



Response to Potential Challenges of Re-emerging Rabies in Taiwan

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- Current situation
- Control measures
- Conclusions
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Background

- 1959: last human case
- 1961: last canine case
- Taiwan had been recognized as one of the rabies free countries since 1961
- Rabies surveillance
 - dogs: since 1999
 - bats: since 2008
- No rabies was found until July 2013



Background (cont.)

- **Wildlife disease surveillance programs-**
 - Many diseases emerged from wild animals, the OIE encourages Member Countries to conduct wildlife disease surveillance.
 - Since 2012, BAPHIQ of the Council Of Agriculture has supported 2 veterinary colleges to conduct disease surveillance in wildlife.



Common Wild Carnivores in Taiwan

Ferret badger (*Melogale moschate subaurantiaca*)



Formosan gem-faced civet (*Paguma larvata*)



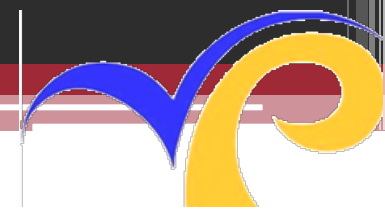
Golden Weasel
(*Mustela sibirica taivana*)



Crab-eating mongoose
(*Herpestes urva*)



Small Chinese civet
(*Viverricula indica pallida*)



Background (cont.)- Rabies in ferret badgers

NTU received a case from Nantou County. Meningoencephalo myelitis was diagnosed; canine distemper (CD) & pseudorabies was suspected but tested negative.

RT-PCR for rabies virus shown positive result.

Brain samples were sent to Animal Health Research Institute (AHRI) for confirmation of rabies. FAT, IHC, RT-PCR were conducted, rabies specific Ag and RNA were found.

Jan., 2013

Jun.

Jun. 24

Jun. 26

Jul. 16

Case found

Re-test

RT-PCR

Case reported

Re-test

Case confirmation

Previous two cases found in May & Nov. of 2012, were also negative for CD & pseudorabies.

NTU reported to BAPHIQ.

Rabies was confirmed in all 3 cases of ferret badgers and the relevant report was sent to the OIE on July 17, 2013.

