Epidemiological situation of rabies in South Korea

Dong-Kun Yang/ OIE expert for rabies & JE

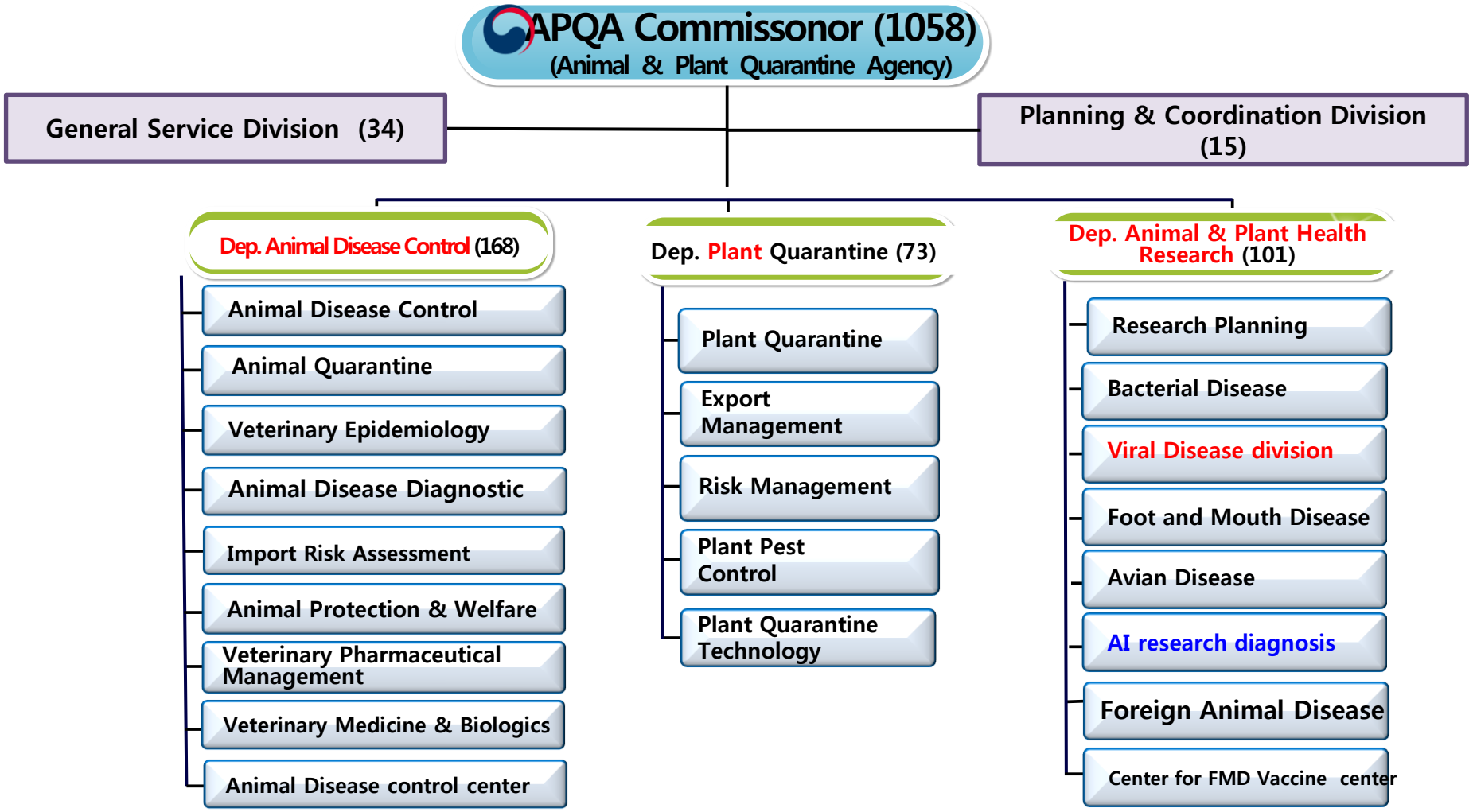
2018.10.17

2018 Launching Meeting of OIE Twinning project for rabies between Ances-Nancy and AHRI

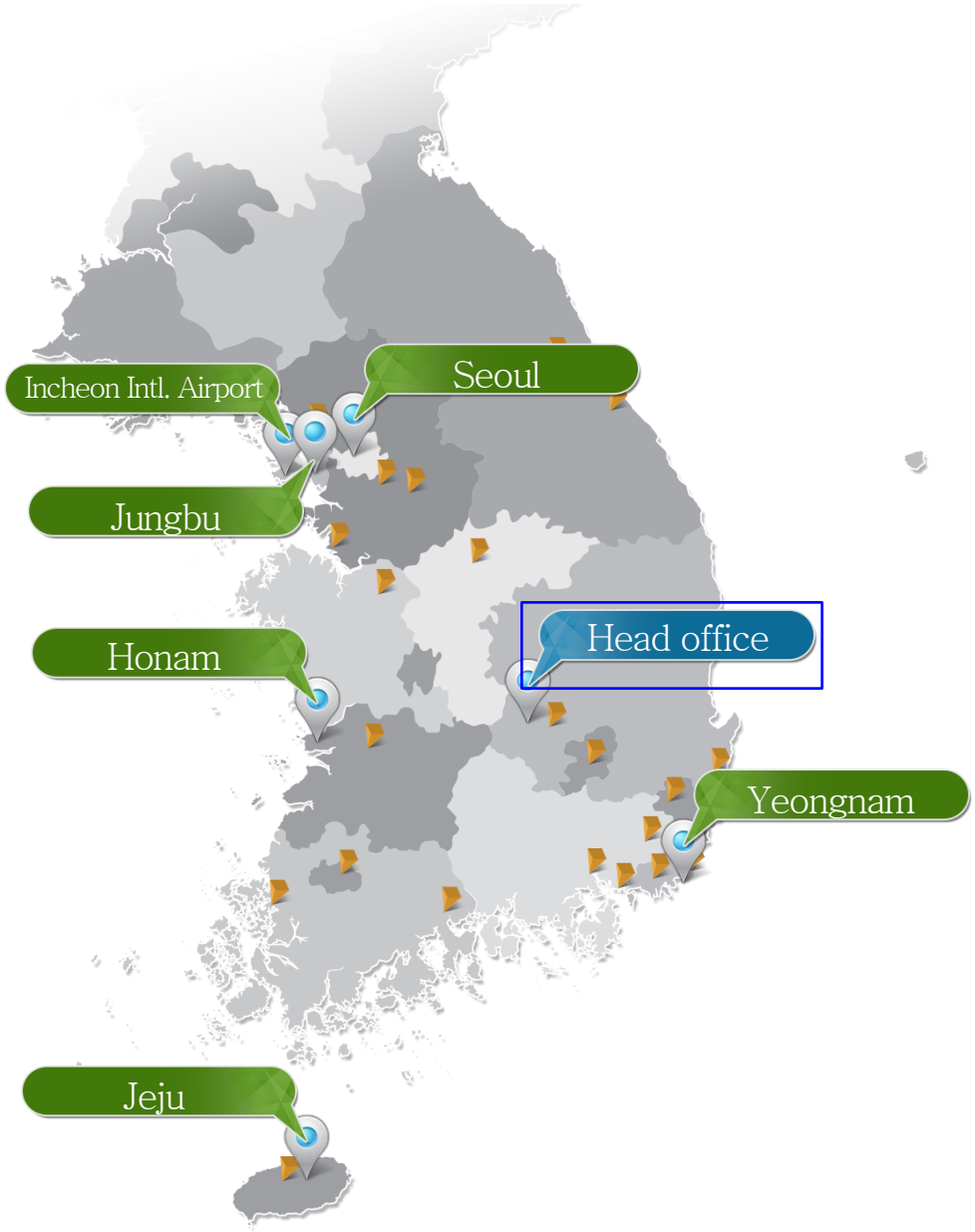
Animal & Plant Quarantine Agency located in Gimcheon city

APQA moved from Anyang city to Gimcheion city in 2016.

