

USDA-APHIS-Wildlife Services
Mission Focus
&
Cape Cod Rabies Program and
Wellfleet Bay Virus Investigation

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The Wildlife Society
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Protecting People
Protecting Agriculture
Protecting Wildlife



United States Department of Agriculture
Animal and Plant Health Inspection Service

USDA-APHIS-WS MA/CT/RI Program:

A federal, non-regulatory, cooperative program providing research-backed technical expertise and specialized wildlife control equipment, operating in compliance with all Federal, State, and local laws for resolution of wildlife conflicts with people.

Provide free site visits and technical consultation as well as providing assistance when necessary to obtain Federal/State depredation permits.

WS Role towards Wildlife Conflict Management Includes **Protecting Agriculture**





Protecting Property



Protecting Human Health & Safety

WS Wildlife Services

Protecting People
Protecting Agriculture
Protecting Wildlife



United States Department of Agriculture
Animal and Plant Health Inspection Service

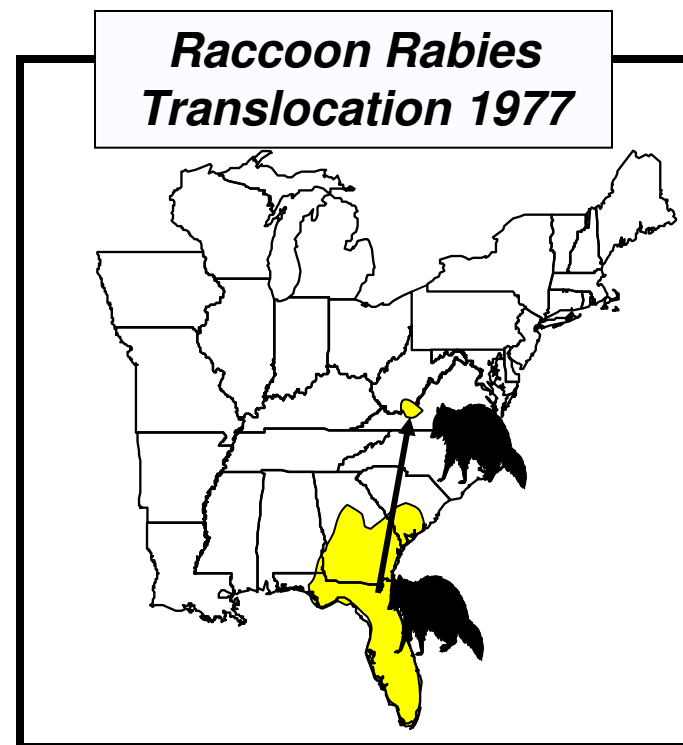
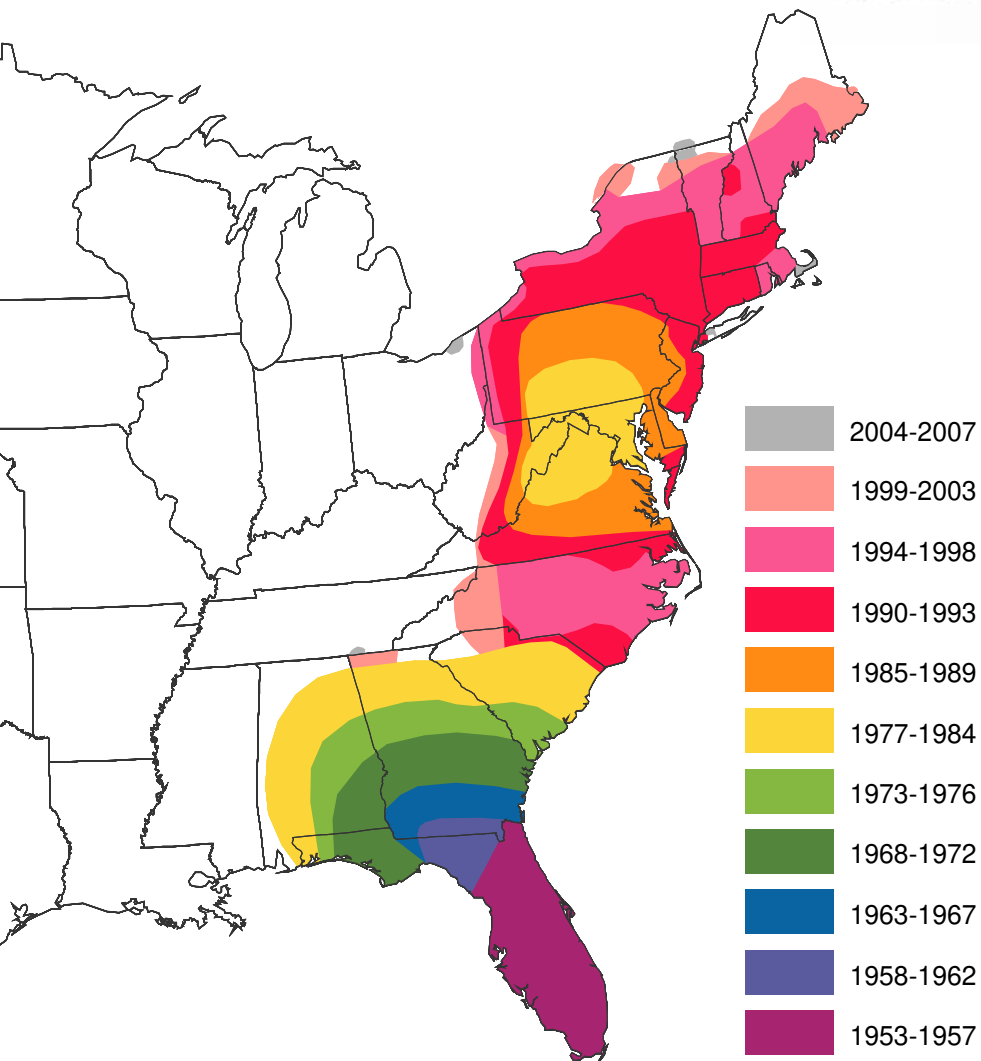
Protecting Wildlife



USDA-APHIS-WS MA/CT/RI Program:

- A staff of 19, including wildlife biologists and wildlife technicians.
- State office in Amherst, MA and a field office in Sutton, MA.
- Includes 3 airport wildlife biologists.
- 1 wildlife disease biologist & 1 wildlife rabies biologist.