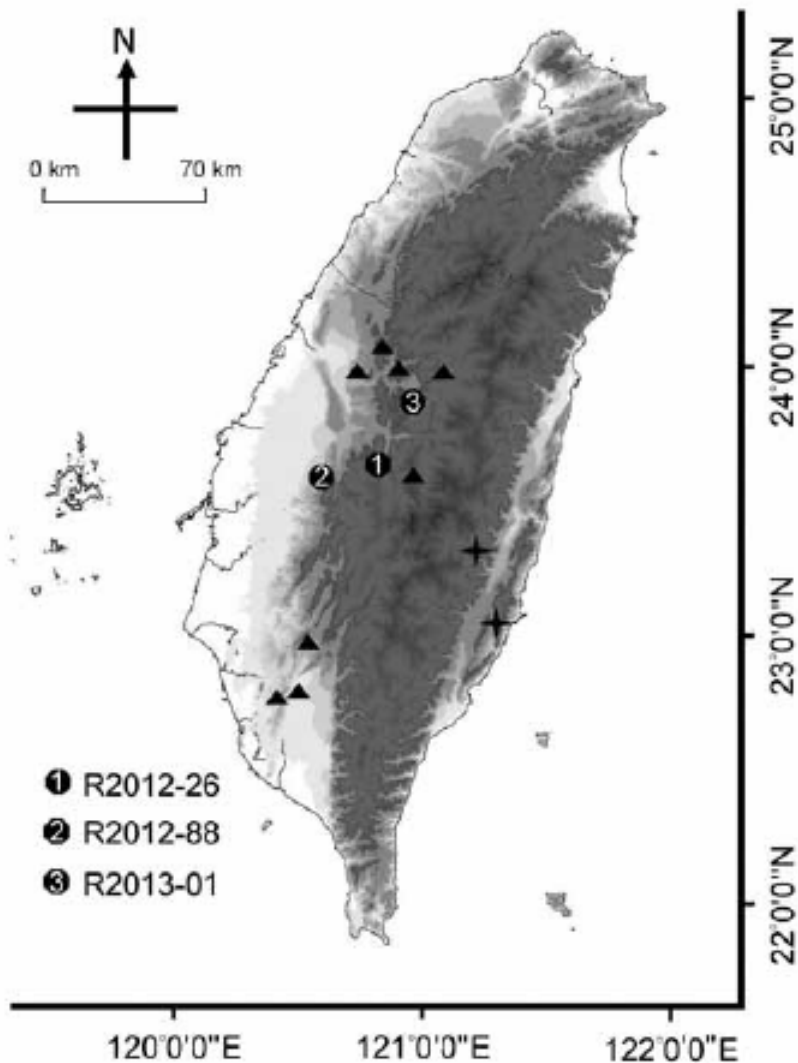


Figure 1. Collection sites of rabies-positive Taiwan ferret badgers (TWFB), Taiwan. Solid circles marked with 1–3 represent the collection sites of the first 3 rabies-positive animals. Triangles represent the collection sites of other rabies virus (RABV) sequences included in this study. Crosses represent the most diverged lineages of rabies virus from Taiwan ferret badgers (TWFB, TW1614, and TW1955), shown in Figure 5, panel B, Appendix (wwwnc.cdc.gov/EID/article/20/5/13-1389-F5.htm), and the easternmost cross represents the isolate from a shrew, TW1955.

Source: Chiou et. al., May 2014
Emerging Infectious Diseases
20(5): 790-798



Cumulative test results

Updated: Jun. 5, 2014

Animals	No. of tests 1999-2012	No. of rabies	No. of tests 2013	No. of rabies	No. of tests 2014	No. of Rabies
Dogs	6,841	0	1,553	1 ^a	389	0
Cats	5	0	112	0	7	0
Bats	322	0	64	0	18	0
Carnivores	--	--	1,019	276 ^b	179	99 ^b
Other wildlife	--	--	341	1 ^c	13	0
Total	7,168	0	3,089	278	606	99

a : A 1.5-month-old puppy was bitten by a rabid ferret-badger and rabies was confirmed after 24 days under quarantine.




b: The ferret badger is the only wild carnivores being infected by rabies virus.