Organization Chart of APQA



Location of six regional Office



Six major missions of APQA

- Import/export quarantine and inspection of animal, livestock products , plant, and plant products
- Control and prevention of animal diseases such as FMD, AI
- Surveillance, control and import risk analysis of exotic plant pests
- Animal protection and welfare
- Quality control and safety management of veterinary biologicals
- Research and development of veterinary science and plant quarantine technology.

Seven Reference Laboratory, APQA

Designation of OIE Reference Laboratory

Brucellosis (2009)
- OIE twining program with Fiji.
- Negligible risk in Korea (0.02%, '16)

Newcastle Disease (2010)
- Preparing disease-free country in 2017 (no cases since June 2010)

Chronic Wasting Disease (2012)
- Strengthened Diagnosis training program in Asia

Rabies (2012)
- 2020 Rabies
- eradication program

Japanese Encephalitis (2013)
- Strengthening a role as the only one OIE reference lab in the world

Foot & Mouth Disease (2016)
- Center for FMD research in pig.
- Preparing joint meeting with OIE Ref. Labs in Asia.

Salmonellosis (2017)
- Monitoring

OIE Reference Laboratories, QIA

Infectious Diseases designated by OIE

7 Ref Labs, 47 staffs (Budget 2017: US$ 4,430,000)

Infectious Disease	Designated Year	OIE expert	Manpower	Budget 2017
Brucellosis	May 2009	Dr. Moon Her	6	US $280,000
Newcastle Disease	May 2010	Dr. Kang Seuk Choi	7	US $210,000
Chronic Wasting Disease	May 2012	Dr. Hyun Joo Sohn	10	US $330,000
Rabies	May 2012	Dr. Dong Kun Yang	7	US $200,000
Japanese Encephalitis	May 2013			
Foot and Mouth Disease	May 2016	Dr. Jong Hyun Park	10	US $3,200,000
Salmonellosis	May 2017	Dr. Min Soo Kang	7	US $210,000

Reference Laboratories, QIA

Laboratory Quality Assurance System

QA system: ISO/IEC* 17025

Organization: ILAC-MRA**

Accreditation (for diagnostic methods):

- Brucellosis (2008)
- Rabies (2012)
- Japanese Encephalitis (2014)
- Newcastle Disease (2014)
- Chronic Wasting Disease (2014)
- Foot and Mouth Disease (2014)
- Salmonellosis (2016)

* ISO/IEC, International Organization for Standardization/International Electrotechnical Commission

** International Laboratory Accreditation Cooperation-Mutual Recognition Arrangement

OIE Reference Laboratories, QIA

International Proficiency test 2017

Brucellosis by ANSES, France

- EU Bovine Brucellosis Serum Proficiency Test 2014(RBT, SAT, iELISA)

Newcastle Disease by APHA, UK

- 2015 EU Conventional Proficiency Ring trial(AI/NDV PCR and classical HI typing)

Chronic Wasting Disease by AHVLA, UK

- Diagnostic protocol for rapid test of TSE (Ag ELISA, Immunoblot)

Rabies by ANSES, France

- EU Rabies FAVN proficiency test

Salmonellosis by APHA, UK

- 2017 EU Conventional Proficiency test (Avian salmonellosis)

Brucellosis by QIA, Korea

- Diagnosis and differentiation of brucellosis (Participant: Thailand, Mongolia)

Reference Laboratories, QIA

Scientific and Technical Training

1st Workshop : 20 participants from 11 Asian countries (23 Oct 2012 to 2 Nov 2016)

2nd Workshop : 19 participants from 11 Asian countries (14 Oct 2013 to 25 Oct 2013)

3rd Workshop : 20 participants from 11 Asian countries (9 June 2014 to 20 June 2014)

4th Workshop : 10 participants , Vietnam (in Korea) (19 April 2015 to 2 May 2015)

5th Workshop : 9 participants from 4 Asian countries (10 Oct 2016 to 21 Oct 2016)

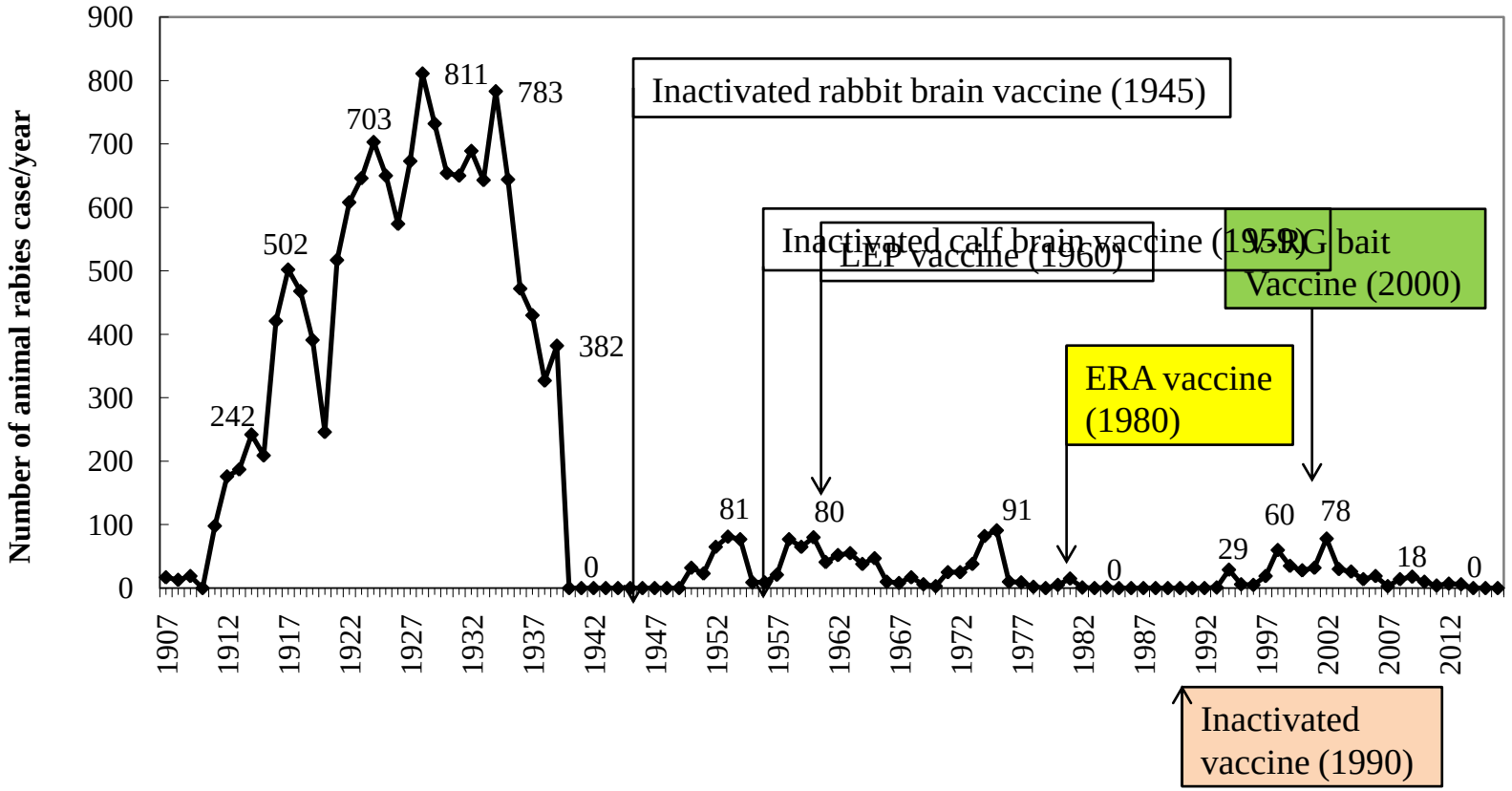
6th Workshop : 10 participants from 5 Asian countries (5 Sep 2017 to 13 Sep 2017)