Spread of Raccoon Rabies 1953-2007



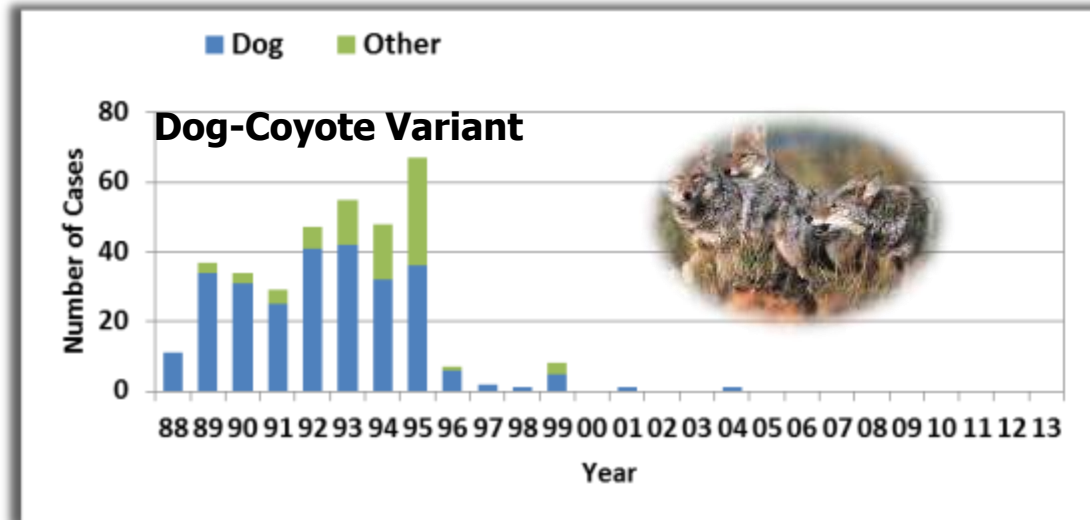
Management with Raboral V-RG® ORV in U.S.

- Raboral V-RG® is the only licensed ORV in the U.S.
- **>153 million V-RG baits** distributed in U.S. since 1992
- Coordinated ORV with V-RG has resulted in 3 major accomplishments in the U.S.



Cooperative Rabies Management Program Accomplishments

- ❑ No canine rabies in U.S. since 2004, declared free in 2007
- ❑ One gray fox rabies case in Texas since May 2009
- ❑ No appreciable spread of raccoon rabies to the West
- ❑ Also: No cases of bat-like virus in gray foxes near Flagstaff, AZ
- ❑ Also: Conducted broad scale ONRAB Field Trials in 5 states (2011-2014)



Global Rabies Statistics



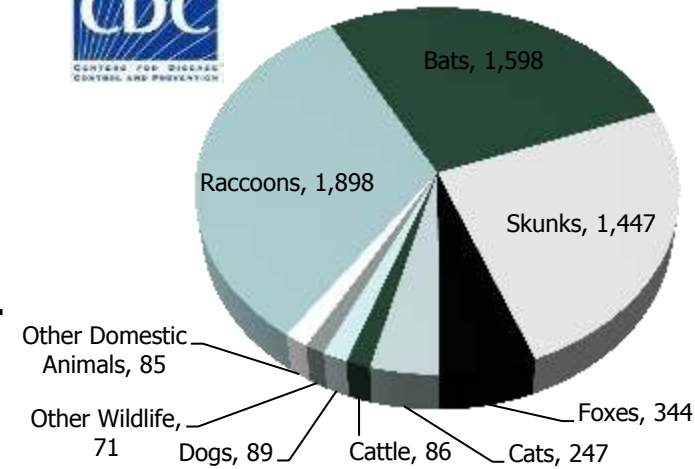
- Occurs in >150 countries and territories
- >70,000 people die each year worldwide from rabies
- >20 million people receive rabies prophylaxis annually
- Global rabies burden >\$6 billion annually
- Hotspots: Africa and Asia (dogs = 90% of exposures)



