

# **ANIMAL RABIES IN NEPAL AND RACCOON RABIES IN ALBANY COUNTY, NEW YORK**

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**MPH Report/Capstone Project Presentation**

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# CHAPTER 1: FIELD EXPERIENCE AT KANSAS STATE UNIVERSITY RABIES LABORATORY

- Duration: February-May
- Largest volume rabies serology center in the world
- Over 60,000 samples are handled annually
- Diagnoses brain tissues, measures rabies antibodies by FAVN, RFFIT, and ELISA

# **FAVN & RFFIT :**

## **FAVN:**

- Measures the response of an animals' immune system to rabies vaccine.
- Required by many rabies free countries or regions

## **RFFIT:**

- Estimates the rabies antibody level in humans and animals
- Greater than or equal to 0.5 IU/ml: adequate response.
- Below 0.5 IU/ml: booster vaccination

# Experience at KSU Rabies Lab

- Acquainted with ongoing activities
- Necropsy, slide preparation for brain tissues, reading the slides
- Processing of serum samples, entry of data, and assisting in other works.

# CHAPTER 2: RABIES-INTRODUCTION

- Viral zoonotic disease, existing since 2300 B.C.
- Genus: *Lyssavirus* & Family *Rhabdoviridae*, negative sense single stranded RNA genome
- 55,000 people die globally (56% in Asia and 44% in Africa)
- 10 million people receive post exposure vaccine each year
- Estimated cost of rabies is US \$583 million/year

# Rabies: Epidemiology and Transmission

- Many animal species harbor and spread
- **US and Canada:** Skunks, Raccoons, Foxes
- **Africa:** Jackals, Bat eared foxes, Mongooses
- **Australia, Africa, Europe, South East Asia:** Many bat species
- **Asia:** Dogs, Mongooses, Jackals, Wolves
- Dogs are the most common susceptible animals in Asia and Africa
- More than 90% of human rabies is transmitted from dogs.

# Rabies Status in Continents

## Asia:

- Endemic, human-dog ratio in rural and urban area: 14.3 and 7.4, respectively
- 2.5 billion people are at risk, in every 20 minutes, one people dies
- In China, 1996-2008, incidence rate was 0.12 per 100,000
- In India, Human death in rural & Urban areas: 2.49/100,000 & 0.37/100,000.

## Africa:

- 70% of human cases were below 20 years of age
- Out of all positive cases, two thirds were male

**Table 1: Distribution (per year) of Human Rabies & Dog Bite Cases in South East Asia (SEA) ([Gongal and Wright 2011](#))**

<b>Country</b>	<b>Estimated number of dog bites</b>	<b>Estimated number human rabies cases</b>	<b>Estimated number of human cases/million of population</b>
Bangladesh	300,000	2,000-2,500	13
Bhutan	5,000	<10	3
DPR Korea	Not Available	Not Available	Not Available
India	17,400,000	18,000-20,000	18
Indonesia	100,000	150-300	1.3
Maldives	0	0	0
Myanmar	600,000	1000	22
Nepal	100,000	<100	4
Sri Lanka	250,000	<60	3
Thailand	400,000	<25	0
Timor Leste	1,000	0	0
<b>Total (SEA)</b>	<b>19,156,000</b>	<b>21,345-23,955</b>	



**Table 2: Estimated Human Mortality (by canine rabies) in Africa and Asia ([Darryn L. Knobel and M. Elizabeth G. Miranda 2005](#))**

Output	Asia						Africa	
	India		China		Other Asia		Urban	Rural
	Urban	Rural	urban	Rural	Urban	Rural		
Total population (millions)	284.7	732.2	459.1	816.1	295.7	525.4	294.2	498.1
Population at risk (millions)	284.7	710.4	459.1	498.3	295.7	409.1	294.2	340.1
No. of bites from suspected rabid dogs (thousand)	409.4	893.4	660.1	626.7	425.2	524.5	374.3	427.8
No. of rabies deaths	1058	18201	1324	1257	853	8135	5886	17937
No. of deaths/100,000 people	0.37	2.49	0.29	0.15	0.29	1.55	2.00	3.60
No. of sub regional deaths	19,713		2336		9489			
Total no. of deaths	31,539 (8,149-61,425)						23,705 (6,903-45,932)	
Total no. of deaths	55,270 (23,910-93,057)							
No. of deaths/100,000 people	1.38 (0.60-2.33)							
Predicted deaths in the absence of any post exposure treatment	327,160 (166,904-525,427)							

## **Europe:**

- Foxes: dominant in transmission and maintenance
- Dogs, skunks, raccoons, wolves and bats are also important
- From 1990-2010, 22 human deaths, mainly in travelers

## **Latin America:**

- Vampire bats and dogs are major vectors
- In 2005, 55 cases of rabies transmitted from vampire bats
- 1 million people at risk were treated

## **North America:**

- Since 1950, 61 human cases of bat rabies in US (55) & Canada (6)
- In 2010, animal rabies cases: 6154, and human rabies cases: 2
- Hawaii and Mississippi : no cases in 2010
- 92% cases in wildlife
- In Mexico, 2-3 human cases/year since 2000, and increasing in recent years.