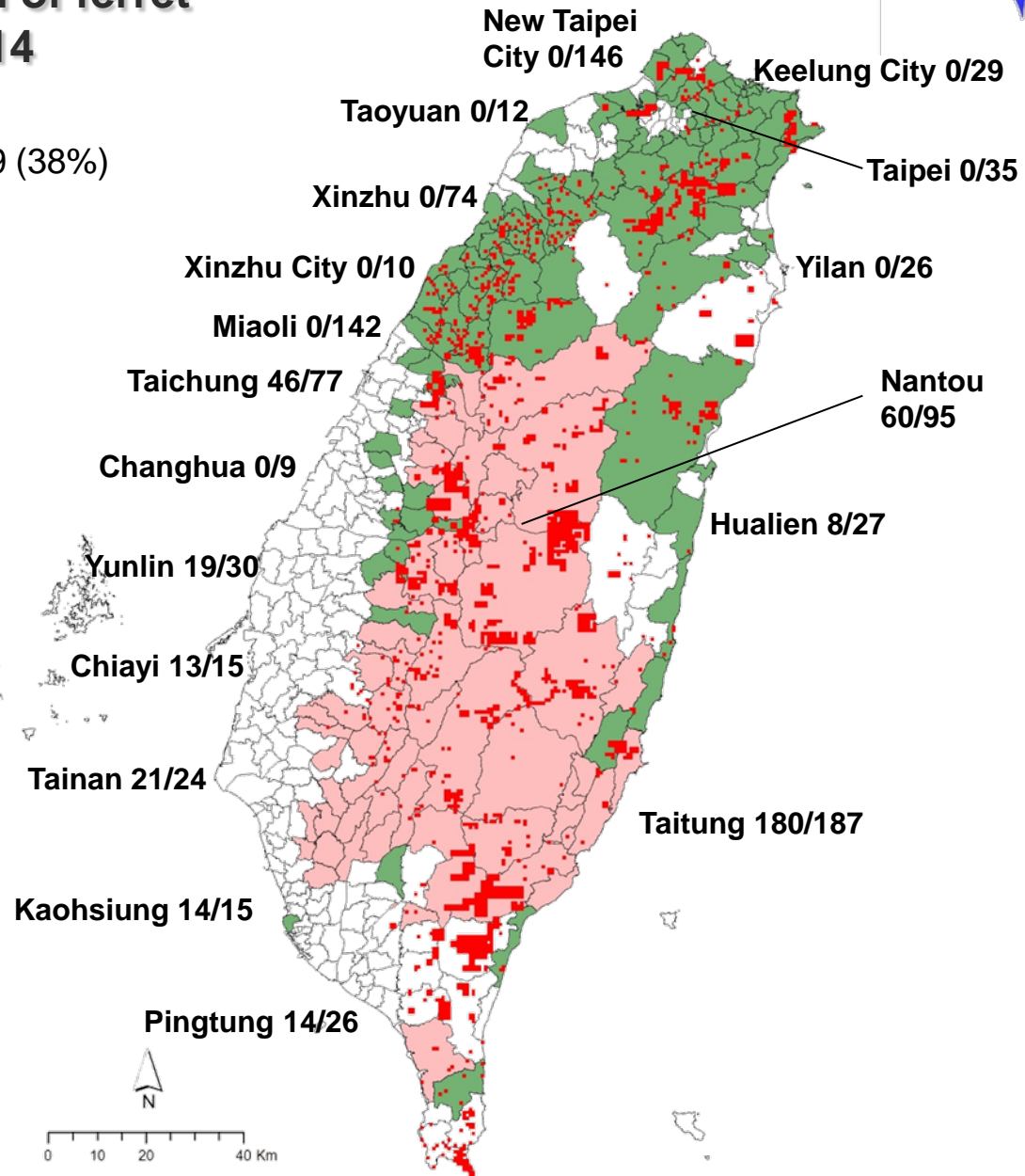
c : A house shrew was confirmed to be rabies positive and was considered to be infected through the bite of a rabid ferret badger.

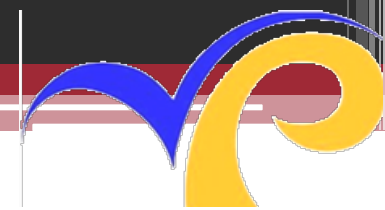


Geographical distribution of ferret badger rabies in 2013-2014

rabies cases / total tests - 375/979 (38%)
(Up to Jun. 5, 2014)

-  Known distribution of ferret badgers
-  Townships with confirmed rabies in ferret badgers
-  Townships with no rabies was found in ferret badgers






The only canine rabies case

- A 1.5-month-old puppy was bitten by a rabid ferret-badger and had developed rabies symptoms after 24 days under quarantine.
- The dog was euthanized and rabies was diagnosed by FAT.



Test results of wild Carnivores in 2013-2014

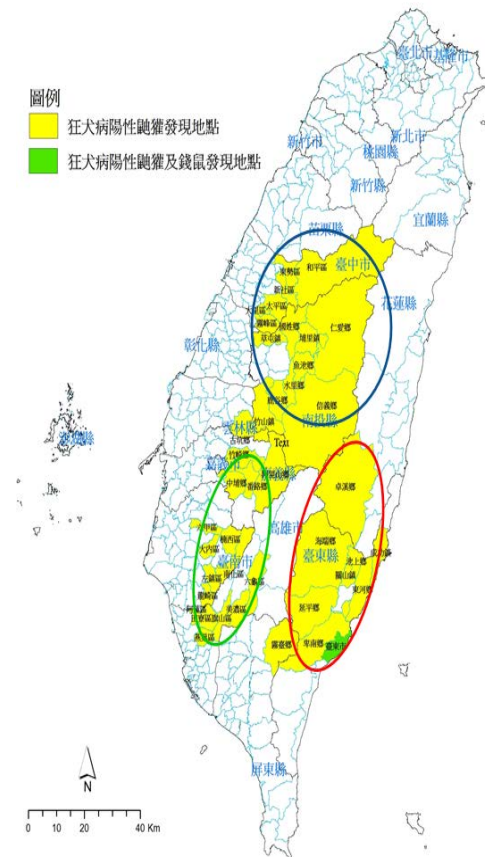
Species	No. of testing	No. of rabies
Ferret badger 	979	375
Formosan gem-faced civet	190	0
Crab-eating mongoose	19	0
Golden weasel	4	0
Small Chinese civet	3	0