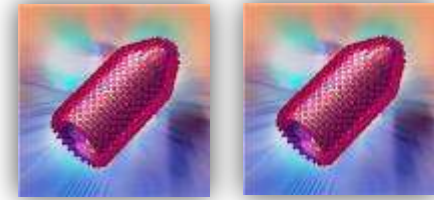
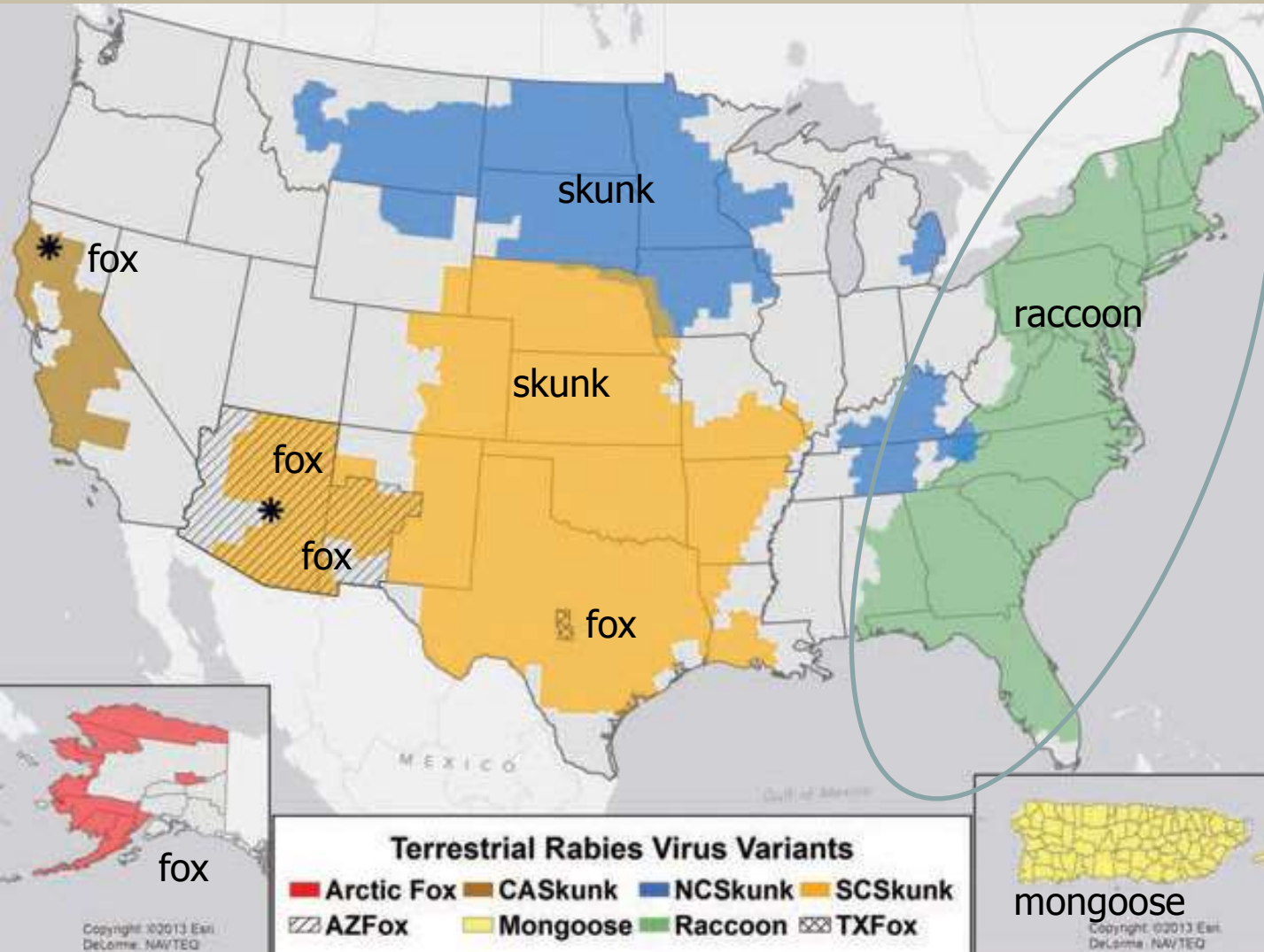


U.S. Rabies Statistics (2013)

- 5,865 rabies cases (incl. 3 humans)
- 92% of rabies cases were in wildlife
- Up to 40,000 people exposed per year
- >\$300 million annually



Terrestrial Rabies Virus Variants 2013



Variants adapted to specific reservoir species

Found in broad geographic regions

8 terrestrial variants
& 2 potential host
shift events.

Current ORV Distribution in the U.S. (2014)