# CHAPTER 3: STATUS OF ANIMAL RABIES IN NEPAL



- Area: 147,181 square Kilometer and population: 29,331,000
- Eco-zones: three (Terai, Hills and Mountains)

- 160-170 human rabies cases,
- >30,000 people receive post exposure treatment annually
- 94% cases are dog bites, 4% due to jackals, and rest due to mongooses, cats, and others

## Data:

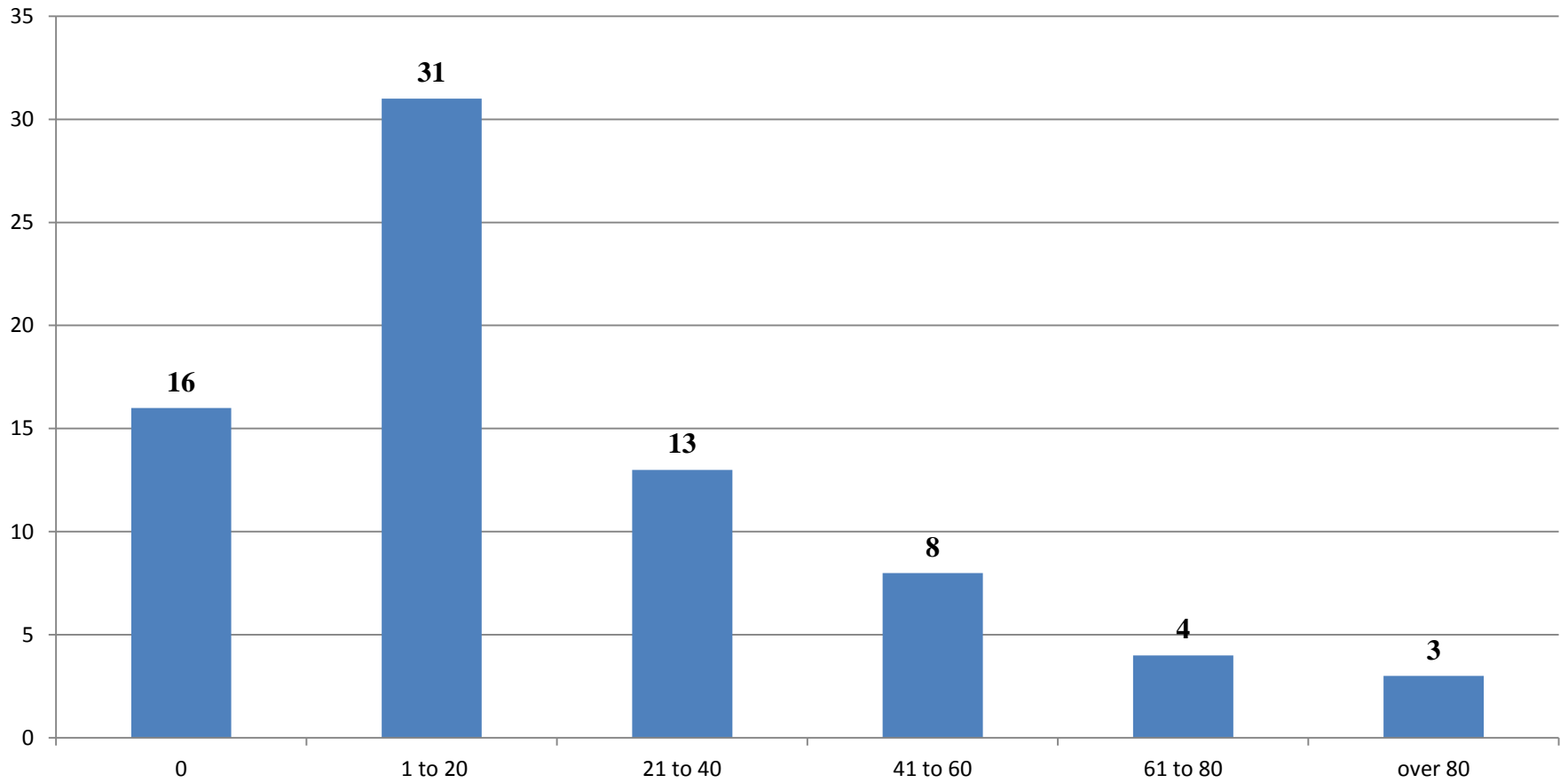
- Animal rabies data of Nepal from 2000-2009
- Based on passive surveillance and clinical examination.
- No laboratory confirmation was found.
- Data collected on monthly basis by DLSOs, and were sent to Central Veterinary Epidemiological Unit, where processed and published
- Tried to find the animal rabies status in Nepal (2000-2009)

