in Figure 20.

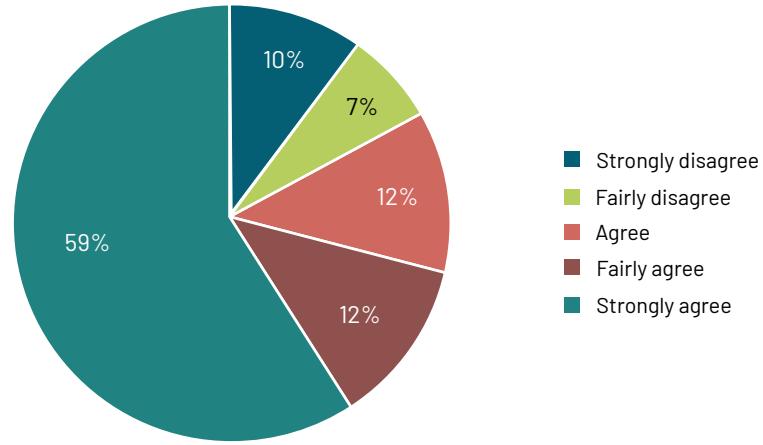


Figure 20: Farm owners' attitudes to the use of personal protective equipment

The survey results show that 59% of the surveyed breeding farms strongly agree, 12% agree, 12% somewhat agree, only 7% somewhat disagree, and 9% strongly disagree with the need to adopt the measure of using protective equipment in taking care of wild animals, cleaning animal cages and breeding farms.

According to farm owners, animal caretakers, they often use protective equipment (mainly masks) in taking care of wild animals, cleaning animal cages, breeding farms to ensure hygiene, and this measure does not incur high costs.

3.3.3. Vaccinating wild animals

The results of assessing farm owners' attitudes towards the need to take the measure to vaccinate wild animals are shown in Figure 21.

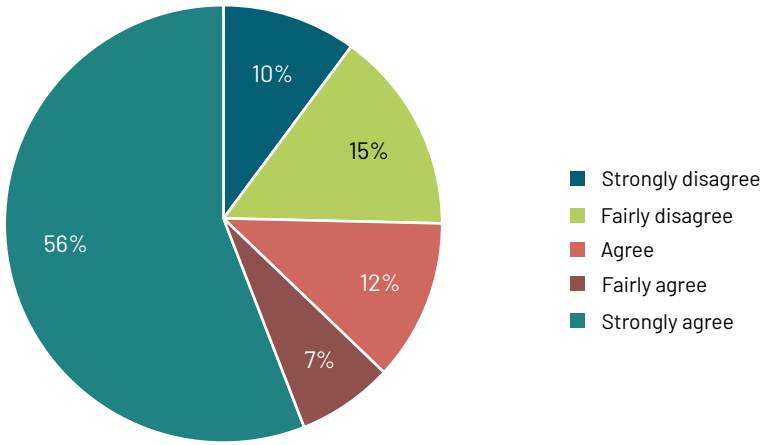


Figure 21: Farm owners' attitudes towards the measure of vaccinating wild animals

The survey results show that 56% of the surveyed breeding farms strongly agree, 15% somewhat disagree, 12% agree, 10% strongly disagree, and only 7% somewhat agree with the need to take the measure of vaccinating wild animals. According to farm owners and animal caretakers, they take this measure in order to protect wild animals from diseases. However, there have not been any vaccines exclusively used for wild animals. Some breeding farms do not agree to vaccinate wild animals for fear that the vaccination may poorly affect their animals' health and incur high costs.

3.3.4. Keeping animal cages far from human accommodation

The results of assessing farm owners' attitudes towards the need to take the measure of keeping animal cages separated from human accommodation are shown in Figure 22.

The survey results show that 41% of the surveyed breeding farms strongly agree, 24% agree, 20% somewhat agree, 10% strongly disagree, and 5% somewhat disagree to keep animal cages separated from human accommodation. Certain farms agree and strongly agree with keeping animal cages far from human accommodation; otherwise, wild animals may suffer from noise pollution, stress, the presence of domestic animals. The farms that disagree or somewhat disagree with this measure argue that this is not necessary because wild animals are unlikely to contract and spread diseases to humans. Moreover, farm owners,

animal caretakers still have to directly contact with wild animals even when they are kept far from human accommodation. Also, farm owners are required to build new animal cages if they take this measure, which often incurs high costs, and some breeding farms have no available land to do so. Local security/safety is also one of the factors discouraging many farm owners - especially those breeding bamboo rats and hedgehogs - from keeping breeding areas far from their accommodation for fear of animal theft.

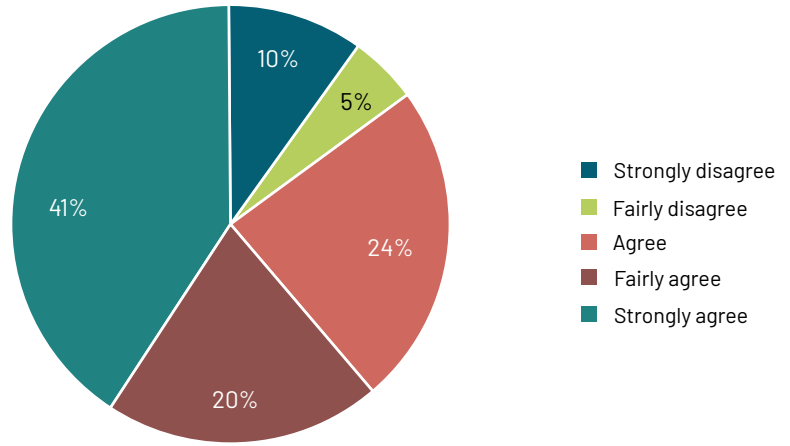
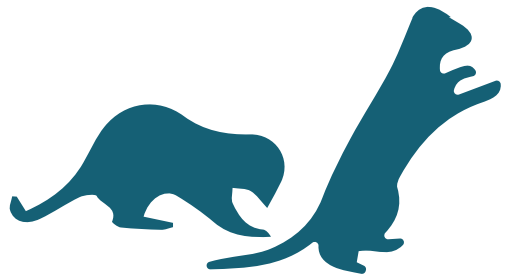


Figure 22: Farm owners' attitudes towards the measure of keeping animal cages from human accommodation



3.4. Factors affecting farm owners' decisions on implementing zoonotic disease prevention measures

In order to identify factors affecting farm owners' decisions on zoonotic disease prevention measures, a number of indicators have been assessed:

01	02	03
Experience from other breeding farms	Opinions from neighbours and family members	Opinions from local authorities

The survey results show that among the factors which affect decisions on implementing zoonotic disease prevention measures, the opinions from local authorities affect farm owners the most (4.15 out of 5 points on average), which is followed by experience from other breeding farms (3.32 out of 5 points) and lastly the opinions from neighbours and family members (2.46 out of 5 points). According to farm owners, animal caretakers, they only tend to follow the recommendations of local authorities, Forest protection agencies, and Veterinary agencies. Some follow the instructions and precedent set by other breeding farms. The opinions of neighbours and family members are not very impactful. In fact, neighbours have no interest in what types of animals are bred by farm owners, and they also have little to no experience or knowledge about the prevention and fight against zoonoses.

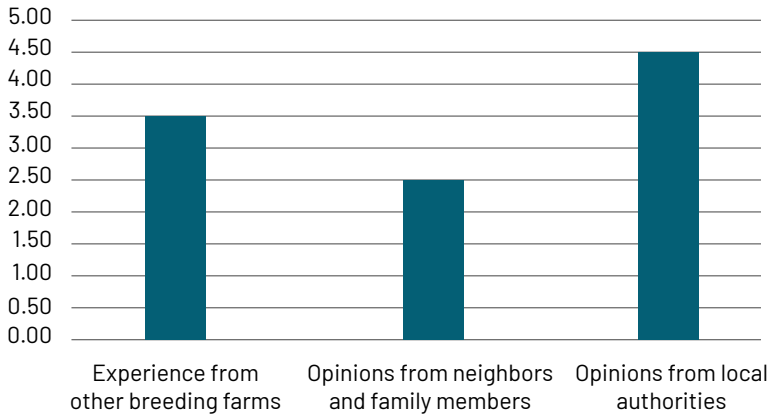


Figure 23: Factors affecting farm owners' decisions on implementing zoonotic disease prevention measures

3.4.1. Experience from other breeding farms

The results of assessing whether experience/precedence set from other breeding farms affects farm owners' decisions on implementing zoonotic disease prevention measures are shown in Figure 24.