7th Workshop : 12 participants from 4 Asian countries (6 Sep 2018 to 14 Sep 2018)

Scientific and Technical Training for rabies and JE in 2018

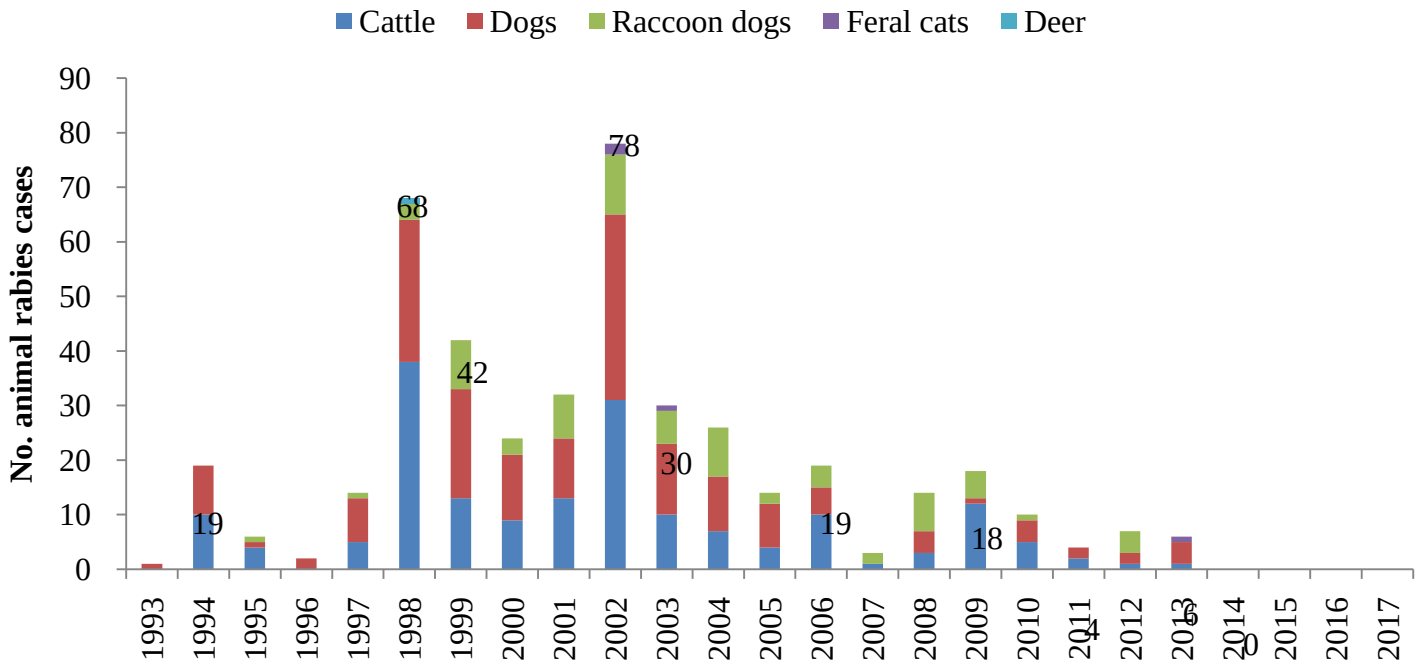
Technical training including FAVN, FAT and RT-PCR for rabies and ELISA for JE has given to Asian veterinarians in OIE reference labs for rabies and JE every year.

Animal rabies cases and vaccines in Korea since 1907



- Live attenuated rabies vaccine, inactivated rabies vaccine and bait vaccines have been used for the prevention of animal rabies in Korea since 1980.
- What was the cause that had not occurred for ten years until 1992, but that occurred continuously every year thereafter?

Animal rabies cases in Korea since1993 according to animal species

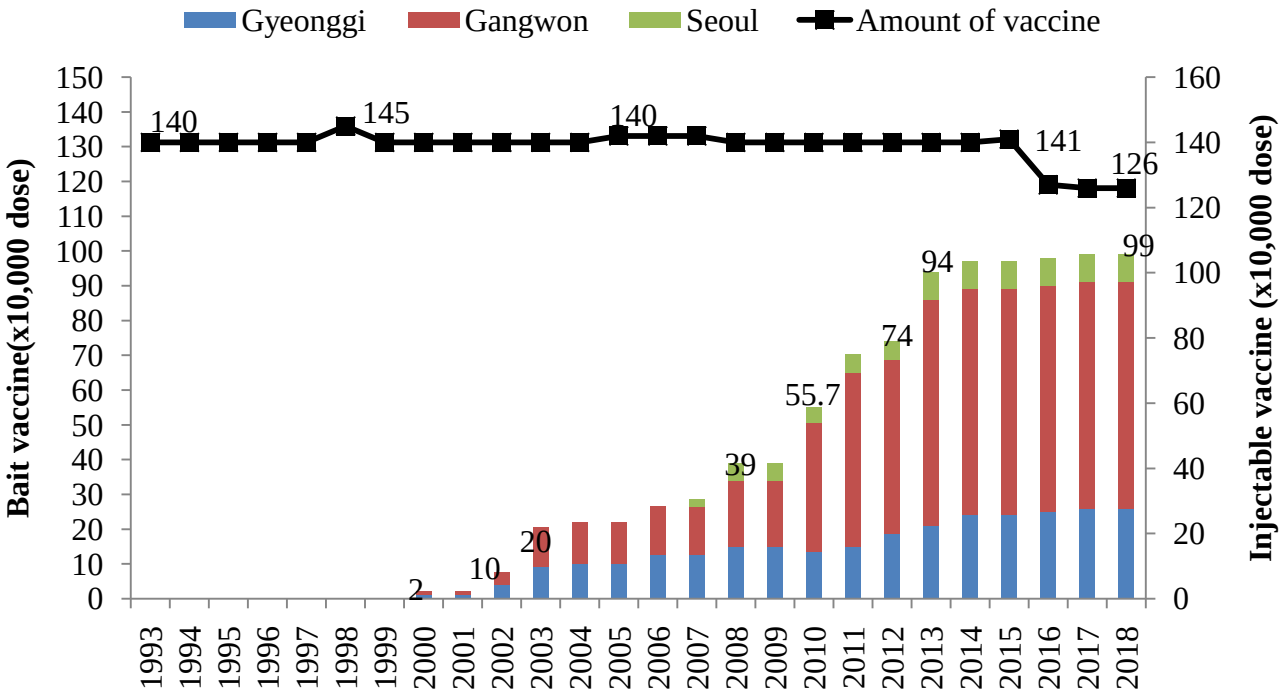


In total, 437 animal rabies cases in five animal species have been identified In Korea since 1993.

In total, six human rabies cases were confirmed between 1999 to 2004.

Human rabies has not been reported in Korea since 2005.