# Result and Discussion

- Cases of animal rabies: 1713
- Cases were found in 59 districts (out of 75)
- Highest cases were recorded in Jhapa (n=149)

# Figure 1: Animal Cases and Number Districts

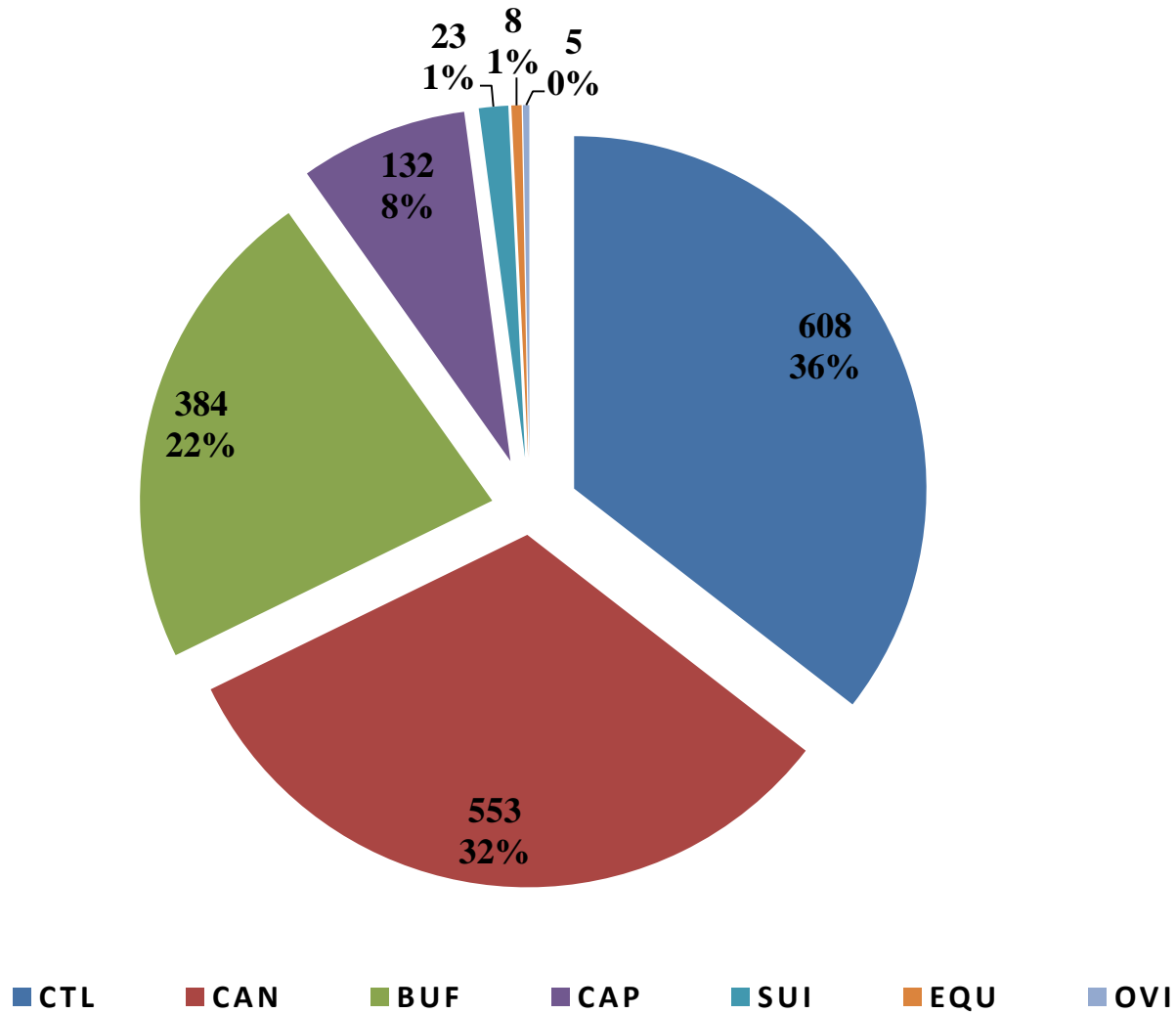
## Number of Districts





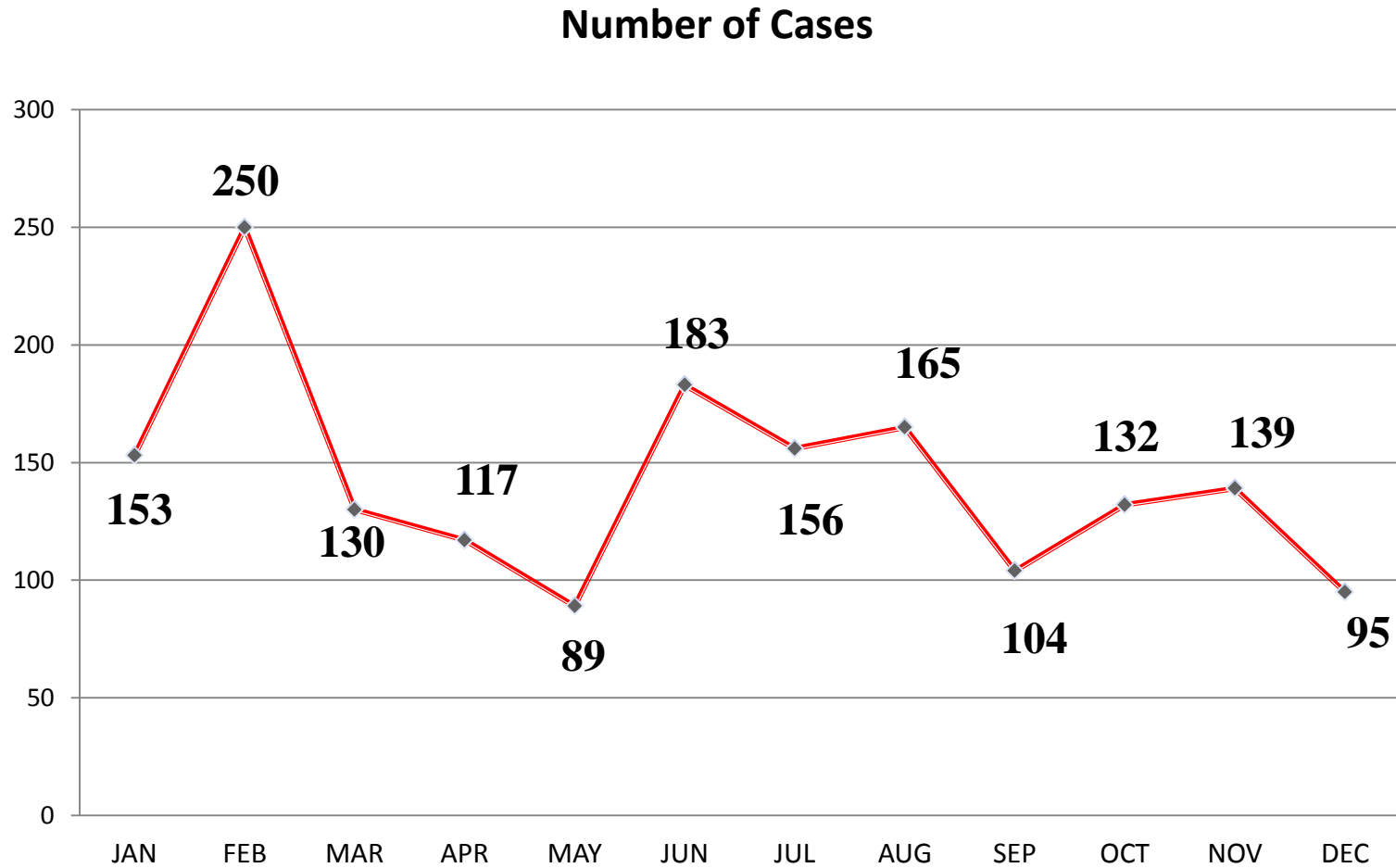
# Distribution of Rabies in Animals

Fig 2: Distribution of Rabies in animal species



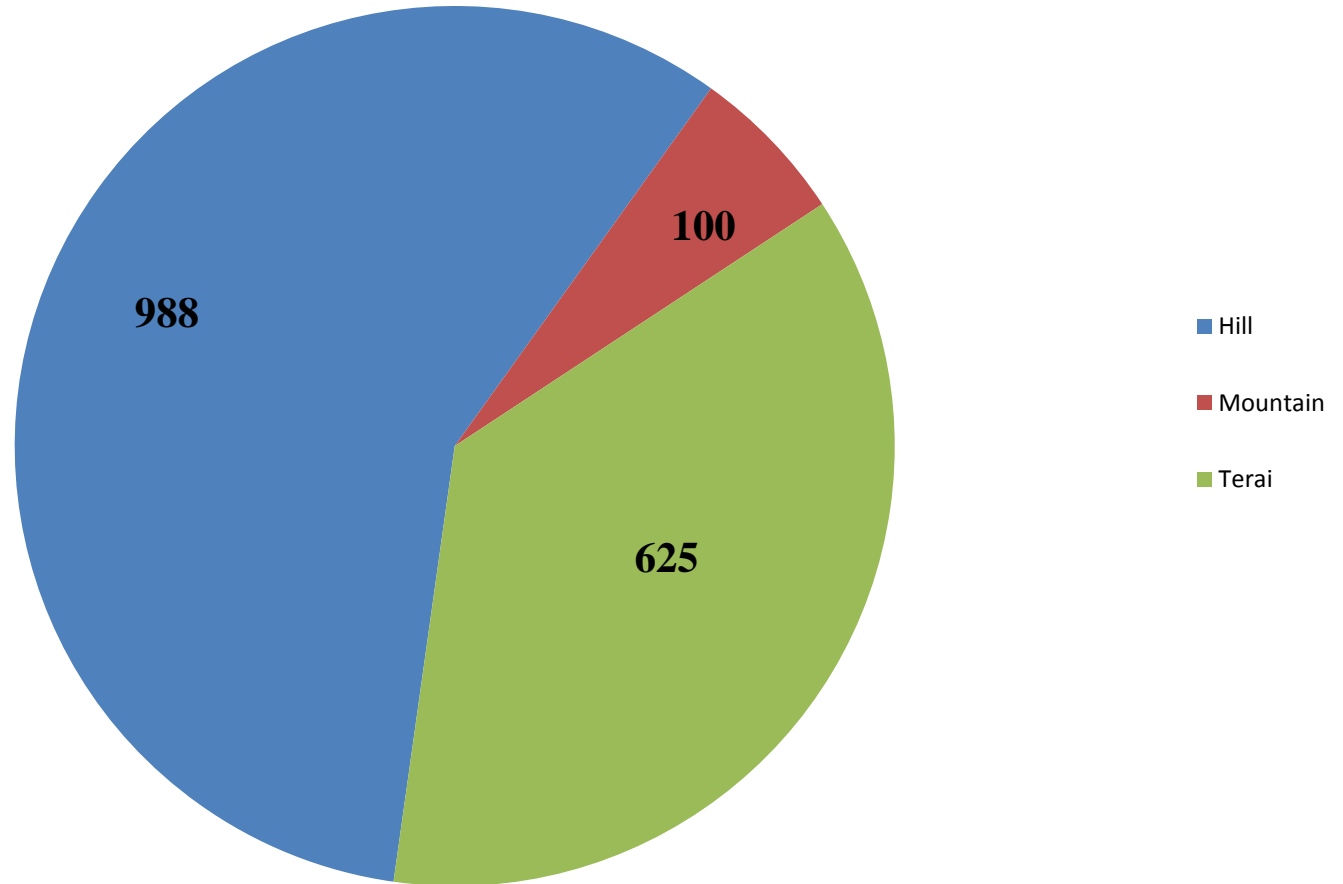
# Seasonal Trends of Animal Rabies in Nepal

Figure 3: Seasonal Trends of Rabies in Nepal



# Animal Rabies in Eco-Zones

**Figure 4: Distribution of Rabies Cases (Eco-zones)**



# Conclusion

- Spread throughout the country in all months
- Contact among dogs, wildlife, and domesticated animals should be minimized
- Public awareness, better stray dogs control programs, and availability of vaccines are required

# **CHAPTER 4: RACCOON RABIES IN ALBANY COUNTY, NEW YORK**

- Prior 1977, raccoon rabies were confined to southern US
- Translocations led to emergence in North East States
- In New York, present since 1990
- It is the most prevalent rabies variant in eastern US.

# **Raccoon population Biology in Northern Atlantic States**

- Winter: breeding season
- Spring: emergence of young
- Summer: a period of growth (young stay with mother)
- Fall: juvenile disperse away from natal territories

# Data collection

- Active surveillance from November 1992 to December 1993
- The Department of Environmental Conservation, Wildlife Pathology unit was involved in the surveillance
- Public support in regard to dead or sick wildlife
- 815 suspected samples were collected
- Samples submitted to the rabies laboratory (Wadsworth Center)

- Signs and behaviors were documented.
- Direct Fluorescent Antibody test
- Data analyzed based on raccoon's attributes like age, gender, seasonality, and observed behaviors to know the role of such attributes on the likelihood of test results
- Used descriptive statistics and logistic regression model or chi-square test where appropriate.