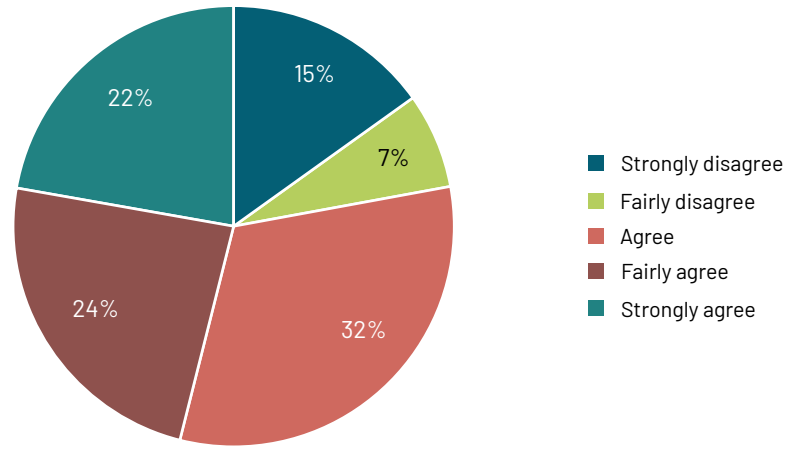


Figure 24: Experience from other breeding farms affecting farm owners' decisions on implementing zoonotic disease prevention measures

The survey results show that 32% of the surveyed breeding farms agree, 24% somewhat agree, 22% strongly agree, 15% strongly disagree, and only 7% somewhat disagree on learning from other farms' experiences and actions in implementing zoonotic disease prevention measures.

As such, experience from other wildlife breeding farms also affects farm owners' decisions on implementing zoonotic disease prevention measures. However, learning from the experiences of similar farms is often difficult because farm owners often tend to keep their good practices and operational methods hidden from other people. This lack of knowledge exchange is further perpetuated by individual psychology and a mentality of competition, among other causes.

3.4.2. Opinions from neighbors and relatives

The results of assessing whether opinions from neighbours and relatives affect farm owners' decisions on implementing zoonotic disease prevention measures are shown in Figure 25.

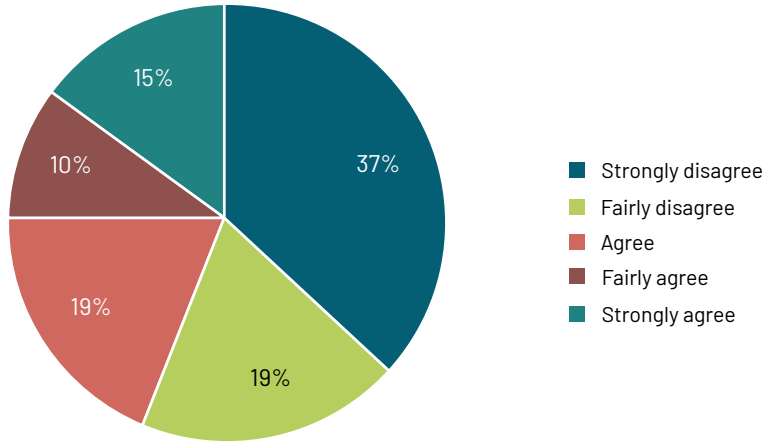


Figure 25: Opinions from neighbors and relatives affecting farm owners' decisions on implementing zoonotic disease prevention measures

The survey results show that 37% of the surveyed breeding farms strongly disagree, 19% agree, 19% somewhat disagree, 15% strongly agree, and only 10% somewhat agree to implement zoonotic disease prevention measures as advised by neighbours and relatives. According to some farm owners, they do not listen to their neighbours or relatives because these people have no interest in what animals are being bred, and neighbours or relatives themselves have little to no experience or knowledge about the prevention and fight against zoonoses.

Thus, the opinions from neighbours and relatives have minimal or no effect on farm owners' decisions on measures against zoonoses.

3.4.3. Opinions from local authorities

The opinions from local authorities in this report include those from local authorities at the commune level, Forest protection agencies, Veterinary agencies and legal provisions. The results of assessing whether the opinions from local authorities (including Forest protection agencies, Veterinary agencies) affect farm owners' decisions on zoonotic disease prevention measures are shown in Figure 26.

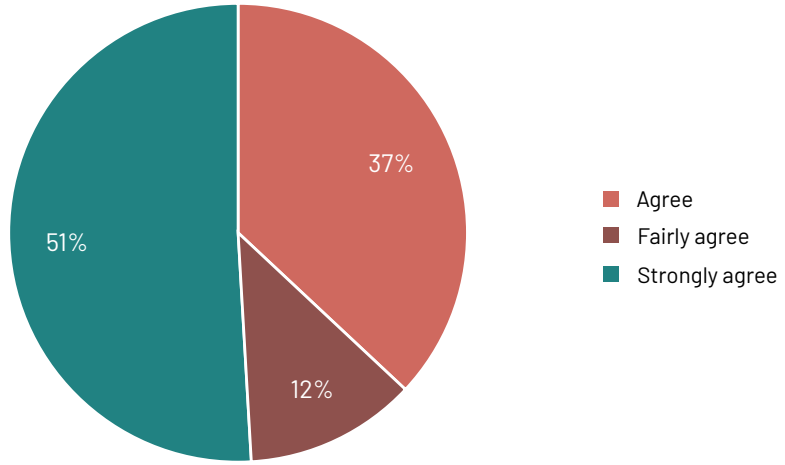


Figure 26: Opinions from local authorities affecting farm owners' decisions on zoonotic disease prevention measures

The survey results show that 51% of the surveyed breeding farms strongly agree, 37% agree, and 12% somewhat agree that the opinions from local authorities affect farm owners' decisions on zoonotic disease prevention measures, and no farms disagree with the opinions from local authorities. Thus, legal provisions, specialized state management agencies (veterinary, forest protection) and local authorities have the greatest influence on farm owners' decisions on zoonotic disease prevention measures. Therefore, in addition to promulgating laws, Veterinary agencies, Forest protection agencies and local authorities are required to promote the dissemination of legal provisions, the dangers and risks, as well as zoonotic disease prevention measures.

3.4.4. Other factors

The survey results also record a number of other factors which directly affect farm owners' decisions on zoonotic disease prevention measures. Specifically:

3.4.4.1. Public awareness of the dangers and risks of zoonoses

Farm owners' awareness of the dangers and risks of zoonoses is an important factor that directly and greatly affects their decisions on implementing zoonotic disease prevention measures. Only when farm owners are aware of dangers and risks shall they take the initiative to fully implement appropriate zoonotic disease prevention measures.

a) The correlation between awareness and keeping wildlife breeding areas from human accommodation

The correlation between farm owners' awareness of the dangers and risks of zoonoses and keeping breeding areas far from human accommodation is shown in Figure 27.

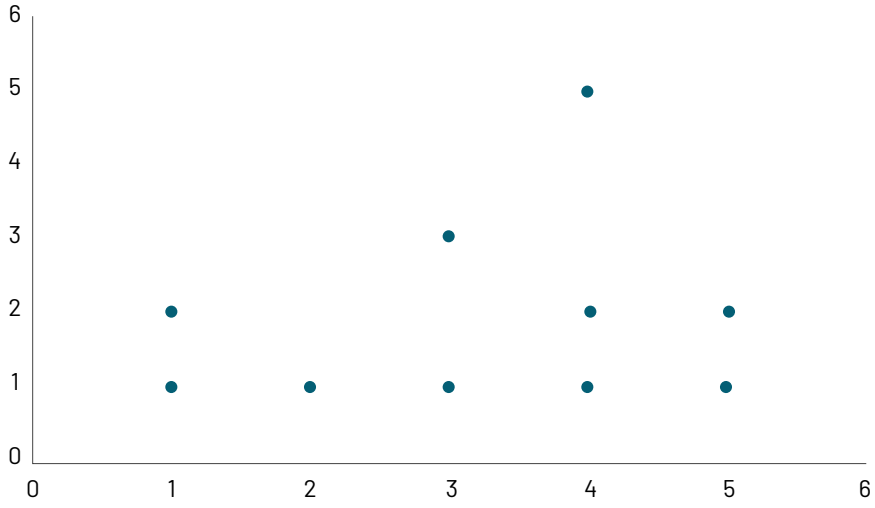


Figure 27: The correlation between the awareness of the dangers and risks of zoonoses and keeping wildlife breeding areas far from human accommodation

Statistical analysis shows that farm owners' awareness of the dangers and risks of zoonoses and keeping breeding areas separated from human accommodation have a positive correlation (Cov = 0.041). However, this correlation is very weak or hardly exists (r = 0.041). This calculation result is in line with the interview results. According to farm owners, the reason for keeping breeding areas far from human accommodation is not to protect wild animals from zoonoses but mainly to protect them from noise pollution, stress, and domestic animals.

b) The correlation between awareness and detoxification, disinfection

The correlation between farm owners' awareness of the dangers and risks of zoonoses and the detoxification, disinfection of animal cages and breeding tools is shown in Figure 28.