Baits Distributed: **8,198,991**

Distance Flown: **274,167 km**

Area baited: **162,902 km²**

Hours of Flight: **1,133**

Across **15 States**



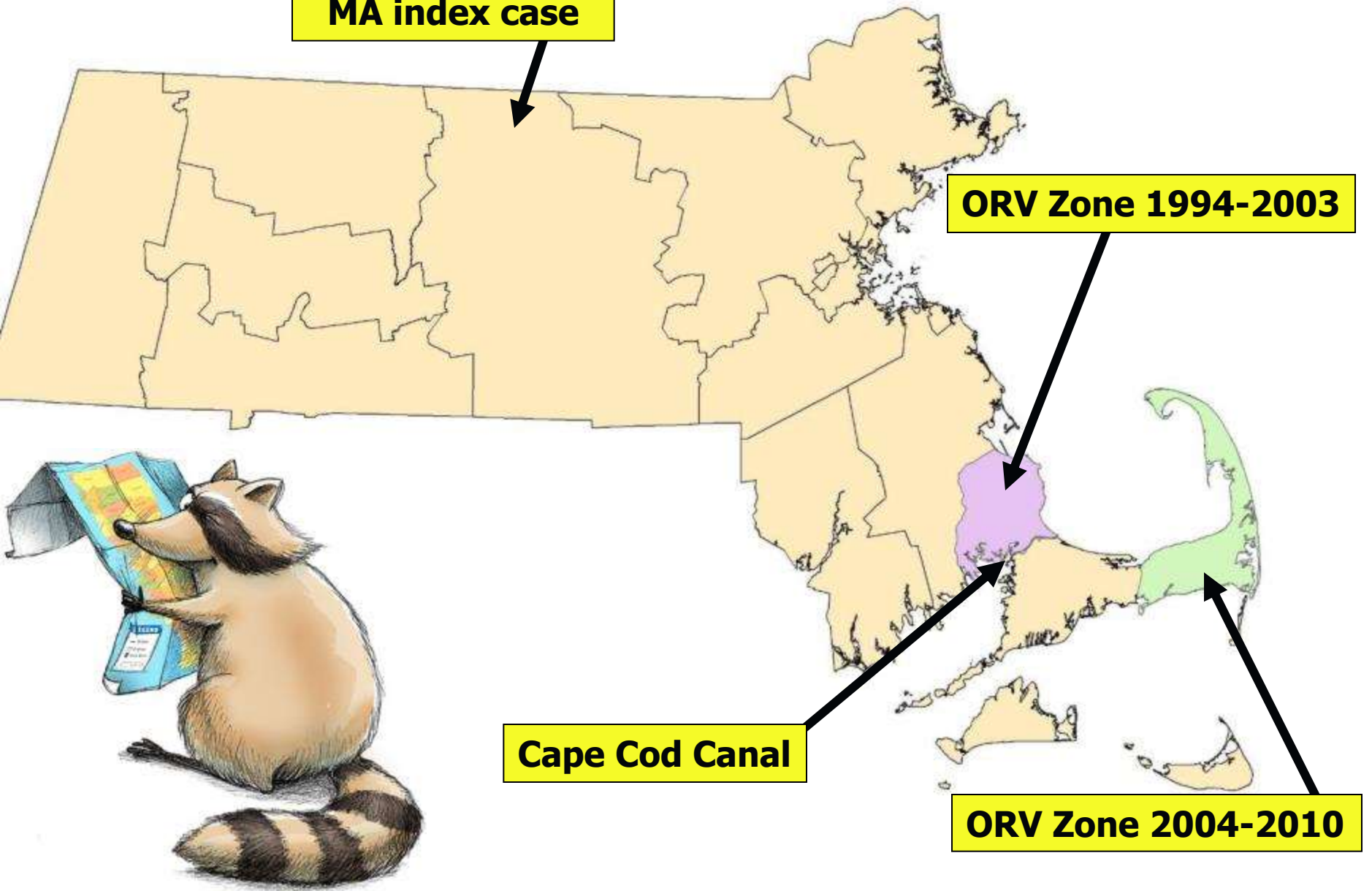
Massachusetts ORV History

**September 1992
MA index case**

ORV Zone 1994-2003

Cape Cod Canal

ORV Zone 2004-2010



Cape Cod, Massachusetts

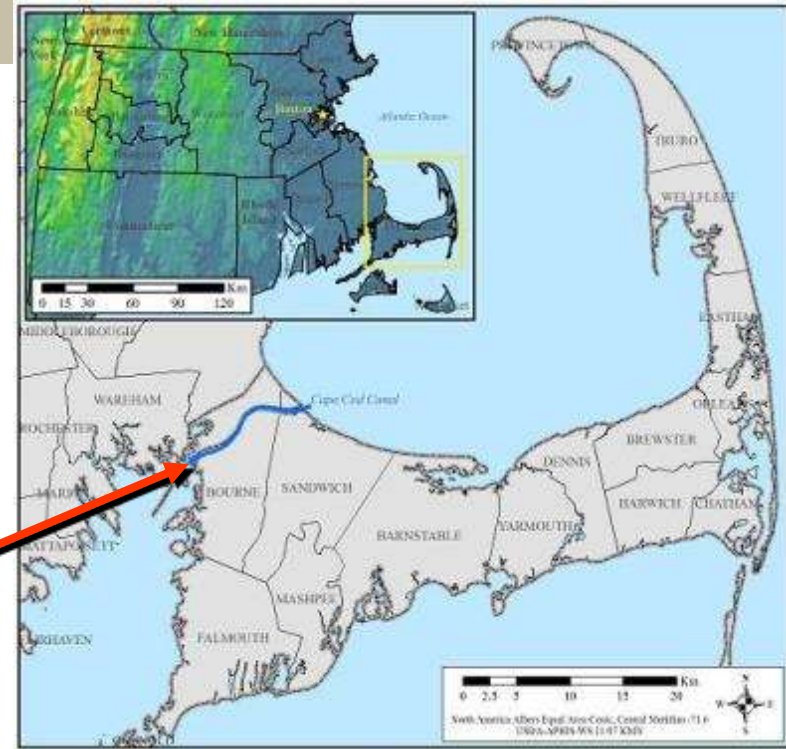
- **Area: 1,033 km²**
- **Popular recreational destination south of Boston**
- **Permanent Population of 214,990**
(2013 estimate)
- **Summer Population >712,000**



Cape Cod, Massachusetts

Cape Cod Oral Rabies Vaccination Program (CCORV)

- Cape Cod Canal: 28 km x 146 m
- Historical ORV barrier: 420-712 km²



- 1994-2004: Oral Rabies Vaccination (ORV) barrier/Canal apparently protects Cape
 - 2003: concern over cases proximal to canal
- March 2004: Barrier breach detected!**
- Emergency response: Trap-Vaccinate-Release (TVR), ORV, and enhanced surveillance

Urbanized Habitats



CCORV Rabies Surveillance

- **Passive public health surveillance**

- Human exposure
- Pet/livestock exposure

- **Enhanced rabies surveillance**

- Roadkills
- Nuisance wildlife
- Euthanasia of sick-acting wildlife
- Deceased wildlife