# Result and Discussion

- Out of the raccoon brain samples, 74.2% (605/815) were positive.
- In 1992, New York State reported 1761 rabies cases, 79% of them were raccoons
- During 1997-2003, a study in various counties of New York including Albany, showed that out of 4,871 terrestrial rabies cases, 63.7% were raccoons.
- In 2010, 36.5% (2246/6154) of positive cases were raccoons.

# Gender

**Table 3: Raccoon Rabies Cases Based on Gender & Test Results:**

<b>Gender</b>	<b>positive</b>	<b>Negative</b>	<b>Total</b>
Male	200 (33%)	107	307 (38%)
Female	344 (57%)	83	427 (52%)
Unidentified Sex	61 (10%)	20	81 (10%)
Total	605	210	815

- Evidence of an association between gender and positive test result ( $p < 0.01$ )
- In Ontario, Canada, 55% (46/83) of test-positive raccoons were adult females and 45% (37/83) were males

# Age

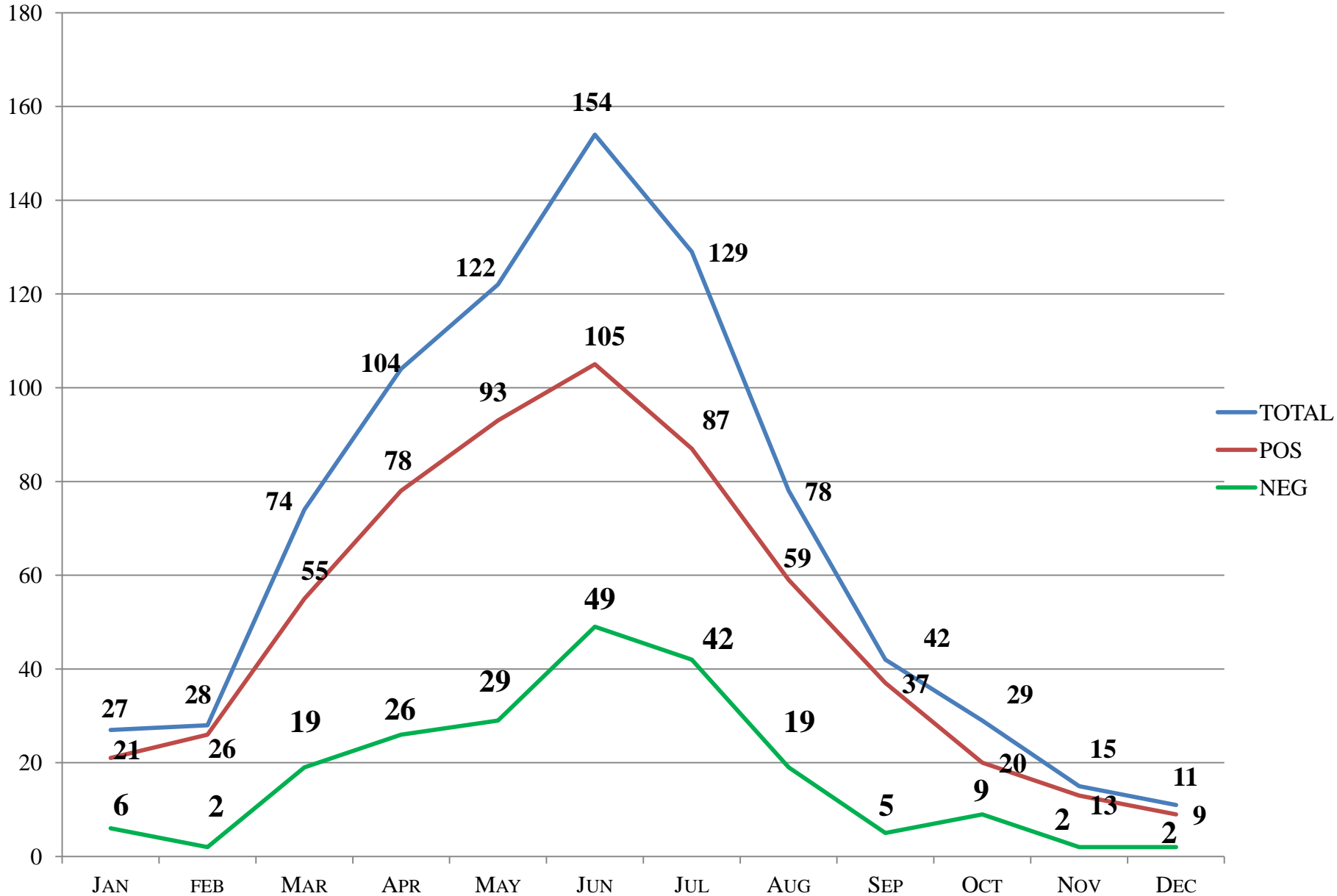
**Table 4: Raccoon Cases based on Age & Test Results**