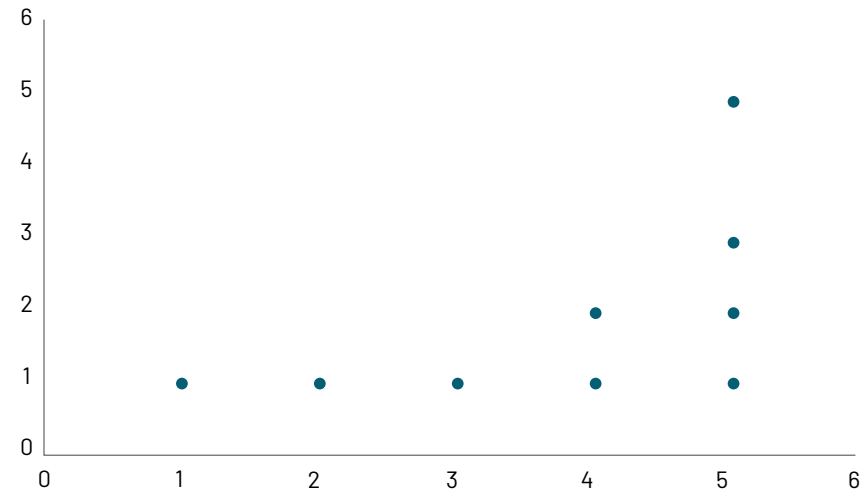


Figure 28: The correlation between the awareness of the dangers and risks of zoonoses and the detoxification, disinfection of animal cages, breeding tools

Statistical analysis shows that farm owners' awareness of the dangers and risks of zoonoses and the detoxification, disinfection of animal cages and breeding tools have a positive correlation (Cov = 0.21) i.e. the greater the public awareness is, the more they are interested in disinfecting, detoxifying animal cages and breeding tools. However, this correlation is not close (r = 0.225). This calculation result is consistent with the interview results. According to farm owners, the reason for detoxifying, disinfecting animal cages, breeding tools is not mainly to protect wild animals from zoonoses but to protect them from common diseases.

c) The correlation between awareness and using equipment

The correlation between farm owners' awareness of the dangers and risks of zoonoses and using protective equipment (wearing masks, gloves, protective clothing, etc.) is shown in Figure 29.

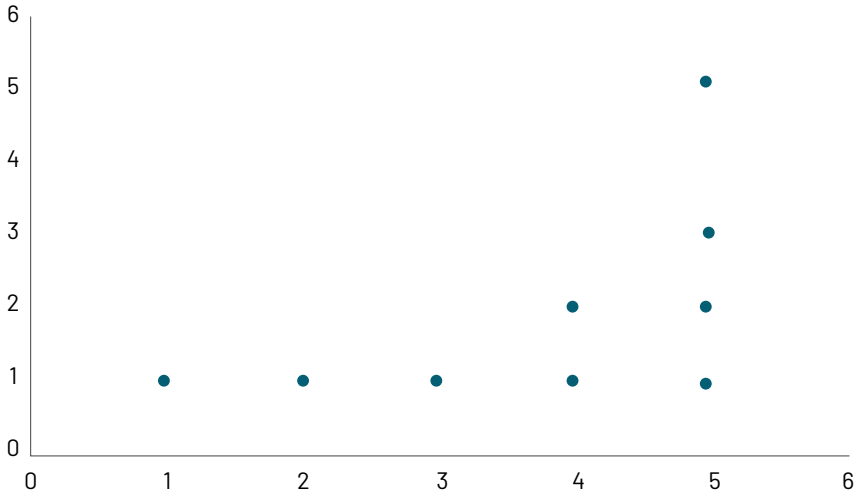


Figure 29: The correlation between farm owners' awareness of the dangers and risks of zoonoses and using protective equipment

Statistical analysis shows that farm owners' awareness of the dangers and risks of zoonoses and using protective clothing have a positive correlation (Cov = 0.22), i.e. the greater the public awareness is, the more they are interested in using protective clothing in taking care of wild animals, cleaning their cages and farms. However, this correlation is not close (r = 0.21). This calculation result is consistent with the interview results. According to farm owners who use personal protective equipment, the reason for using protective clothing (mainly masks) is to ensure hygiene in breeding and taking care of wild animals. They do not know that using protective clothing is a measure against zoonoses.

d) The correlation between awareness and vaccination

The correlation between farm owners' awareness of the dangers and risks of zoonoses and the vaccination against diseases for wild animals is shown in Figure 30.

Statistical analysis shows that farm owners' awareness of the dangers and risks of zoonoses and the vaccination against diseases for wild animals have a positive correlation (Cov = 0.34), i. e., the greater the public awareness is, the more they are aware of the vaccination against diseases for wild animals. However, this correlation is not close (r = 0.31).

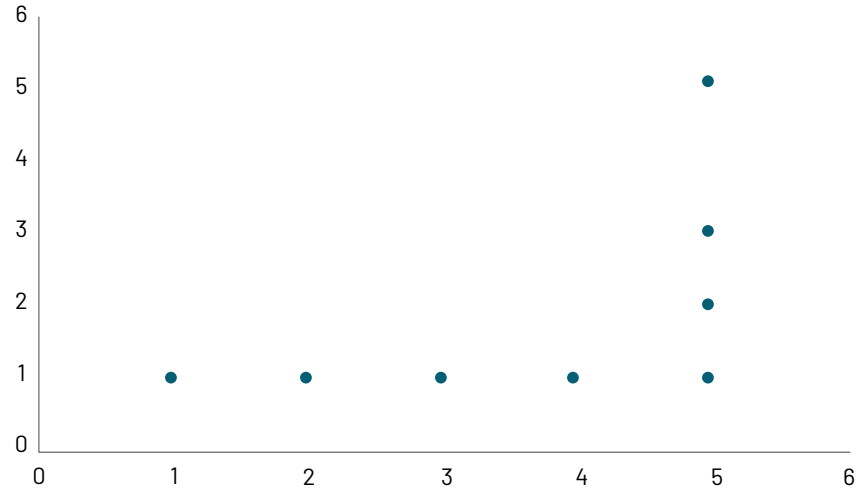


Figure 30: The correlation between farm owners' awareness of the dangers and risks of zoonoses and the vaccination against diseases for wild animals

3.4.4.2. The emergence of zoonoses in practice

The survey results show that there have not been any cases of zoonoses at wildlife breeding farms in surveyed provinces. Therefore, farm owners and animal caretakers are often neglectful of zoonotic disease prevention measures.

However, according to some farm owners, since the Covid-19 pandemic and the claim in the media that the Coronavirus was derived from wild animals, they have become much more cautious when in contact with wild animals and, at the same time, have had antiseptic pits placed at the entrance to animal cages. Therefore, media communications on the dangers and risks of zoonoses are required to give specific examples of cases of zoonoses so that farm owners, in general, and the communities, in particular, become fully aware of the dangers and risks, thereby voluntarily adopting zoonotic disease prevention measures.

3.4.4.3. Implementation costs

Survey results show that zoonotic disease prevention measures such as wearing masks, detoxifying, disinfecting, cleaning animal cages, breeding tools, etc., are inexpensive and easy measures to carry out. Zoonotic disease prevention measures with high costs are not supported and adopted by many breeding farms. Therefore, it is necessary to take into account any costs incurred by measures taken by farm owners to protect their wild animals from zoonoses.

3.4.4.4. Legal regulations and State agencies' management

Currently, there have not been any legal regulations on the prevention and fight against zoonoses. However, the survey results show that many farm owners are willing to comply with legal regulations if required by the State.

The survey results also show that if State agencies (Veterinary, Forest protection) are active in disseminating legal regulations on veterinary, wildlife protection - in combination with inspections, supervision, and a strict handling of violations - farm owners' compliance with laws shall improve. Therefore, in order for farm owners to take the initiative and voluntarily implement zoonotic disease prevention measures, State agencies need to be active in the dissemination of information, in combination with inspections, supervision and strict treatment of violations.

3.5. Capabilities to take zoonotic disease prevention measures

In order to prevent and combat zoonoses, farm owners must have certain resources and capabilities. This could consist of financial resources, knowledge, experience, and facilities. Assessing this issue shall help identify which preventive measures are likely or unlikely to be taken by farm owners.

Farm owners' capabilities (resources) to take a number of zoonotic disease prevention measures are divided into 05 levels and assessed according to their perception, which includes: 1 point - Extremely incapable; 2 points - Somewhat incapable; 3 points - Capable; 4 points - Somewhat capable; and 5 points - Extremely capable.