Updated: Jun 5, 2014



Phylogenetic analysis

- Comparison of 3 groups of rabies virus
 - Divided by geographical location (by County)
 - Nantou & Taichung
 - Yunlin, Tainan & Kaoshiung
 - Taitung
 - The identity of nucleic acid sequence
 - G-protein: 91.1~98.9%
 - N-protein: 91.7~98.5%
 - All belongs to Lyssavirus genotype I



Phylogenetic analysis of RABV from Taiwan ferret badgers

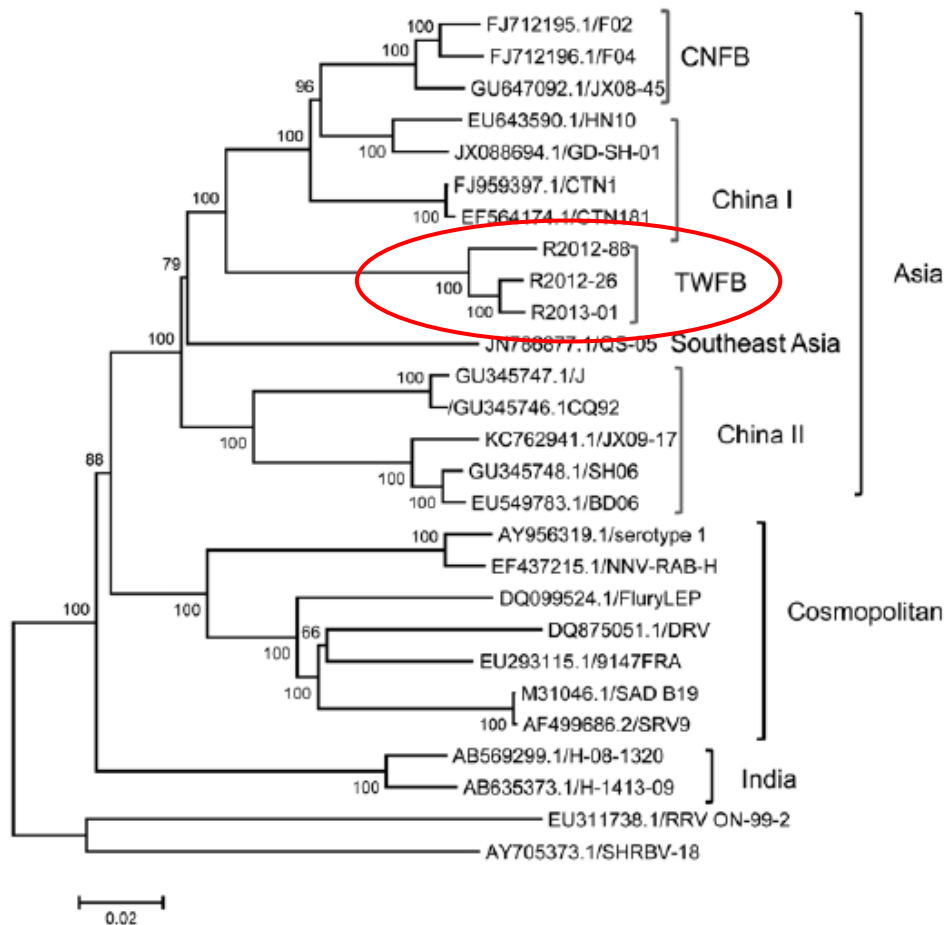
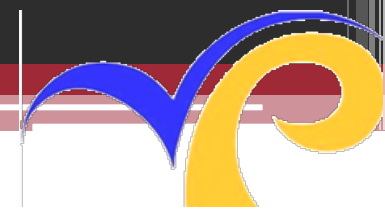