<b>Age Group</b>	<b>Positive</b>	<b>Negative</b>	<b>Total</b>
Young Raccoons (0-1 year)	49 (8%)	93	142 (17%)
Adult Raccoons (>1 year)	556 (92%)	117	673 (83%)
Total	605 (74%)	210	815

- Evidence of association between rabies cases and age ( $p < 0.01$ )
- Did not find any data about the particular susceptible age of raccoons

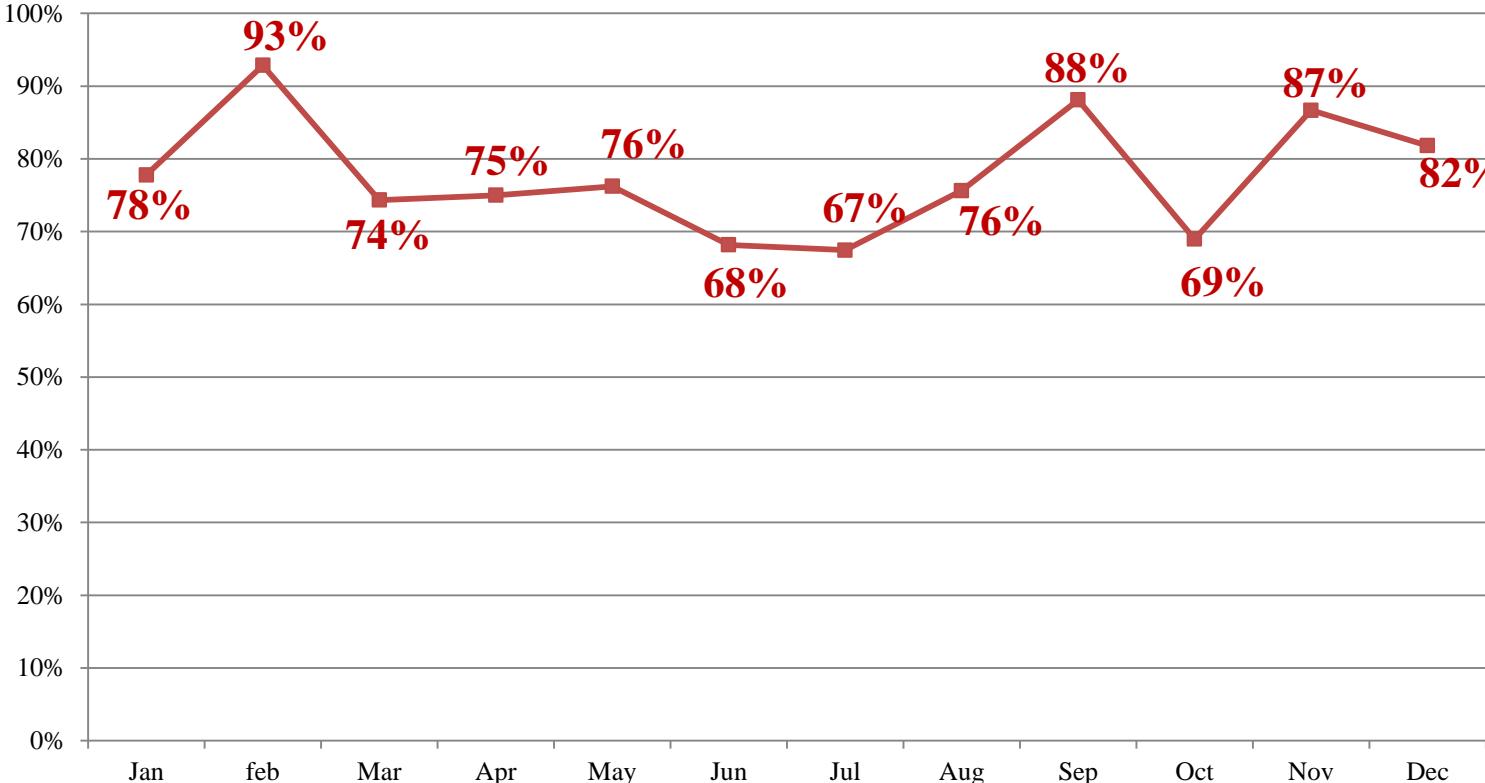
# Months and Seasonality

Figure 5: Raccoons cases & Test Results Based on Months:



**Figure 6: Percentage of Raccoon Cases (month-wise)**

**Positive Cases (in percentage)**



**Table 5: Raccoons Cases & Test Results Based on Seasonality**

<b>Seasons</b>	<b>Positive</b>	<b>Negative</b>	<b>Total</b>
Fall (Aug, Sep, Oct, Nov)	129 (78%)	35 (22%)	164
Spring/Winter (Dec, Jan, Feb, March)	111 (79%)	29 (21%)	140
Summer (Apr, May, June, July)	363(71%)	146 (29%)	509
Total	603	210	813

- In Ontario, 63 % (79/125) raccoon rabies cases were in the breeding seasons
- In Massachusetts, positive rabies cases were mostly detected in spring and fall.
- The summer had the highest submissions, but the least percentages of positive cases.