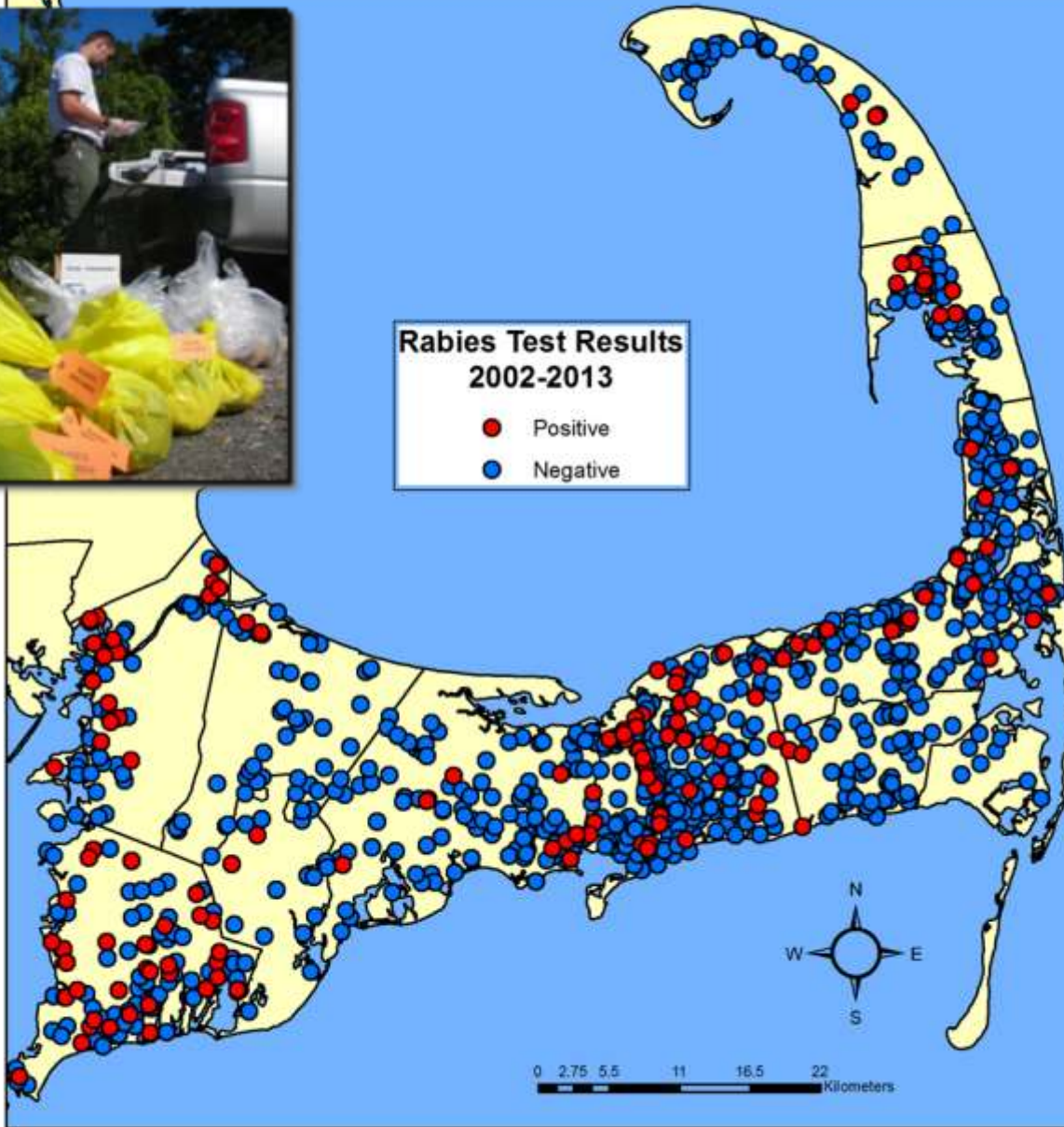


Cape Cod Rabies Surveillance (2002 - 2014)



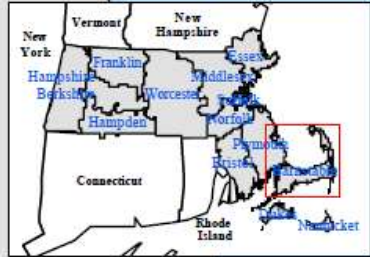
**Rabies Test Results
2002-2013**

- Positive
- Negative



Year	# Positives
2002	0
2003	0
2004	124
2005	157
2006	74
2007	5
2008	10
2009	8
2010	11
2011	7
2012	4
2013	2
2014	0