The zoonotic disease prevention measures which are assessed include:

01 Detoxifying, disinfecting animal cages, breeding tools, disinfecting before and after accessing animal cages, isolating sick or newly bought animals and using protective clothing in taking care of wild animals, cleaning their cages;

02 Keeping wildlife breeding areas far from human accommodation;

03 Vaccinating wild animals.

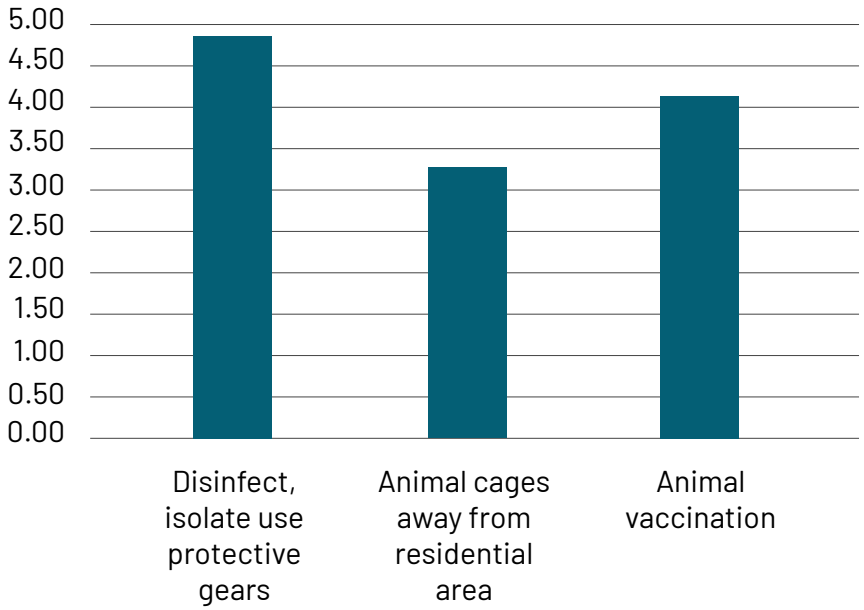


Figure 31: Capabilities to take a number of zoonotic disease prevention measures at surveyed breeding farms

The survey results show that locals are generally capable of taking the above-mentioned zoonotic disease prevention measures, of which detoxifying, disinfecting, isolating wild animals and using protective clothing are likely to be practised the most, with an average of 4.61 points out of 5 points, followed by vaccinating with an average of 3.88 points out of 5 points. Keeping wild animal cages away from houses/residential areas is the least likely to be implemented. (2.90 points out of 5 points).

3.5.1. Disinfecting, isolating and using protective clothing

The results of assessing farm owners' capabilities to detoxify, disinfect animal cages, breeding tools, disinfect before and after accessing animal cages, isolate sick or newly bought animals and use protective clothing in taking care of wild animals and cleaning animal cages at surveyed farms are shown in Figure 32.

The survey results show that 68% of the surveyed breeding farms are extremely capable, 25% are fairly capable, and 7% are capable of detoxifying, disinfecting animal cages, breeding tools, disinfecting before and after accessing animal cages, isolating sick or newly bought animals, and using protective clothing in taking care of wild animals and cleaning animal cages. No breeding farms are incapable or quite incapable of taking the above-mentioned zoonotic disease prevention measures.

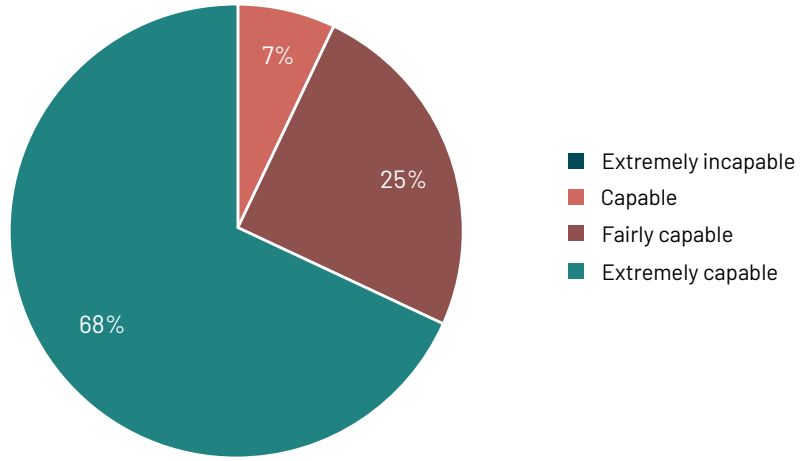


Figure 32: Farm owners' capabilities to disinfect animal cages isolate sick or newly bought animals and use protective clothing at surveyed farms

3.5.2. Keeping animal cages from housing or residential areas

The results of assessing farm owners' capabilities to keep wild animal cages, breeding areas away from houses, common living areas or residential areas at surveyed farms are shown in Figure 33.

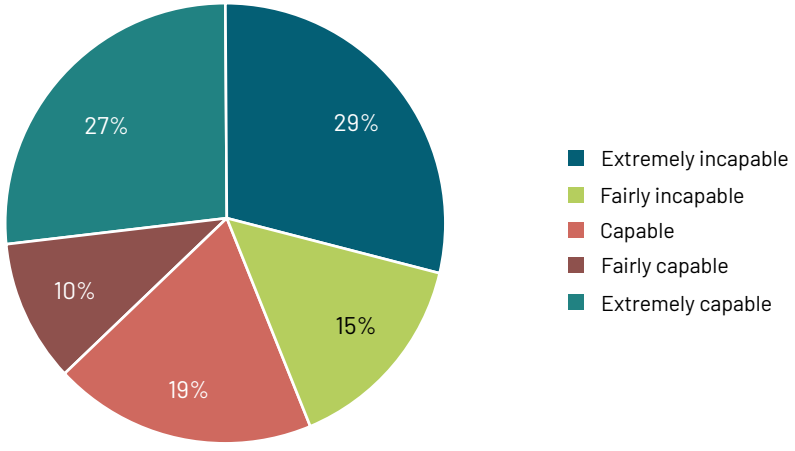
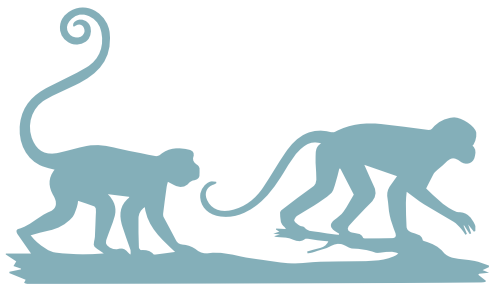


Figure 33: Farm owners' capabilities to keep wild animal cages, breeding areas far from houses, common living areas or residential areas

The survey results show that 29% of the surveyed breeding farms are extremely incapable, and 15% are fairly incapable of keeping animal cages from housing and residential areas; 27% of breeding farms are extremely capable, 19% are capable, and 10% are fairly capable of keeping animal cages away from housing and residential areas because they have suitable land and their existing breeding farms are already being kept away from houses. The farms which are incapable or quite incapable of doing so do not have suitable land, and keeping animal cages far from houses requires them to rebuild cages and breeding areas, thus incurring high costs.



3.5.3. Vaccinating wild animals

The results of assessing farm owners' capabilities to vaccinate wild animals at surveyed farms are shown in Figure 34.

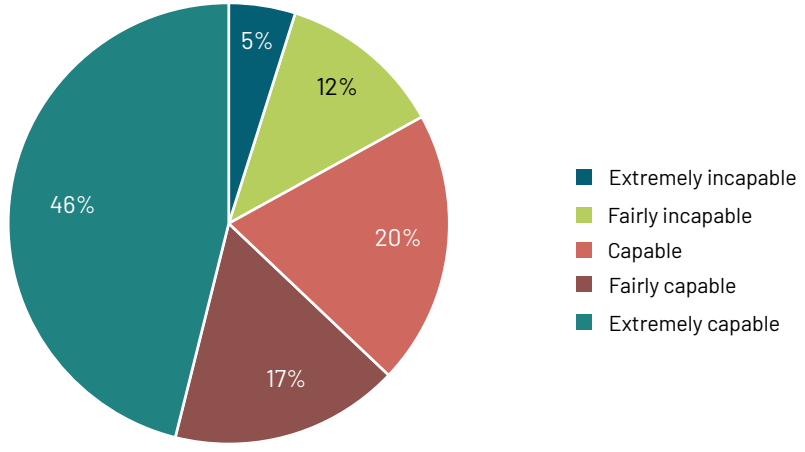
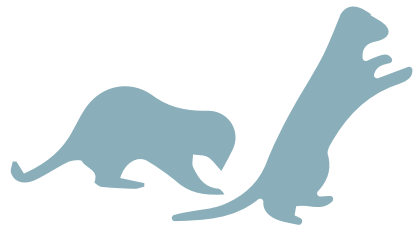


Figure 34: Farm owners' capabilities to vaccinate wild animals

The survey results show that 46% of the surveyed breeding farms are extremely capable, 20% are capable and 17% are incapable of vaccinating wild animals, while 12% are quite incapable and 5% are extremely incapable. According to farm owners, vaccination is an effective and low-cost measure to protect wild animals from diseases. However, so far, there have not been any vaccines exclusively designated for wild animals. Most farm owners use vaccines intended for cattle and poultry to vaccinate their wild animals if vaccination is required.