- Breeding behavior increases the contact rates and spread
- The rise in cases in winter (Feb) may be due to breeding season
- The 2<sup>nd</sup> rise in fall (Sep) may be due to the dispersion of young
- Winter may be associated with fewer encounters, but a higher likelihood of an encounter with a rabid raccoon.

# Association of Raccoon Observed Behaviors & Test Results

- Raccoon behaviors considered: Human aggression, domestic animal aggression, wild animal aggression, object aggression, active by day, unafraid, and abnormality
- Used logistic regression model (SAS Software),
- Some behaviors were highly associated with the test results, while others are not.



**Table 6: Analysis of Odd Ratio Estimates**

<b>Parameter</b>	<b>Point Estimate (OR)</b>	<b>95% Confidence Limits</b>		<b>Probability (p-value)</b>
Domestic Animal Aggression (DAA) ( <i>n=121</i> )	4.121	2.150	7.897	<0.0001
Unafraid ( <i>n=81</i> )	2.340	1.232	4.447	0.0094
Active by Day ( <i>n=226</i> )	1.466	1.009	2.130	0.045
Abnormal ( <i>n=141</i> )	0.654	0.440	0.972	0.0358
Human Aggression (HA) ( <i>n=67</i> )	1.694	0.875	3.277	0.1177
Wild Animal Aggression (WAA) ( <i>n=12</i> )	0.727	0.211	2.499	0.6124
Object Aggression (OA) ( <i>n=25</i> )	0.687	0.285	1.658	0.4036

- During 1992-2006, in Massachusetts, aggression (OR=3.94,  $p<0.0001$ ), disorientation (OR=1.17,  $p<0.006$ ), paralysis (OR=1.22,  $p<0.041$ ), unexplained wound (OR=1.472,  $p,0.0001$ ), and found dead (OR=1.16,  $p<0.0089$ ) were independently associated with positive rabies test results
- The other study in Massachusetts (1992-2007) showed observed signs (aggressions, paralysis, ataxia, disorientation, unexplained wounds) were significantly associated with rabies test results; however, seizures and animal found dead were not significantly associated

# CHAPTER 5: OVERALL SUMMARY

- Enabled with technical abilities to diagnose rabies suspected brain tissues
- In Nepal, during 2000-2009, the disease was present in 59 districts (out of 75)
- Unfocused control plans, poor public awareness, and low literacy rate are contributing in high number rabies cases
- In the Albany County, 74.2% of raccoon brain samples were positive
- Evidence of an association between gender and test results, and age and test results were found independently ( $p < 0.01$ )

- Raccoon's behaviors like domestic animal aggression, unafraid, activity by day, and abnormal were significantly associated with the test results
- Other behaviors like human aggression, wild animal aggression, and object aggression were not significantly associated (may be due to limited data)
- Age, gender, seasonality, and observed behaviors of raccoons should be taken in consideration while handling the suspected cases
- Summer months had least percentage of positive cases.
- Winter may be associated with fewer encounters, but a higher likelihood of an encounter with a rabid raccoon.

# Competencies from MPH Courses

<b>Courses</b>	<b>Competencies</b>
DMP 754	Epidemiological concepts, skill, and tools
STAT 703	Statistical concepts, skills and tools
DMP 806	Environmental hazards, and impact on animal & health
HMD 720	Roles and responsibilities about the health care administrator, Health care issues affecting public health in the US
KIN 818	Role of an individual's behavior in public health. Concepts and theories about health behavior

DMP 860	Pathogenic mechanisms of diseases
DMP 815	Writing, formatting, citation, presentation, Endnote, about critical thinking & their linkage in multidisciplinary scholarly activities
DMP 816	Global trade issues, sanitary and phytosanitary measures
DMP 854	Epidemiological designs, and used some software to calculate outputs
DMP 899	Basics about the infectious disease modeling
DMP 830	Learned to analyze data by the use of MS EXCEL, very helpful while working on project.
FDSCI 730	Food safety and food security issues
FDSCI 731	Food defense issues and incidents of public health issues related with food

- Thank you very much for your attention!!!