Cape Cod ORV Zones – 2004-2008



2004 ORV

Cape Cod Canal

2005 ORV

**2006-08
ORV**

2009-2010 Cape Cod ORV

ORV Bait Stations

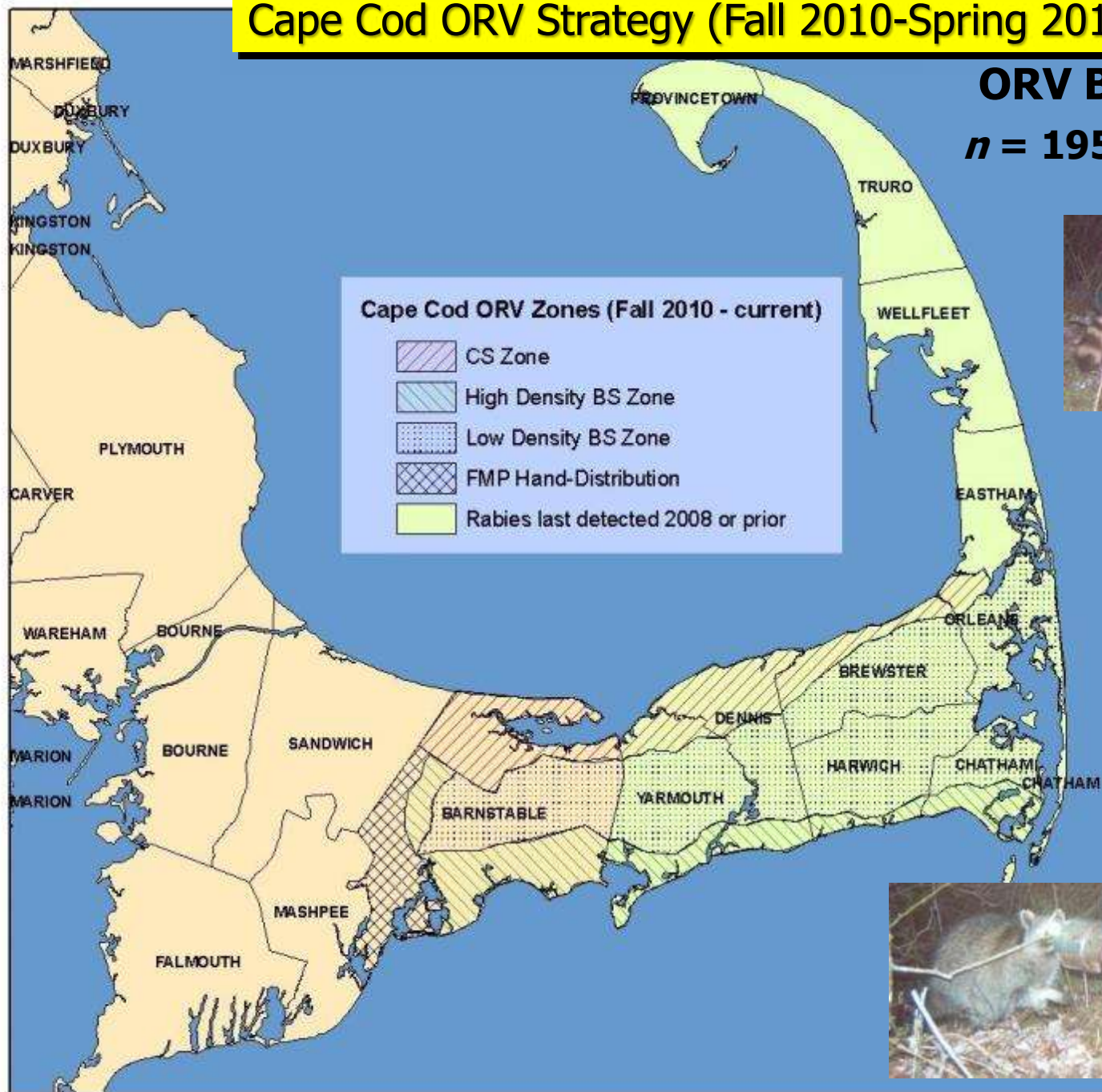
$n = 104 - 116$ bait stations

2009-spring 2010



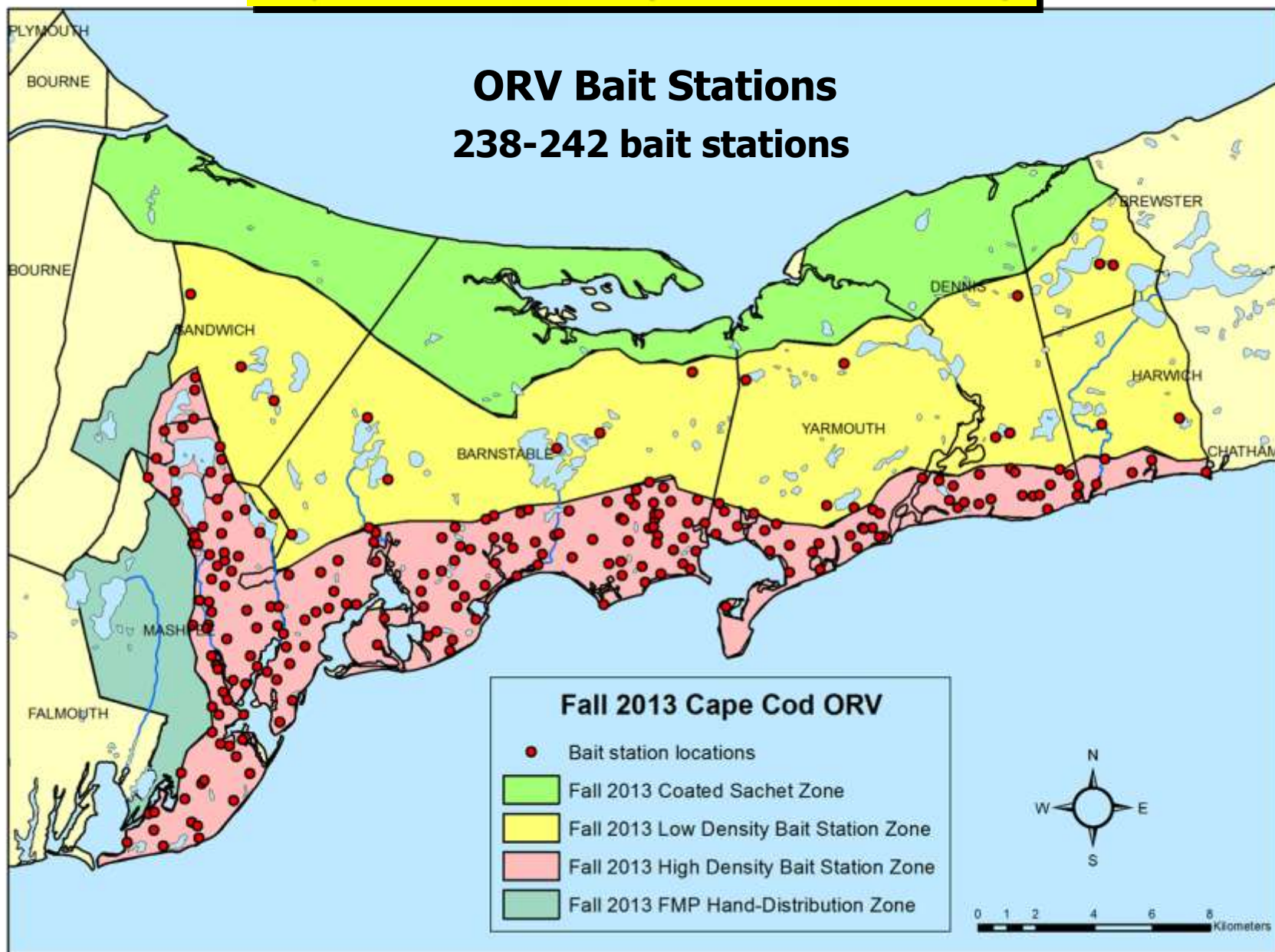
Cape Cod ORV Strategy (Fall 2010-Spring 2013)