3.6. Proposals for enhancing the implementation of zoonotic disease prevention measures

In order to enhance the implementation of zoonotic disease prevention measures, it is necessary to adopt solutions from both State agencies and farm owners. Specifically:

3.6.1. For the State

- Studying, formulating and promulgating a List of zoonoses which specifies types of disease; wild species contracting those diseases; modes of disease transmission; symptoms of wild animals contracting diseases; a technical process of disease prevention and treatment for wild animals contracting diseases; reporting regimen when wild animals contract diseases or are suspected of contracting diseases.
- Formulating and promulgating a list of wild animals that are at high risk of spreading diseases to humans and that has its own management regime.
- Planning wildlife breeding areas, which gradually removes wild animals at risk of zoonoses from residential areas.
- Establishing technical standards on animal cages and biosafety measures in wildlife farming, especially species groups that are assessed to be at high risk of zoonoses, such as wild birds, primates, civets, rodents, etc. These measures should be easy and inexpensive to apply and immediately implementable, such as detoxifying, disinfecting animal cages and breeding tools, wearing protective clothing in taking care of animals and cleaning cages, not consuming food and drinks in wildlife breeding areas, etc.
- Enhancing the dissemination of the dangers and risks of zoonoses – especially among those who breed, purchase, transport, and consume wild animals – through the media such as posters, documents, TV, radio, books, newspapers, etc. In particular, there must be active involvement of local authorities and veterinary agencies.
- Providing training courses in zoonotic disease prevention measures for Forest protection and Veterinary staff in provinces, thereby facilitating their instructions of implementation for the locals.
- Strengthening law enforcement to eliminate illegal wildlife trading farms, strictly handling cases failing to conduct wild animal quarantine as regulated by law.

- Introducing policies of loan support, science and technology in animal husbandry, processing, and markets for wild animals to ensure sustainable breeding activities.
- Conducting research on developing a vaccine(s) against diseases exclusively used for wild animals; disseminating the information among the locals on vaccinating wild animals to protect them from diseases, especially zoonoses.
- Providing training courses in the prevention and treatment of wild animal diseases and zoonoses for veterinarians.

3.6.2. For animal breeders

Modes of disease transmission from wild animals to humans can be from direct contact, wounds, scratches on the body, contact with waste, blood and bodily fluid, etc., of wild animals. The transmission can also be through the air, gastrointestinal tract and vectors such as insects, rats, etc. Therefore, in order to prevent and combat zoonoses, farm owners are required to take the following measures:

- Large-scale breeding farms with many people involved in breeding and taking care of wild animals are required to issue internal regulations on breeding procedures, environmental sanitation, and disease prevention. All employees and persons concerned must strictly comply with these regulations and procedures.
- Farm owners, animal caretakers and managers must wash their hands (even when they wear gloves) with soap or sanitiser before and after they have contact with wild animals, their food, waste, and bodily fluids.
- Wildlife animal caretakers should be equipped with personal protective equipment, hats, masks, gloves, and boots. No direct contact with wild animals should be made unless treatment is required.
- Wild animal cages and farms must frequently be kept clean to reduce the risk of airborne transmission of diseases as well as environments for pathogens to grow.
- Employees must wear protective clothing, masks, gloves, boots, etc., when cleaning or feeding wild animals. These protective items must be discarded or washed after use and must not be taken out of the establishment if not washed. Cleaning tools are not allowed to be shared between cages.

- Smoking or consuming food and drinks in wildlife breeding areas are not allowed. Touching of the mouth, nose, eyes, etc., should not be made while cleaning or feeding wild animals. Workers taking care of sick animals are not allowed to have physical or close contact with other healthy individuals.
- Farm owners, animal caretakers must always proceed with caution to avoid being attacked, bitten or scratched. In case of being bitten or scratched by wild animals, they must immediately notify health workers, wash their wound(s) carefully with bactericidal soap and visit a medical facility in case the wound(s) gets worse.
- On purchase outside the province, it is necessary to request the seller to quarantine wild animals before transport to ensure that they are healthy and disease-free. Wild animals also must be of verified and legal origin.
- Wild animals contracting infectious diseases, suspected of infectious diseases, or dead from unknown causes must be reported immediately to the nearest local authorities or the nearest Veterinary agencies to prevent zoonoses and to comply with the law on veterinary medicine. The instructions of Veterinary agencies must be observed when wild animals are sick or dead from infectious diseases.
- Wild animals that are sick or dead of unknown causes must not be consumed for food; the corpse of wild animals that have contracted infectious diseases or died from unknown causes must not be discharged into the natural environment.
- Waste of wild animals should be treated and must not be directly discharged into the natural environment, especially where there is a water source in the vicinity.
- Do not keep animal cages near human accommodation or in people's living area. Do not allow domestic animals, unauthorised persons to access wildlife breeding areas.
- Each wildlife breeding farm must have an antiseptic pit and perform disinfection before and after accessing wildlife breeding areas.

References

[1] Law on Forestry No. 16/2017/QH14 dated November 15, 2017.

[2] Law on Biological diversity No. 20/2008/QH12 dated November 13, 2008.

[3] Law on Environmental Protection No. 55/2014/QH13 dated June 23, 2014.

[4] Law on Veterinary medicine No. 79/2015/QH13 dated June 19, 2015.

[5] Law on Fisheries No. 18/2017/QH14 dated November 21, 2017.

[6] Law on Animal Husbandry No. 32/2018/QH14 dated November 19, 2018.

[7] Decree No. 06/2019/ND-CP dated January 22, 2019 of the Government on the management of endangered, precious, rare forest animals and plants and the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

[8] Decree No. 84/2021/ND-CP of September 22, 2021 amending and supplementing a number of articles of the Government's Decree No. 06, January 22, 2019 on the management of endangered, precious, rare forest animals and plants and the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

[9] Decree 160/2013/ND-CP dated November 12, 2013 of the Government on the criteria for identifying species and management regime of species on the List of endangered, precious and rare species prioritized for protection.

[10] Circular No. 27/2018/TT-BNNPTNT dated November 16, 2018 of the Ministry of Agriculture and Rural Development prescribing the management and traceability of forest products.

[11] Circular No. 09/2016/TT-BNNTPTN dated June 1, 2016 of the Ministry of Agriculture and Rural Development on animal slaughter control and veterinary hygiene inspection.

[12] Circular No. 13/2017/TT-BNNPTNT dated June 20, 2017 of the Ministry of Agriculture and Rural Development promulgating national technical regulations in veterinary medicine sector.

[13] Circular No. 07/2016/TT-BNNPTNT dated May 31, 2016 of the Ministry of Agriculture and Rural Development on prevention and control of terrestrial animal disease epidemics.

[14] Circular No. 24/2019/TT-BNNPTNT dated December 24, 2019 of the Ministry of Agriculture and Rural Development amending and supplementing a number of articles of the Minister's Circular No. 07/2016/TT-BNNPTNT dated May 31, 2016 of the Minister of Agriculture and Rural Development on prevention and control of terrestrial animal disease epidemics.

[15] Circular No. 09/2021/TT-BNNPTNT dated 12/8/2021 of the Ministry of Agriculture and Rural Development amending and supplementing a number of articles of the Minister's Circular No. 07/2016/TT-BNNPTNT dated May 31, 2016 of the Minister of Agriculture and Rural Development on the prevention and control of terrestrial animal disease epidemics.

[16] Circular No. 04/2016/TT-BNNPTNT dated May 31, 2016 of the Ministry of Agriculture and Rural Development stipulating measures to prevent and combat animal diseases.

[17] Circular No. 10/2022/TT-BNNPTNT dated September 14, 2022 Ministry of Agriculture and Rural Development amending and supplementing a number of articles of Circular No. 09/2016/TT-BNNPTNT dated June 1, 2016 of the Minister of Agriculture and Rural Development on animal slaughter control and veterinary hygiene inspection.

[18] Circular No. 09/2022/TT-BNNPTNT dated August 19, 2022 of the Ministry of Agriculture and Rural Development amending and supplementing a number of articles of the Circulars on the quarantine of terrestrial animals and animal products.