Figure 2. Phylogenetic relationships of 27 rabies virus (RABV) genomes constructed by maximum-likelihood method. Numbers close to the nodes were from 1,000 bootstrap replications. The tree was rooted with RABV from bats and raccoons. Three major groups, Asia, Cosmopolitan, and India, are strongly supported, as indicated (17). There are 4 major lineages within the group from Asia, including previously recognized China I, China II (16), Southeast Asia, and RABV from Taiwan ferret badgers (TWFB). RABVs derived from Chinese ferret badgers (CNFB) are clustered with China I, indicating that RABVs of TWFB and CNFB are of independent origin. Scale bar indicates nucleotide substitutions per site.

Source: Chiou et. al., May 2014
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Genetic diversity & phylogeographical origin of RABV-TWFB

- Both N & G gene trees support that the RABV-TWFB is a distinct lineage within the Asia group of rabies viruses.
- It is estimated that the RABV-TWFB was separated from China I and the Philippines isolates **158 years** (ranging 110-225 years).
- The RABV-TWFB could be cryptically circulating within Taiwan's ferret badger population over 100 years.

Source: Chiou et. al., May 2014, Emerging Infectious Diseases 20(5): 790-798

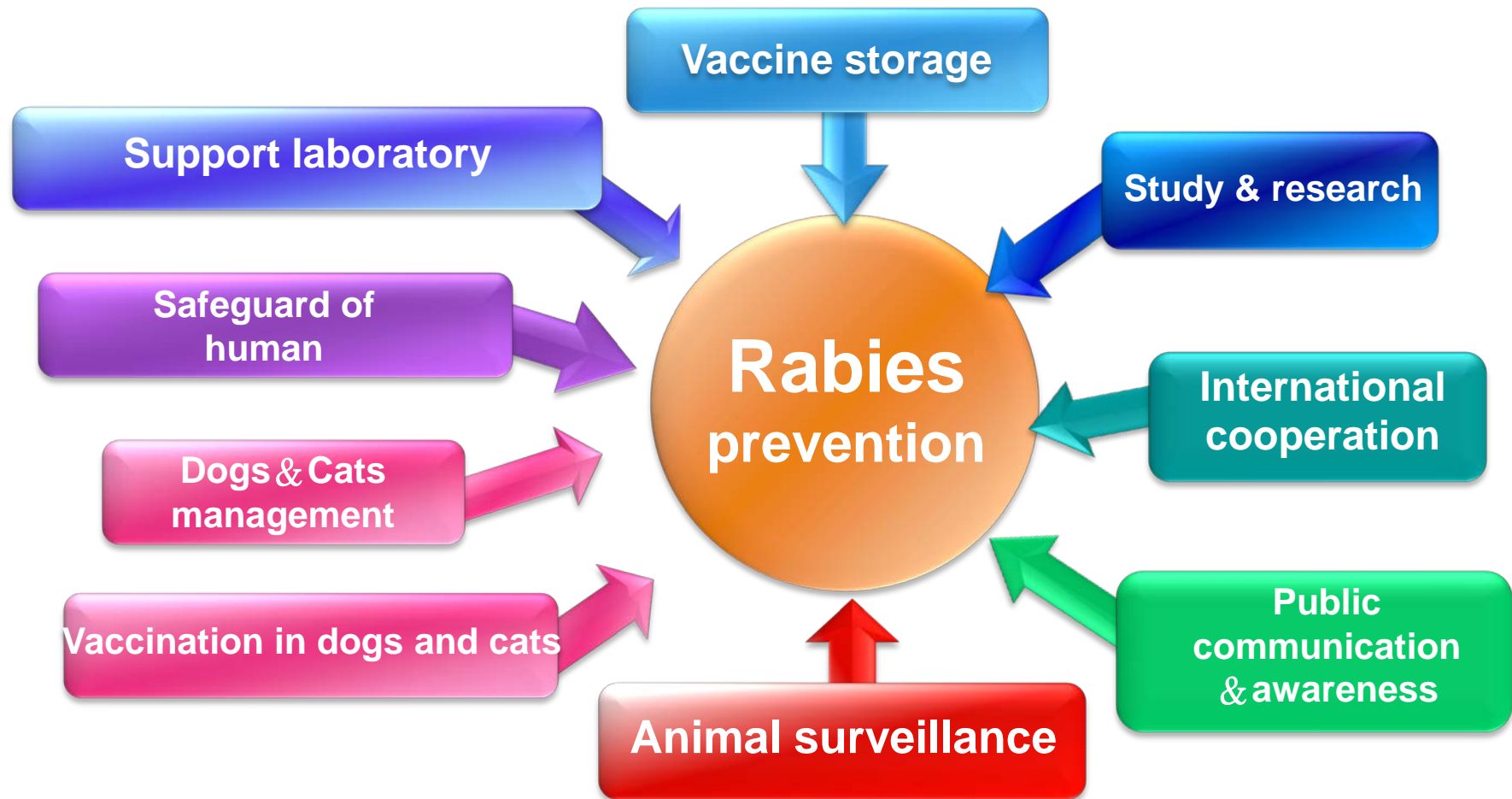


Control Measures

- Import of vaccines: 2 million doses of rabies vaccine had been imported within 2 months after the confirmation of rabies diagnosis.
- Improve rabies vaccination coverage: the vaccination coverage of dogs and cats is estimated over 90% in high-risk areas and about 68% nationwide.
- Safeguard of human: pre-exposure vaccination for 3,500 frontline staffs (vets, wild life workers, ...)

Control Measures (continued)

Goal: no rabies cases in dogs and cats



Continued Animal Surveillance

- Set up animal rabies notification hotline.
- Monitor wild animals downers or those with abnormal behavior.
- Continue the rabies surveillance on dogs, cats, bats, and those animals had a history of bitten human.

Vaccination in dogs and cats

- Vaccination coverage in dogs and cats