ORV Bait Stations
 $n = 195$ bait stations



Cape Cod ORV Zone (Fall 2013 – Current)

ORV Bait Stations 238-242 bait stations



Raccoon Population Data

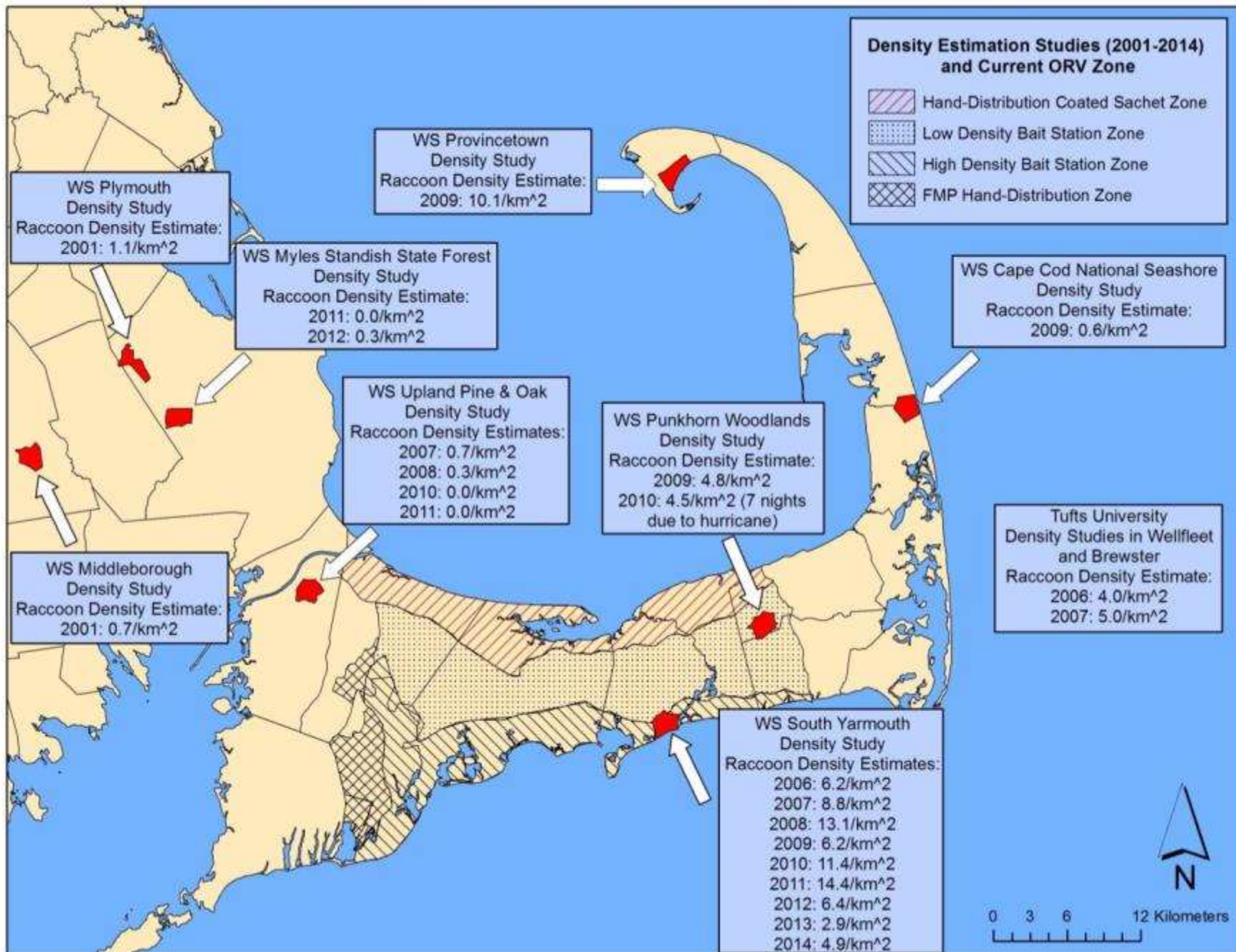
Density estimation procedure:

- 3 km² study areas
- 10 days (modified under low and high density protocols)
- 50 traps (moved after 2-4 days no captures)
- Marking/data collection
- Minimum number alive procedure