[19] Joint Circular No. 16/2013/TTLT-BYT-BNN & PTNT dated May 27, 2013 of the Ministry of Health and the Ministry of Agriculture and Rural Development guiding the coordination of prevention and control of zoonoses.

[20] Circular No. 25/2016/TT-BNNPTNT dated June 30, 2016 of the Ministry of Agriculture and Rural Development stipulating the quarantine of terrestrial animals and animal products.

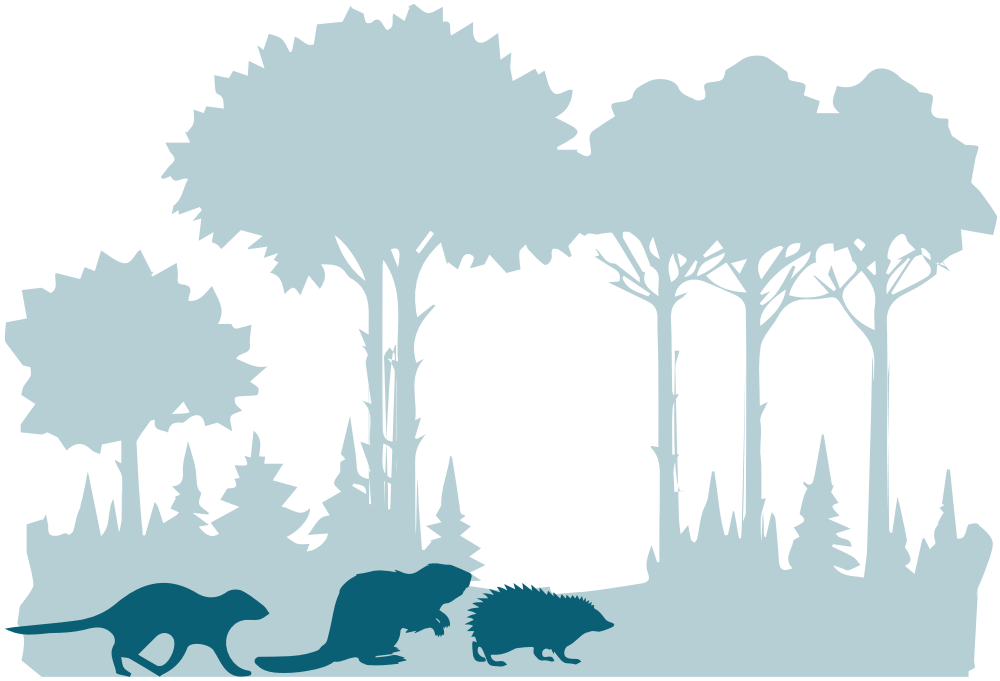
[21] Directive No. 03/CT-TTg dated February 20, 2014 of the Prime Minister on strengthening the direction and implementation of measures to control and conserve endangered, precious and rare species.

[22] Directive No. 28/CT-TTg dated September 17, 2016 of the Prime Minister on a number of urgent solutions for preventing and fighting the violation of wild animals against the law.

[23] Directive No. 29/CT-TTg dated July 23, 2020 of the Prime Minister on a number of urgent solutions for wildlife management.

[24] Report on assessing legal provisions on wildlife breeding in Vietnam (ENV, 2021).

[25] Report on reviewing and assessing the application of Vietnamese legal documents on the management of commercial wildlife farms (Viet Nam CITES Management Authority, 2018).



Appendix 1

INTERVIEWING QUESTIONNAIRE FOR FARM OWNERS/ BREEDING FARM MANAGERS ON COMPLYING WITH LEGAL REGULATIONS ON WILDLIFE BREEDING AND PREVENTION OF DISEASES

1. Information about interviewers and interviewing time

1.1 Interviewers:

Nguyen Manh Dzung Pham Le Hoa Dang Vu Hoai Nam

Giang Trong Toan Le Thi Cong Ngan Nguyen Van Doan

1.2 Interviewing time .....

2. Information about interviewees (farm owners or breeding farm managers)

2.1. Interviewee's full name: .....

2.2. Position: .....

2.3. Breeding farm: .....

2.4. Telephone: ..... Email: .....

2.5. Address: .....

.....

PART 1: GENERAL INFORMATION ABOUT BREEDING FARMS

What wild animal species are you breeding at your farms?

.....

1. When did you start breeding wild animals?
2. Farm scale: Large [...], Medium [...], Small [...]
3. What agencies conduct regular inspections and checks of your farms?
4. 4.1. Which agencies regularly inspect your farms?

Forest protection	☐ Yes	☐ No
Veterinary medicine	☐ Yes	☐ No
Environmental protection	☐ Yes	☐ No
Local authorities	☐ Yes	☐ No

Environmental police ☐ Yes ☐ No

Others ☐ Yes ☐ No

Please specify if there is any other agencies: .....

4.2. If yes, what issues are inspected and checked? .....

PART 2: MEASURES TO PROTECT WILD ANIMALS FROM DISEASES

5. What measures have you taken in wildlife breeding to reduce the risk of zoonoses?

Disinfecting breeding areas periodically	☐ Yes ☐ No	Vaccinating	☐ Yes ☐ No
Isolating and monitoring newly bought animals	☐ Yes ☐ No	Asking veterinary companies to give treatment	☐ Yes ☐ No
Keeping breeding areas from human accommodation	☐ Yes ☐ No	Destroying wild animals which die from diseases	☐ Yes ☐ No
Using personal protective equipment	☐ Yes ☐ No	Disinfecting prior to access breeding areas (E.g. lime powder)	☐ Yes ☐ No
Others	☐ Yes ☐ No		

Please specify other measures if any:

.....

6. Have animal breeders/animal caretakers contracted any diseases during wildlife breeding?

☐ Yes ☐ No

- If yes, please specify the diseases:.....

7. Have wild animals contracted any diseases during wildlife breeding?

☐ Yes ☐ No

7.1 If yes, please specify the diseases:.....

7.2 If you, did you notify any State management agencies? .....

Why/Why not?.....

8. In your locality, what units/individuals are involved in the prevention and treatment of diseases for wild animals at your farm?.....

9. Have you heard of legal regulations on the management of wildlife breeding, animal slaughter and transportation?

☐ Yes ☐ No

If yes, please name specific regulations:.....

.....

10. What do you do in case wild animals contract diseases

- Asking veterinarians for examination and treatment:

☐ Yes ☐ No

- Notifying local authorities/veterinary staff:

☐ Yes ☐ No

- Doing nothing: ☐ Yes ☐ No

- Other measures (Specify if any): .....

.....

11. What do you do when wild animals are dead from unknown causes?

- Notifying Forest Protection Department: ☐ Yes ☐ No

- Asking veterinarians for treatment: ☐ Yes ☐ No

- Notifying local authorities/ veterinary staff: ☐ Yes ☐ No

- Selling dead animals: ☐ Yes ☐ No

- Destroying dead animals: ☐ Yes ☐ No

- Consuming dead animals for food: ☐ Yes ☐ No

- Doing nothing: ☐ Yes ☐ No

- Other measures (Specify if any): .....

12. In case you notify local authorities of sick, dead wild animals, local authorities/ veterinary agencies shall:

- Being present promptly for checking: ☐ Yes ☐ No

- Giving instructions of treatment and handling wild animals with diseases:

☐ Yes ☐ No

- Giving instructions on how to handle sick, dead wild animals:

☐ Yes ☐ No

- Giving instructions on how to handle animal cages/breeding areas:

☐ Yes ☐ No

- Checking and giving instructions: ☐ Yes ☐ No

- Please specify if any other measures are taken: .....

13. Do you handle animal cages when wild animals are sick, dead?

☐ Yes ☐ No

- If yes, please specify measures to be taken:

+ Detoxifying, disinfecting cages/breeding farms: ☐ Yes ☐ No

+ Cleaning cages /breeding areas: ☐ Yes ☐ No

+ Leaving cages unused for a certain period of time before reusing them:

☐ Yes ☐ No

+ Please specify if any other measures are taken: .....

- If yes, please state reasons?

+ Protecting captive wild animals from diseases: ☐ Yes ☐ No

+ Complying with requests or instructions of veterinary agencies:

☐ Yes ☐ No

+ Following the instructions from books, newspapers, documents,...:

☐ Yes ☐ No

+ Other reasons (if any): .....

14. Do you often have animal cages, breeding farms cleaned?

☐ Yes ☐ No

- If yes, how often? .....

- What are your ways of cleaning?.....

15. What do you do to handle dungs, waste and wastewater of wild animals?

- Discharging directly into the environment: ☐ Yes ☐ No

- Collecting for treatment: ☐ Yes ☐ No

- Please specify if any other measures are taken: .....