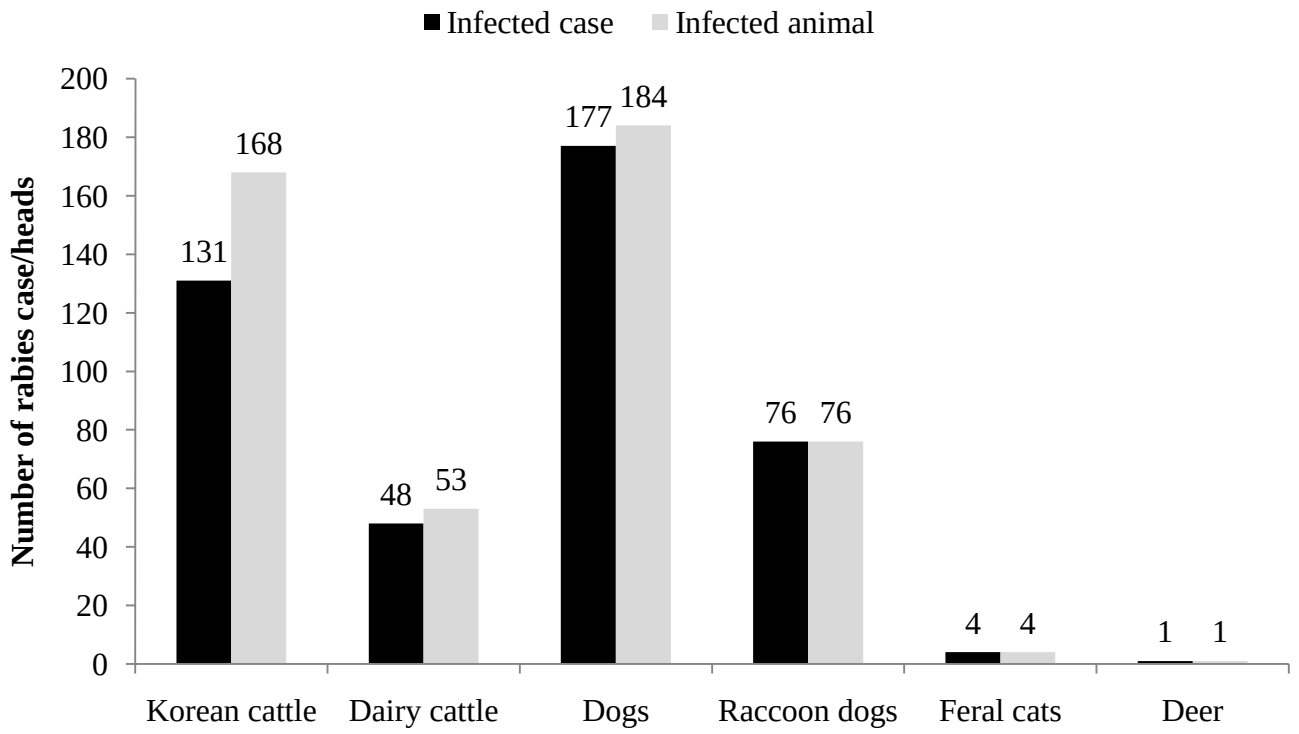
Changes in vaccination doses of a VRG bait and injectable vaccine per year



As raccoon dogs transmit animal rabies in Korea, the Veterinary Authority decided to distribute a rabies bait vaccine in 2000. The injectable vaccine has been distributed to all municipal governments where the vaccine is injected into dogs and cattle via intramuscular route.

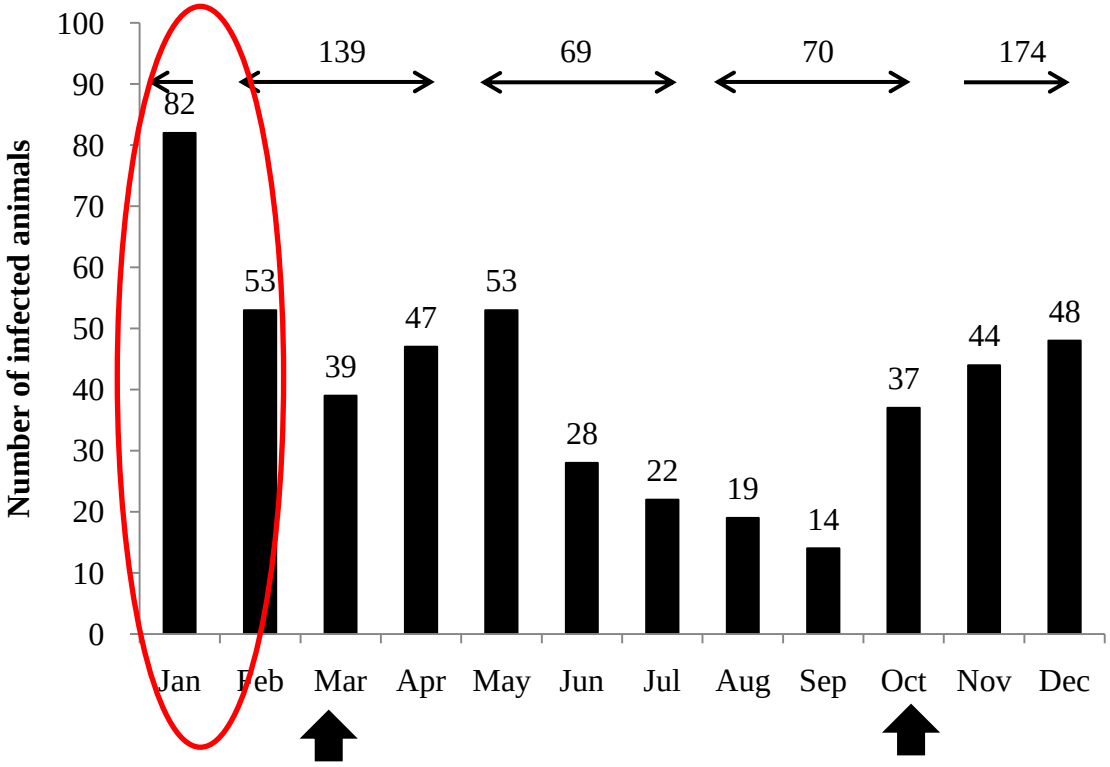
What is the effect of distributing bait vaccine?

Distribution of animal rabies cases according to species in Korea since 1993



Of the five animals, cattle (221 heads) were the most common rabies victims.

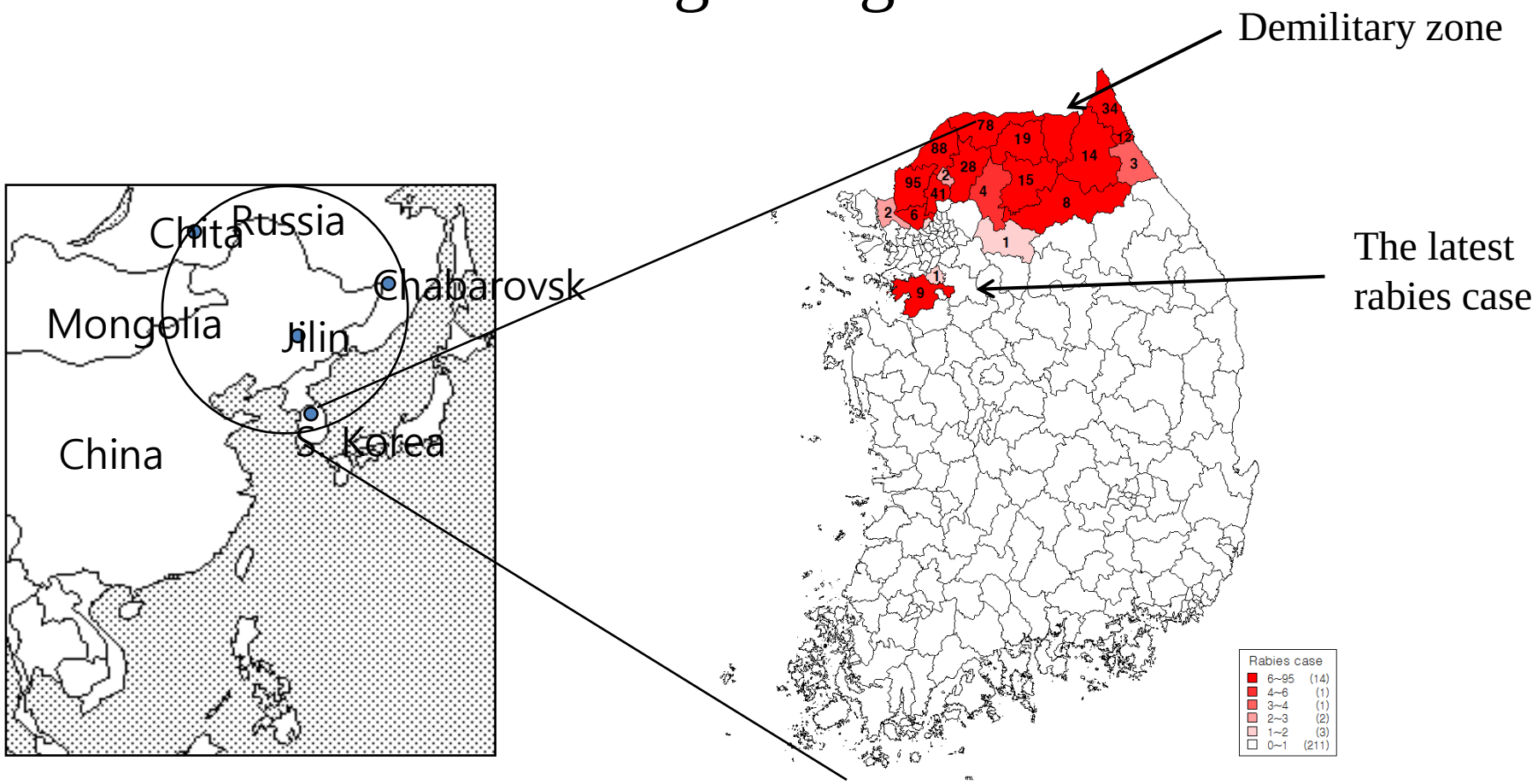
Monthly distribution of animal rabies cases from 1993 to 2018