 - High risk areas (rabies-positive mountainous areas): 90% of the population
 - Other areas: 70% of the population
- Starting from 2014, the owner whose dogs and cats have no rabies vaccination shall be fined (US\$ 350-1,700).

廣告



愛牠

請每年帶牠注射
狂犬病疫苗

行政院農畜委員會
動物防疫檢疫局

Dogs & Cats Management

- Encourage owners to sterilize & to register their dogs & cats.
- Assist animal protection NGOs to establish shelters for stray dogs.
- Work with veterinary practitioners to improve rabies vaccination coverage in dogs & cats.

Safeguard of Humans

- Continue to practice the pre-exposure vaccination on veterinarians & high risk personnel.

Support Laboratory

- Support 2 veterinary colleges to set up rabies diagnostic laboratories.
- The Animal Health Research Institute is responsible for confirmation of rabies diagnosis.

Vaccine Storage

- Stockpile rabies vaccine: 250,000 doses for emergency response.
- These vaccines will be given to dogs & cats in high risk areas & animal shelters free of charge.

Study and Research

- Feasibility study on oral rabies vaccines for ferret badgers
- Epidemiological studies on ferret badger rabies
- Pathogenicity of RABV-TWFB



International Cooperation

- Invite international experts to provide prevention strategies and oral vaccination for wildlife.

Public Communication and Awareness

- Generally propagating “Two Nots and One Do”
 - Do Not abandon pets
 - Do Not catch or contact with wild animals
 - Do vaccinate your dogs & cats
- Media (including TV, website, radio, and print media etc.)
- Community activities
- School education
- Training for vets & physicians

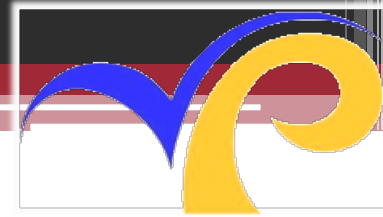


Conclusions

- **The rabies virus could be cryptically circulating in ferret badgers in Taiwan for a long time.**
- **The rabies epidemic is under control and the disease is restricted only in ferret badgers.**

Recommendation

- **Rabies in ferret badgers is a critical issue and may be unknown in other parts of the region. Countries with a population of ferret badgers should take this seriously and start to monitor rabies in wildlife.**



Thank you for your attention.