16. After each breeding period, do you handle animal cages before starting a new one? ☐ Yes ☐ No

- If yes, please specify measures to be taken:

+ Detoxifying, disinfecting cages/breeding areas: ☐ Yes ☐ No

+ Cleaning cages/breeding areas: ☐ Yes ☐ No

+ Leaving animal cages unused for a certain period of time before reusing them:

☐ Yes ☐ No

+ Please specify if any other measures are taken: .....

- If yes, please specify reasons?

+ Protecting captive wild animals from diseases: ☐ Yes ☐ No

+ Complying with the requests or instructions of veterinary agencies:

☐ Yes ☐ No

+ Following the instructions from books, newspapers, documents,...:

☐ Yes ☐ No

+ Other reasons (if any): .....

17. Do you ask sellers to quarantine wild animals when you buy and take them to your farms? ☐ Yes ☐ No

- If yes, please specify reasons: .....

- If not, please specify reasons: .....

18. Do you quarantine wild animals when selling them to farms?

☐ Yes ☐ No

- If yes, please specify reasons: .....

- If not, please specify reasons: .....

19. Do you vaccinate wild animals? ☐ Yes ☐ No

- If yes, please specify reasons: .....

- If not, please specify reasons:.....

20. According to you, what further actions should the State and you yourselves do to prevent the risk of zoonoses? Why?

.....

.....

PART 3: ATTITUDES TOWARDS THE RISK OF ZOONOSES

21. What is your assessment of the risk of zoonoses from breeding activities (E.g. at your farms)? (1 = Very low; 2 = Low; 3 = Unknown; 4 = High; 5 = Very high)

Reasons:.....

22. Do you think that wildlife breeding and taking care of wild animals pose the risk of zoonoses? ☐ Yes ☐ No

If yes, please specify reasons: .....

.....

If yes, what job, phase poses the highest risk of zoonoses, according to you?

.....

23. Have you been given any training courses/informed about the risk of zoonoses and measures to reduce the risk of zoonoses?

☐ Yes ☐ No

If yes, who gave you training courses/informed you of relevant information?

- Veterinary agencies: ☐ Yes ☐ No
- Forest Protection Department: ☐ Yes ☐ No
- Local authorities: ☐ Yes ☐ No
- Through TV, books, newspaper: ☐ Yes ☐ No
- Learning from schools: ☐ Yes ☐ No

24. Where are your animal cages/breeding areas located?

- In the living areas of your family: ☐
- Far from the living areas of your family (completely separate from animal cages) ☐

25. Do you allow domestic animals (dogs, cats, and poultry, etc.) to freely access wildlife breeding areas? ☐ Yes ☐ No

- If not, please specify reasons:

+ Preventing cross-infection between wild animals and domestic ones:

☐ Yes ☐ No

+ Complying with the requests or instructions of Veterinary agencies:

☐ Yes ☐ No

+ Following the instructions from books, newspapers, documents, ...:

☐ Yes ☐ No

+ Other reasons (if any): .....

26. Do you place any antiseptic pits at the entrance to wildlife breeding areas?

☐ Yes ☐ No

If yes, please specify reasons:

+ Protecting wild animals and humans from diseases: ☐ Yes ☐ No

+ Complying with the requests or instructions of veterinary agencies:

☐ Yes ☐ No

+ Following the instructions of books, newspapers, documents, ...:

☐ Yes ☐ No

+ Other reasons (if any): .....

If not, please specify reasons: .....

.....

27. Do you allow unauthorized persons (strangers, those who are not employees, caretakers, etc.) to freely access wildlife breeding areas?

☐ Yes ☐ No

Reasons:.....

28. Do you use protective equipment when feeding animals or cleaning cages?

☐ Yes ☐ No

If yes, what protective equipment do you use?

Wearing masks: ☐ Yes ☐ No

Wearing gloves: ☐ Yes ☐ No

Wearing boots: ☐ Yes ☐ No

Wearing protective clothing: ☐ Yes ☐ No

Other protective equipment (if any) ☐ Yes ☐ No

Reasons:.....

29. Do you consume foods/drinks or smoke while feeding wild animals/cleaning cages or breeding areas? ☐ Yes ☐ No

Reasons:.....

30. Do you handle protective equipment, clothing after cleaning cages or breeding areas? ☐ Yes ☐ No

- What are the reasons for handling protective equipment, clothing? .....
.....

31. Do you handle cleaning tools after cleaning cages or breeding areas?
☐ Yes ☐ No

What are your reasons for handling cleaning tools:.....

.....

32. What do you do in case you are attacked by wild animals (such as being bitten, scratched ...)?

- Cleaning and sterilizing the wound: ☐ Yes ☐ No

- Having the wound examined and treated according to the instructions of medical staff: ☐ Yes ☐ No

- Monitoring if there are any unusual signs of health in a certain period of time:
☐ Yes ☐ No

- Doing nothing: ☐ Yes ☐ No

33. Do you have periodic health examinations in order to detect zoonoses?
☐ Yes ☐ No

Reasons:.....

34. Have you heard of the transmission of diseases from animal species you are breeding in other farms, both now and before?

☐ Yes ☐ No

If yes, please provide further information:.....

.....

PART 4: ATTITUDES TOWARDS IMPLEMENTING ZOONOTIC DISEASE PREVENTION MEASURES

35. Implementing measures such as disinfecting farming areas, disinfecting prior to access farming areas (E.g. lime powder), isolating newly bought animals can help reduce the risk of zoonoses. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

36. Using personal protective measures such as wearing masks, gloves when contacting with wild animals can help reduce the risk of zoonoses. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

37. Vaccinating animals can help reduce the risk of zoonoses. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

38. Building and keeping breeding areas from human accommodation can help reduce the risk of zoonoses. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

39. According to you, what other measures (if necessary) can help reduce the risk of zoonoses. Why?

Reasons: .....

.....

PART 5: OPINIONS ON IMPLEMENTING ZOONOTIC DISEASE PREVENTION MEASURES

40. Do you know any zoonotic disease prevention measures implemented by other wildlife farms (breeding similar species)? Why? .....
.....

41. If yes, do you want to learn from them? Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

42. In your opinion, do your family members, relatives, neighbours support you in implementing zoonotic disease prevention measures?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

If yes, do you listen to them? Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

43. In your opinion, do the local authorities encourage and support measures zoonoses?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

44. Do you listen to local authorities? Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

PART 6: CAPABILITIES (RESOURCES) TO IMPLEMENT ZOONOTIC DISEASE PREVENTION MEASURES

45. If I want, I can completely implement zoonotic disease prevention measures such as disinfecting cages and farms, isolating newly bought animals, using personal protective equipment. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

46. If I want, I can completely keep breeding areas far from human accommodation. Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

47. If I want, I can completely vaccinate wild animals for the prevention of diseases (zoonoses). Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

48. According to you, should the State introduce compulsory zoonotic disease prevention measures in the coming time? Why?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

49. If compulsory measures are required by the State, do you think you can completely comply with or want to comply with them? Why (E.g. more finance, time, effort)?

Strongly disagree	1	2	3	4	5	Strongly agree

Reasons: .....

.....

THANK YOU FOR YOUR HELP AND COCOPERATION!

Appendix 2

LIST OF INTERVIEWED FARM OWNERS

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
LAM DONG	1	Phan Dac Vinh Khue	Animal owner	Phu An Weasel Coffee, Elephant Coffee Garden	268 Dinh An Hamlet, Hiep An Commune, Duc Trong District, Lam Dong	Paradoxurus hermaphroditus / Common palm civets, ferrets, elephants, tigers, Nomascus siki, Ostrich, Pterorhinus chinensis	200 weasels, 8 elephants, 2 tigers
	2	Dang Thanh Phuc	Animal care worker	Tinh An Tourist Company Ltd	Sub-quarter 160B, Ta Nung Commune, Da Lat	Weasels (Paradoxurus hermaphroditus)	54 individuals
	3	Ly Ngoc Vu	Animal owner	Ly Ngoc Vu breeding farm	Tan Duc Hamlet, Tan Van Commune, Lam Ha District, Lam Dong	Paradoxurus hermaphroditus, Common palm civets	24 individuals
	4	Nguyen Doan Anh Quoc	Animal care worker	Me Linh coffee garden)	Sub-quarter 20, Hamlet 4, Ta Nung Commune, Da Lat	Paradoxurus hermaphroditus, Common palm civets	30 individuals
	5	Nguyen Thi Quy		Dinh Quoc Huy bamboo rat breeding farm	Tan Van, Lam Ha, Lam Dong	Bamboo rats	25 individuals
	6	Pham Ngoc Quang	Animal owner		Lam Ha, Lam Dong	Civets	15 individuals
	7	Phan Thi My Thanh	Farm manager	Trai Ham weasel coffee	135E, Hoang Hoa Tham, Dist. 10, Da Lat	Paradoxurus hermaphroditus, Common palm civets	25 individuals
	8	Tran Hoa	Animal owner	Tran Hoa farm	Lien Trung Hamlet, Tan Hoa Commune, Lam Ha District	Bamboo rats	15 individuals