Rabies bait vaccine has been distributed two times (Mar, Oct)

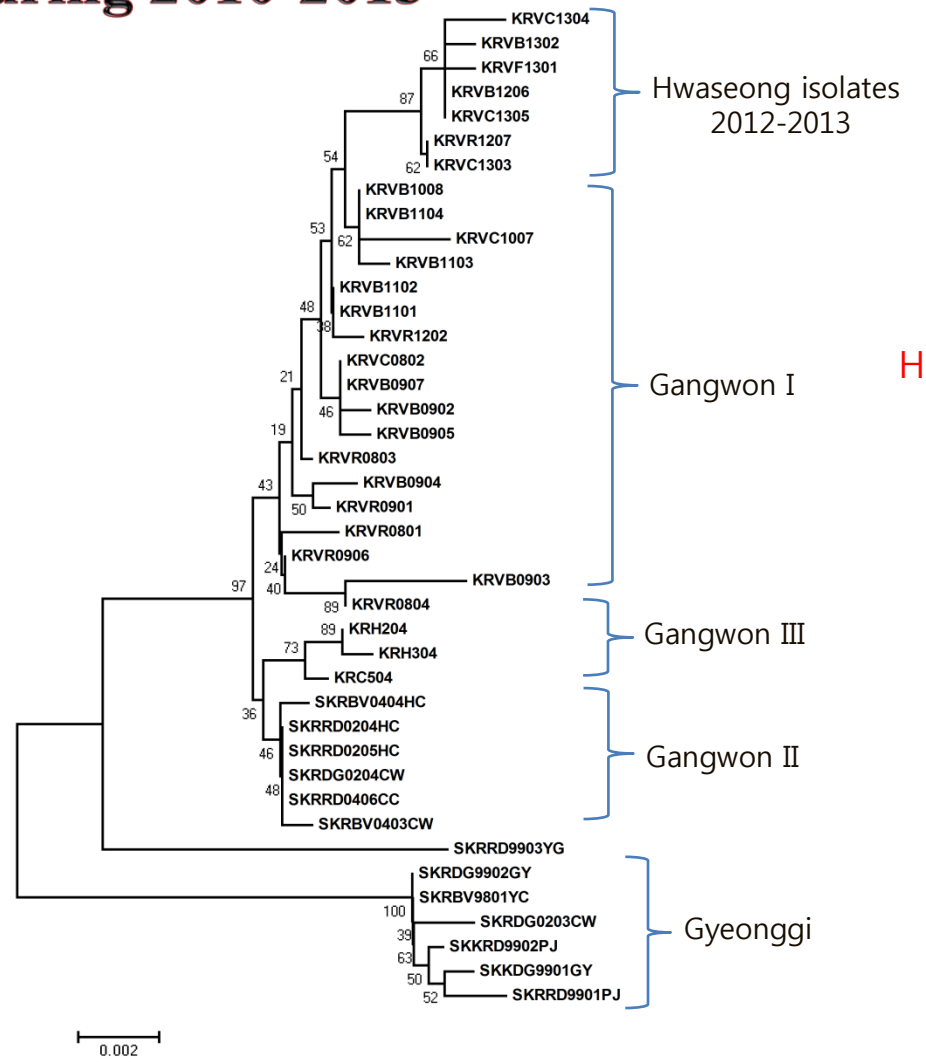
Raccoon dogs tried to come down for finding out food in winter season.
The rabid animals have a tendency to fight domestic or pet animals.

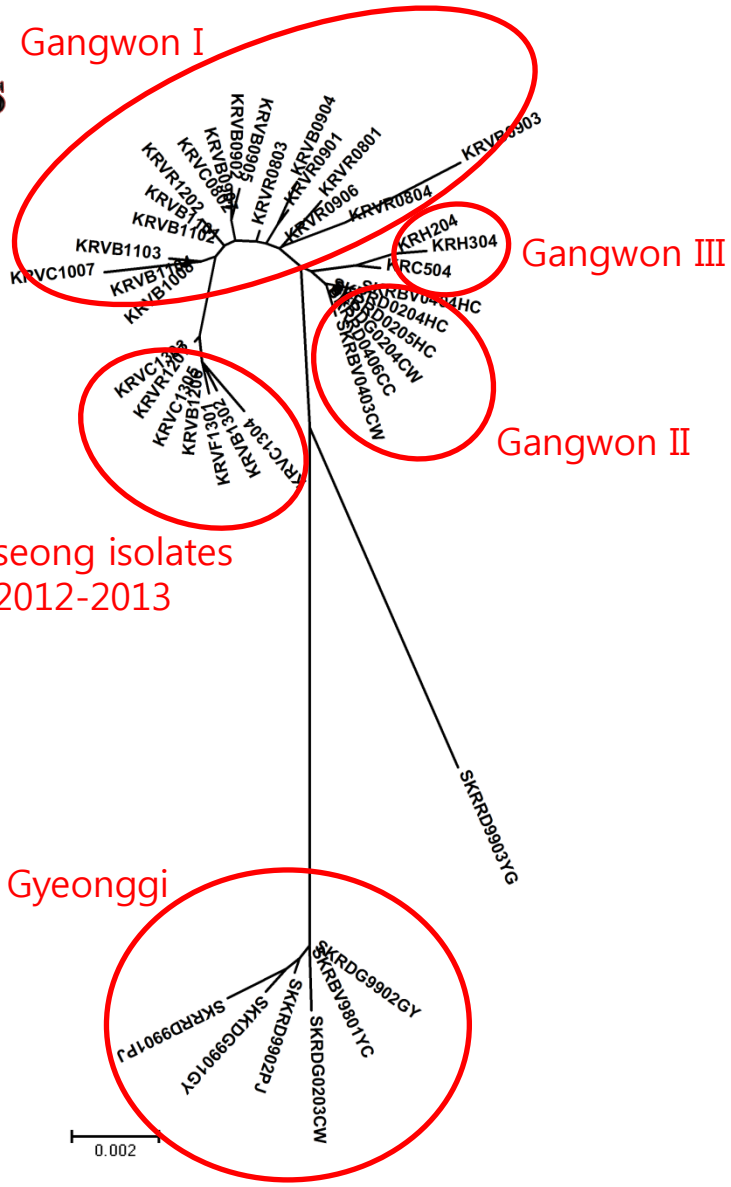
Rabies cases in Korea since1993 according to regions



Most animal rabies cases occurred around DMZ, assuming that rabies originated from the north. The latest animal rabies was identified in Hwaseoung-si in 2013.

Phylogenetic analysis based on N gene using 14 Korean rabies viruses isolates during 2010-2013





Specific nucleotide substitution of Hwaseong isolates : nt 545(T⇒C, aa 182 V→A), 567(G⇒A), 798(G⇒A)

RABV containing **Arginine** at position 333 in the glycoprotein gene indicates strong virulence in animals

```
Isolates 26          37       310      319          333          346
                                                    ★  ★
KRVR0801  PNNLVVEDEGCTNLSGF.....GFGKAYTIFNKTLMEADAHYKSVRTWNEIIPSKGCLR
KRVC0802  ----------------.....-----------------------D-----------
KRVR0803  ----------------.....----------------------------------
KRVR0804  ----------------.....----------------------------------
KRVR0901  ----------------.....----------------------------------
KRVB0902  ----------------.....------------------H---------------
KRVB0903  ----------------.....----------------------------------
KRVB0904  ----------------.....----------------------------------
KRVB0905  ----------------.....----------------------------------
KRVR0906  ----------------.....----------------------------------
KRVB0907  ----------------.....----------------------------------
KRVB0908  ----------------.....----------------------------------
KRVB0909  ----------------.....----------------------------------
KRVB0910  ----------------.....----------------------------------
KRVB1301  ----------------.....----------------------------------
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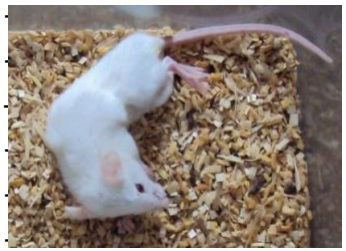
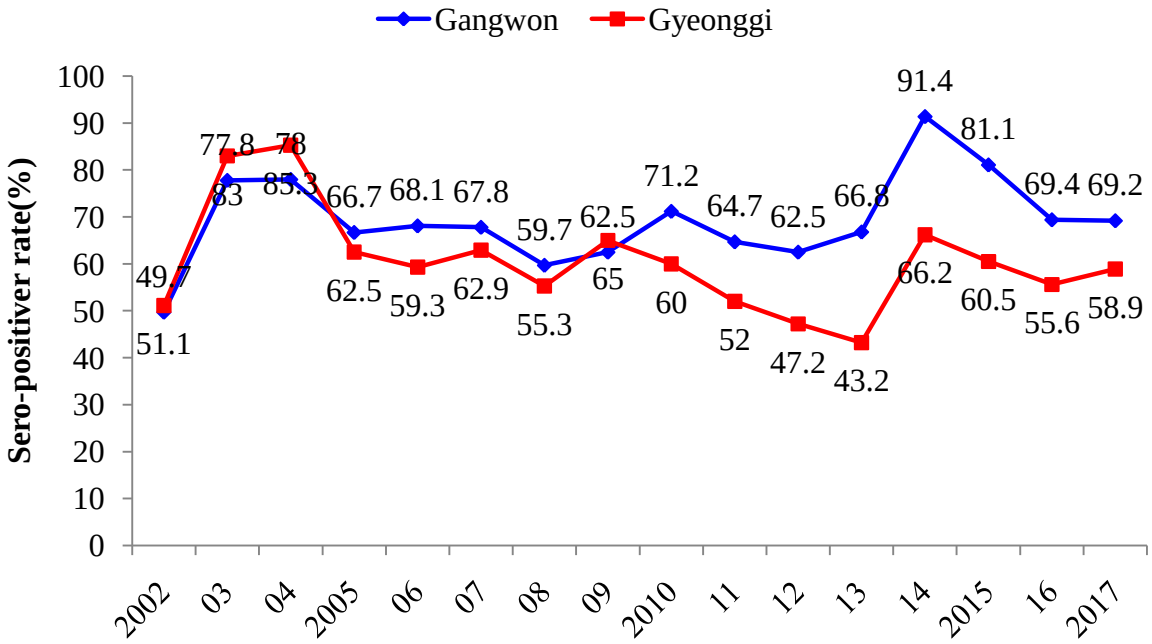
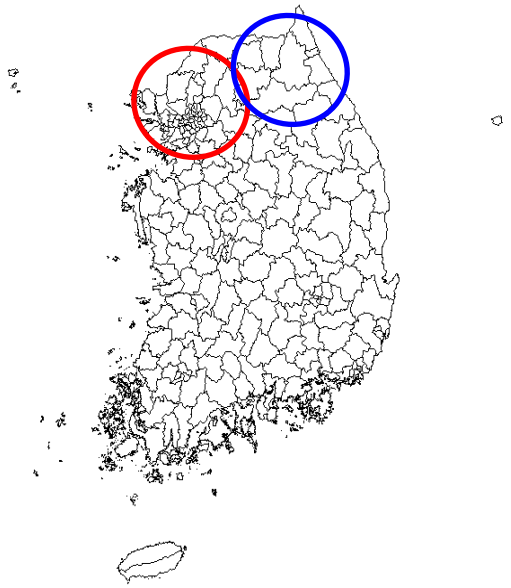


- Dashes indicate amino acids agreeing with the KRVR0801 isolate.
- Numbers represent amino acid positions of the ectodomain of glycoprotein.

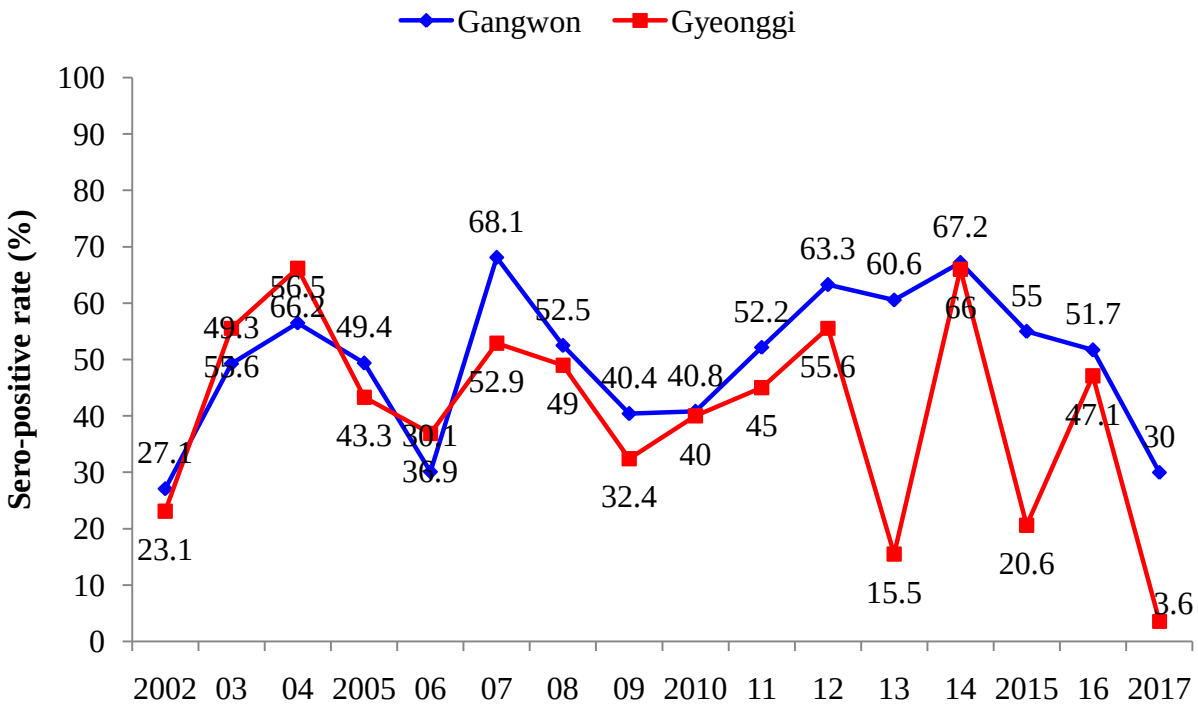
Sero-surveillance of rabies in dogs in two rabies risk regions

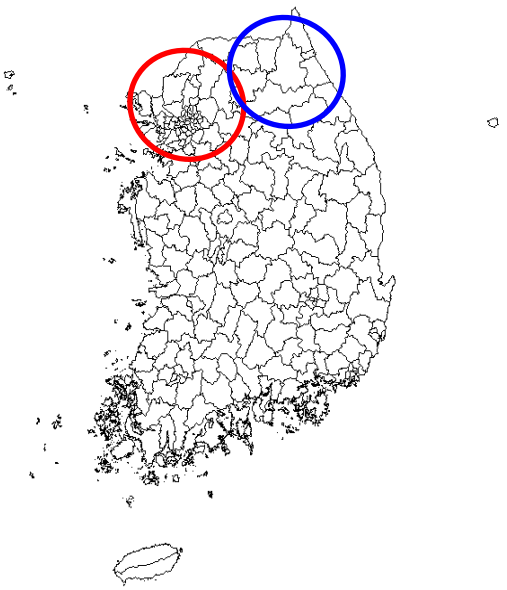




A dog living in Gangwon has slightly higher positive rate against rabies than that in Gyeonggi.