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
TAY NINH	9	Nguyen Thanh Dat	Animal owner	Nguyen Thanh Dat	Thanh Trung Hamlet, Thanh Lam Commune, Chau Thanh District, Tay Ninh	Long-tailed Macque, Paradoxurus hermaphroditus	01 individuals
	10	Nguyen Van Sanh	Civet owner	Nguyen Van Sanh	Ninh Son Ward, Tay Ninh City, Tay Ninh	Paradoxurus hermaphroditus, Heosemys grandis, Heosemys annandalii, Indotestudo elongata (yellow-headed tortoise), Cuora amboinensis kamaroma, tortose, Cyclemys oldhamil	20 individuals
	11	Dao Thanh Phi Hieu	Animal owner	Dao Thanh Phi Hieu	Lane 28, House 12, Boi Loi Rd, Linh Trung, Linh Son, Tay Ninh City, Tay Ninh	Bamboo rats	80 individuals
TAY NINH	12	Nguyen Tat Thanh	Animal owner	Nguyen Tan Thanh	56/7A, Truong An Hamlet, Truong Tay Commune, Hoa Thanh Town, Tay Ninh	Rhizomys pruinosus, Rhizomys sumatrensis	110 individuals
	13	Nguyen Thanh Phong	Animal owner	Nguyen Thanh Phong	Nam Trai Hamlet, Truong Đong Commune, Hoa Thanh Town, Tay Ninh	Paradoxurus hermaphroditus	4 individuals
	14	Nguyen Van Phi	Animal owner	Nguyen Van Phi	Truong Tay Hamlet, Truong Tay Town, Tan Bien District, Tay Ninh	Hedgehogs, Amyda cartilaginea	9 hedgehogs, 100 Amyda cartilaginea
	15	Nguyen Xuan Quang	Deputy director of Vina Mekong	Vina Mekong Company	Thanh Hiep Hamlet, Than Bac Commune, Tan Bien District, Tay Ninh	Long-tailed Macaque, Macaca nemestrina	5300 individuals

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
	16	Tran Khac Sinh	Animal owner	Tran Khac Sinh	Suoi Rop Hamlet, Thai Binh Commune, Chau Thanh District, Tay Ninh	Bamboo rats, weasels	19 weasels Bamboo rats >40
	17	Vo Huy Cuong	Animal owner	Vo Hung Cuong breeding farm	Loc Thanh Street, Loc Hung Ward, Trang Bang Town, Tay Ninh	Long-tailed Macaque,	1200 individuals
BINH PHUOC	18	Đo Thl Thanh Huong	Animal owner	Binh Phuoc Poultry and Waterfowl breed	An Hoa Hamlet, Tan Tien Commune, Dong Phu District, Binh Phuoc	Phasianus colchicus torquatus, Pavo muticus imperator, Pavo cristatus	1500 individuals
	19	Hoang Minh Tam	Animal owner	Hoang Minh Tam breeding farm	Sub-quarter 3, Dong Chat Hamlet, Tan Hoa Commune, Dong Phu District, Binh Phuoc	Hedghogs	200 individuals

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
BINH PHUOC	20	Nguyen Thi Tai	Animal owner	Nguyen Thi Tai breeding farm	Sub-quarter 3, Tien Thanh Ward, Dong Xoai City, Binh Phuoc	Paradoxurus hermaphroditus, Sika deers, Phasianus colchicus	Sika deers: 2 Paradoxurus hermaphroditus: 3 Phasianus colchicus: 4
	21	Pham Duy Tuong	Animal owner	Pham Duy Tuong breeding farm	Minh Tan Hamlet, Tan Tien Commune, Dong Phu District, Binh Phuoc	Phasianus colchicus	5 individuals
LONG AN	22	Ho Thi Yen Tam & Đang Kim Hieu	Animal owner	Ho Thi Yen Tam	Dong Hoa Hamlet, Thuy Dong Commune, Thanh Hoa District, Long An	Teal, Purple Swamphen	Teal: (1150), Purple Swamphen (300)

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
LONG AN	23	Le Hoang Hung	Animal owner	Le Hoang Hung	Hamlet 4, Long Hau Commune, Can Guoc District, Long An.	Paradoxurus hermaphroditus	147 individuals
	24	Le Van Bi	Animal owner	Le Van Bi	Hamlet 1, Hau Thanh Tay Commune, Tan Thanh District, Long An	Teal, Purple Swamphen	Teal 70, Purple Swamphen 300
	25	Nguyen Chi Hai	Animal owner	Nguyen Chi Hai	Binh Lang Commune, Tan Tru District, Long An	Hoary bamboo rats	55 individuals
	26	Nguyen Chi Linh	Animal owner	Nguyen Chi Linh	Hiep Thanh Hamlet, Tan Binh Commune, Tan Thanh District, Long An	Paradoxurus hermaphroditus	50 individuals
LONG AN	27	Nguyen Van Cua	Animal owner	Nguyen Van Cua	Phuoc Thoi Hamlet, Phuoc Loi Commune, Can Guoc District, Long An	Paradoxurus hermaphroditus	65 individuals
SOC TRANG	28	Nguyen Van Doi	Animal owner	Nguyen Van Doi	343 Hamlet 4, Que My Thanh Commune, Tan Tru District, Long An	Macaw parrots, pheasants	Macaw parrots: 21 individuals, The Lady Amherst's pheasants: 400 individuals
	29	Luong Duc Thien	Animal owner	Luong Duc Thien	112/sub-quarter 30/4, Quarter 6, Ward 6, Soc Trang City	Paradoxurus hermaphroditus	8 individuals
	30	Duong Quang Truong	Animal owner	Duong Quang Truong	Hamlet 19/5, Ke An commune, Ke Sach District, Soc Trang	Hedgehogs	23 individuals

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
SOC TRANG	31	Lam Khanh Huy	Animal owner	Lam Khanh Huy	Truong Binh Hamlet, Truong Khanh Commune, Long Phu District, Soc Trang	Paradoxurus hermaphroditus	40 individuals
	32	Le Minh Tuan	Animal owner	Le Minh Tuan	Dac Luc Hamlet, Ho Dac Kien Commune, Chau Thanh, Soc Trang	Paradoxurus hermaphroditus	20 individuals
	33	Le Van Cua	Animal owner	Le Van Cua	Cong Doi Hamlet, Ho Dac Kien Commune, Chau Thanh, Soc Trang	Paradoxurus hermaphroditus	13 individuals
	34	Truong Hieu Liem & Truong Quoc Bao	Animal owner	Truong Hieu Liem	Phu Thanh B Hamlet, Phu Tam Commune, Chau Thanh District, Soc Trang City.	Rhizomys sumatrensis	28 parents và 35 young

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
SOC TRANG	35	Le Van Đat	Animal owner	Le Van Đat	Kenh Dao Hamlet, Ho Đac Thien Commune, Chau Thanh District, Soc Trang City.	boars	70 individuals
	36	Luong Duc Thien & Tran Thi Mo	Animal owner	Luong Đuc Thien	112/sub-quarter 30/4, Quarter 6 Ward 6, Soc Trang city.	Paradoxurus hermaphroditus	8 individuals
	37	Nguyen Minh Tan	Animal owner	Nguyen Minh Tan	413 Tra Quyet Hamlet, Chau Thanh Town, Chau Thanh District, Soc Trang City	Rhizomys sumatrensis	23 individuals
	38	Do Thi Men & Thai Anh Hung	Animal owner	Do Thi Men	67 sub-quarter Truong Tho, Quarter 6, Ward 6, Soc Trang City	Rhizomys sumatrensis	8 individuals

Province	Order	Full name	Position	Farm	Address	Species	Number of individuals
	39	Truong Minh Hoa	Animal owner	Truong Minh Hoa	Đac Thang Hamlet, Ho Dac Kien Commune, Chau Thanh, Soc Trang	Rhizomys sumatrensis	21 individuals
HAU GIANG	40	Truong Van Lam	Animal owner	Truong Van Lam	My Quoi Hamlet, Cay Duong Town, Phung Hiep, Hau Giang	Rhizomys sumatrensis	9 individuals
	41	Nguyen Van Thuy	Animal owner	Nguyen Van Thuy	My Hoa Hamlet, Cay Duong Town, Phung Hiep, Hau Giang	Sus scrofa x Sus scrofa domesticus	60 individuals

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