Sero-surveillance of rabies in cattle in two rabies risk regions



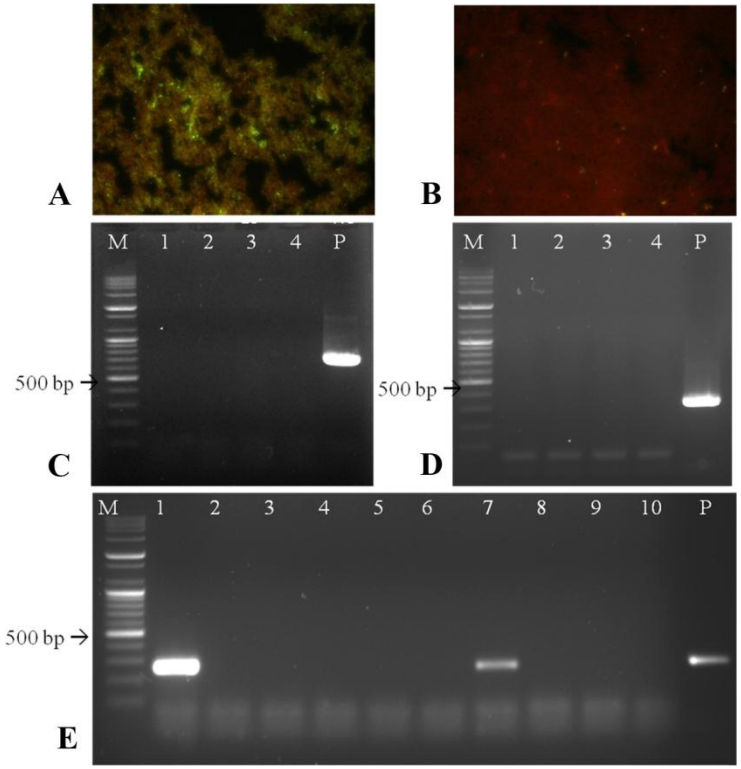


Cattle rearing in Gangwon has higher positive rate against rabies than that in Gyeonggi. Warning is given to the cities that shows a low sero-positive rate. Are the measures to promote vaccination for cattle advanced?

Detection of viral infections in wild Korean raccoon dogs (*Nyctereutes procyonoides koreensis*)

Dong-Kun Yang[1,*], Seoug Heon Lee[1], Ha-Hyun Kim[1], Jong-Taek Kim[2], Sangin Ahn[2], In-Soo Cho[1]

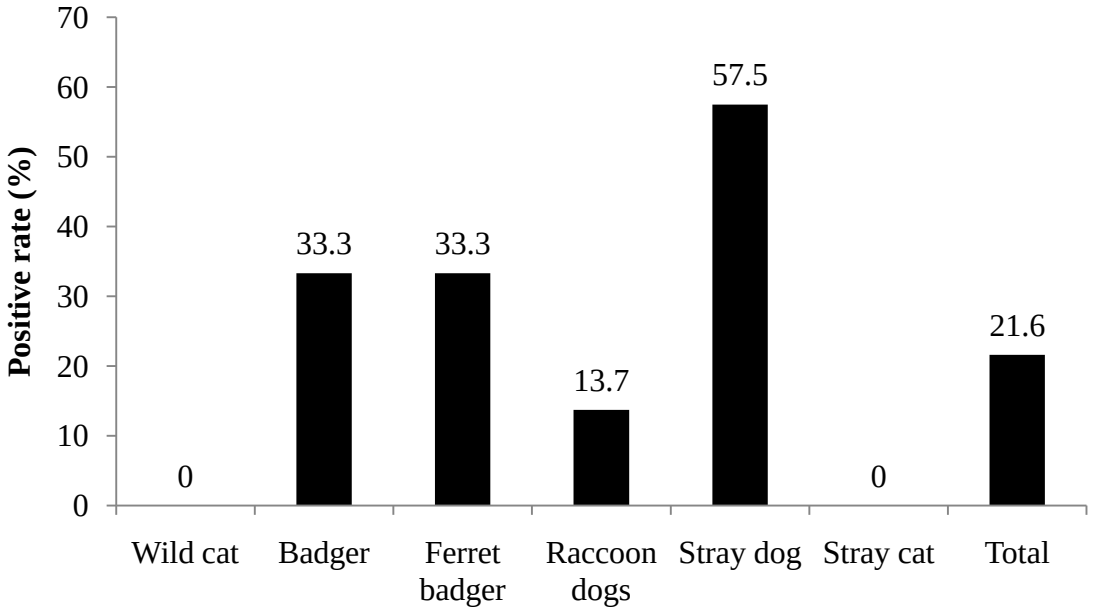
[1]Animal and Plant Quarantine Agency, Ministry of Agriculture, Food and Rural Affair, Gimcheon 39660, Korea
[2]College of Veterinary Medicine, Kangwon National University, Chuncheon 24341, Korea



In total, 62 brain samples of raccoon dogs were examined for rabies virus (RABV) and CDV, and 49 lung samples were screened for CDV, CAdV-2, CPIV-5, and CHV. No RABV, CAdV-2, CPIV-5, or CHV was identified, but nine CDV antigens (8.1%, 9/111) were detected.

Detection of canine distemper virus (CDV) in Korean raccoon dog brain samples (E). Lanes 1–10, brain samples; P, positive sample. Samples 1 and 7 showed positive reactions against CDV.

Sero-positive rates of rabies in several wild animals in South Korea



Species	Positive rate(%)	No. posi/ samples
Wild cat	0	0/5
Badger	33.3	1/3
Ferret badger	33.3	1/3
Raccoon dogs	13.7	21/153
Stray dog	57.5	23/40
Stray cat	0	0/9
Total	21.6	46/213

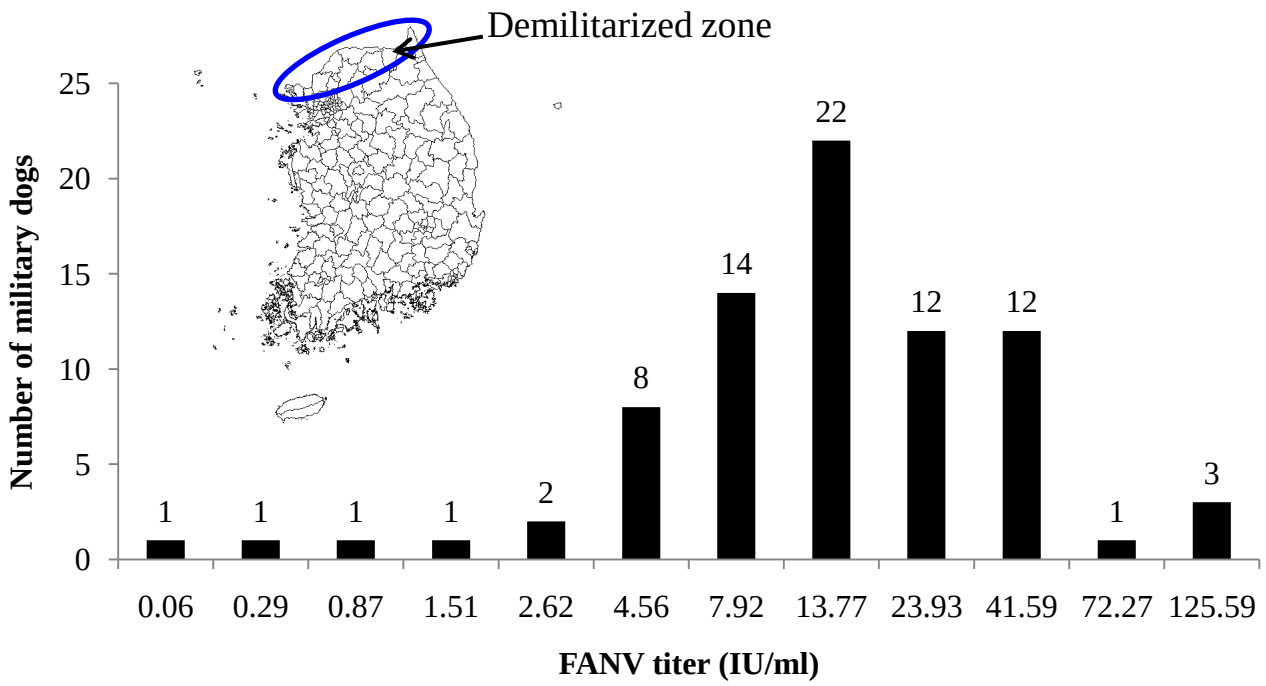
- Animals were caught from two provinces where rabies bait vaccine has been distributed since 2000 and rabies antibody was measured by FAVN.
- Only 13.7% of raccoon dogs have rabies antibody. indicating that new methods to distribute bait vaccine be needed. In addition, different oral vaccines for rabies may be introduced to rabies risk regions.

The Journal of Veterinary Medical Science

FULL PAPER
Virology

Serosurvey of rabies virus, canine distemper virus, parvovirus, and influenza virus in military working dogs in Korea

Ha-Hyun KIM[1], Dong-Kun YANG[1]*, Bo-Hyun SEO[2] and In-Soo CHO[1]



The number of dogs showing each viral neutralizing antibody titer against rabies virus in 78 Korean military working dogs. The VNA titers (0.29 and 0.06 IU/mL) of 2 dogs were lower than protective level (0.5 IU/mL) among 4 military dogs born in 2014

Characterization of Korean raccoon dog

- Family Canidae, *Nycteeutes procyonoides koreensis*
- Name: Korean Raccoon dog
- Distribution in Korea: all provinces except Jeju
- Distribution in other country: North Korea, China Japan, Russia, Vietnam, North America
- Size: body 50-68 cm, tail 13-20 cm
- Characterization: try to hibernate, act in darkness
- Introduction of Korea: In order to get fur from Russia in 1928, but become a wild animal now
- Food: omnivorous animal, rat, reptile, frog, insect, fruit
- Inhabitation: live around small river, and in a hill

Raccoon dog's life and new bait vaccine

In Seoul

In Korea

In America

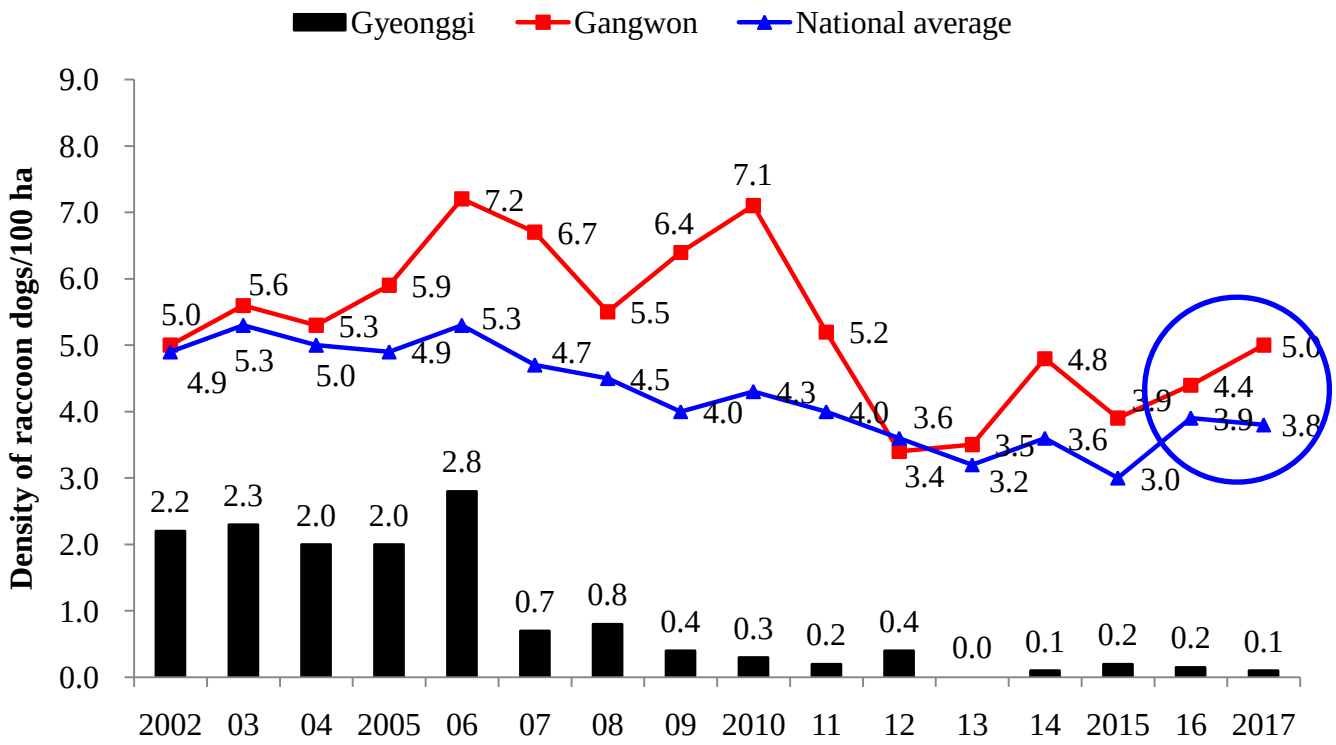
Habitat

Dung

New bait vaccine

Korean raccoon dogs have high intelligence and do not bark.

Density of raccoon dogs in rabies risk regions



Recently, density of raccoon dogs have increased in Gaingwon province.

Is it possible to reduce the number of susceptible raccoon dogs?

Is there any prospect of a joint rabies study between South and North Korea ?

Conclusions

- Continuous implementation of rabies control program with mess vaccination for dogs and ongoing distribution of rabies bait vaccine for raccoon dogs will lead Korea to rabies free country.
- For the declaration of rabies free country, active surveillance on suspected dogs and raccoon dogs residing in rabies risk regions should be strengthened.
- Prohibiting the smuggling of animals from other countries is needed.

Thank you for your attention

- Acknowledgements

- Dr. Kim HH