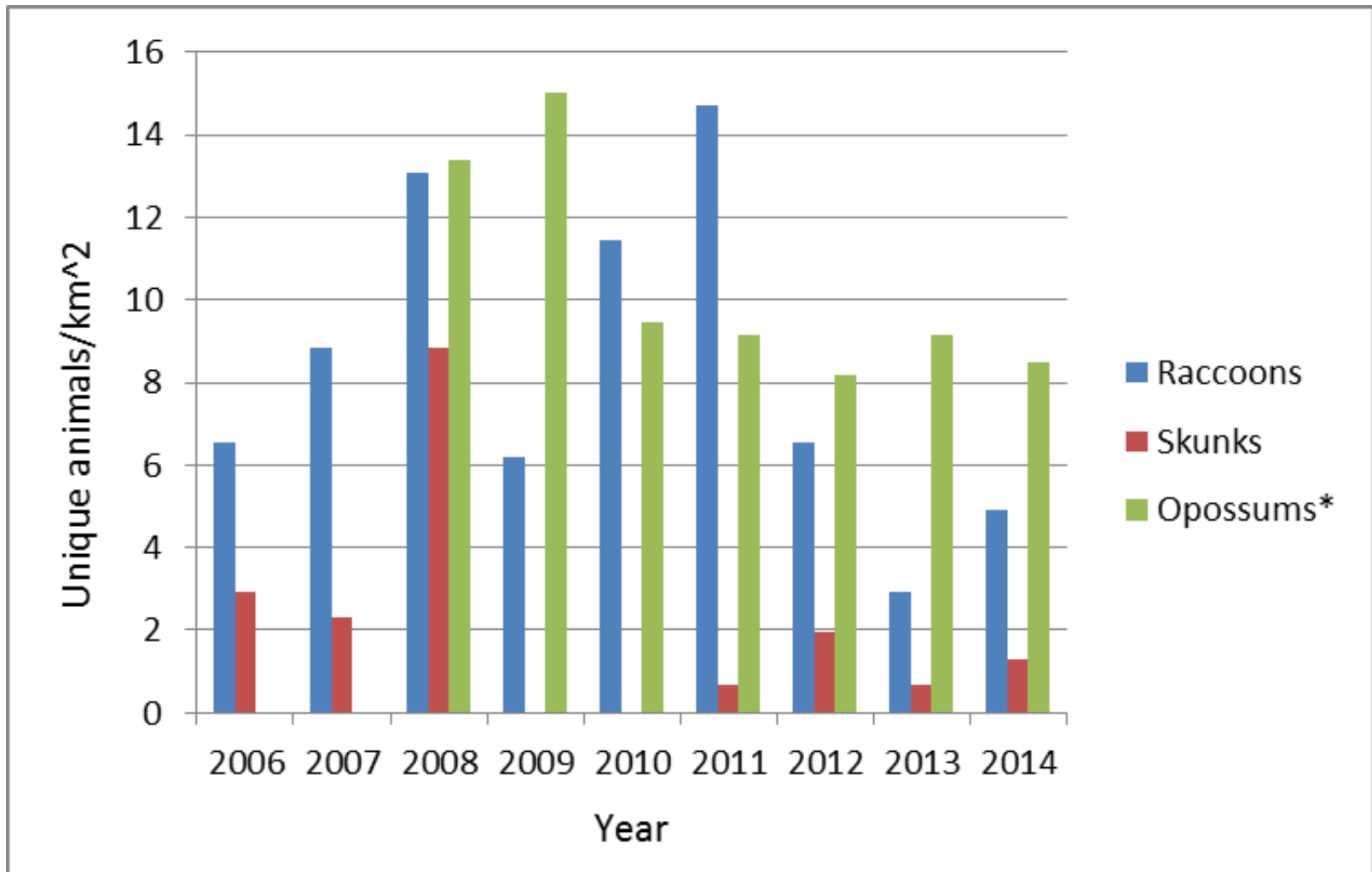


Post-ORV Sampling





South Yarmouth Density Study – 2006-2014



Future ORV-Related Pilot Studies in MA and FL



- **Non-target exclusion trials at ORV bait stations:**
 - **Revisit bait station opening trials**
 - **Bait station deployment height trials (Spring and summer 2015)**
- **Revisit ORV bait station temperature trials**
- **Analyze data collected at each bait station location since 2006 regarding bait-uptake**



Future ORV-Related Pilot Studies in MA and FL

- **Use of raccoon and/or coyote urine as repellant for non-targets?**
- **Increasing efficiency**
- **Disposable/biodegradable bait stations?**
 - **Cardboard, hemp, etc.?**
- **Fire ants – will repellants keep them off of bait stations (Summer 2014, FL)?**
 - **Will this deter raccoons?**
 - **Will this translate to something useful for aerially-distributed baits?**



Potential 5-Year Cape Cod ORV Goals

- 1. Elimination of raccoon-variant rabies from peninsular Cape Cod**
- 2. Establishment of a permanent buffer using ORV bait stations on mainland**
- 3. Collaborate with NRMP & NWRC to continue bait station research in urban and suburban settings**



30-mile buffer to protect Cape Cod from terrestrial rabies

USDA-APHIS-WS

Disease Surveillance Projects

- Tularemia
- Leptospirosis
- Avian Health (AI, NDV, Arboviruses, Salmonella, Bornavirus)
- Feral Swine Diseases (CSF, Swine Brucellosis, FMD, Pseudorabies)
- Blue Tongue / Epizootic Hemorrhagic Disease
- Plague

Zoonotic Disease



Reported cases of tularemia, United States, 2001-2010



* Not placed uniformly within County of residence for each confirmed case

Lyme Disease Human Risk Map



High risk
Transitional area
<95% confidence
Low risk



Zoonotic Disease



FAD/Zoonotic Disease



Counties with Feral Swine Reported by Wildlife Services

■ Feral Swine Reported



- NWDP Feral Hog Disease Surveillance Program
- Classical Swine Fever
 - African Swine Fever
 - Foot and Mouth Disease
 - Pseudorabies Virus
 - PRRS
 - Porcine Circovirus Type 2
 - Swine Brucellosis
 - Swine Influenza Virus
 - Toxoplasmosis
 - Trichinosis

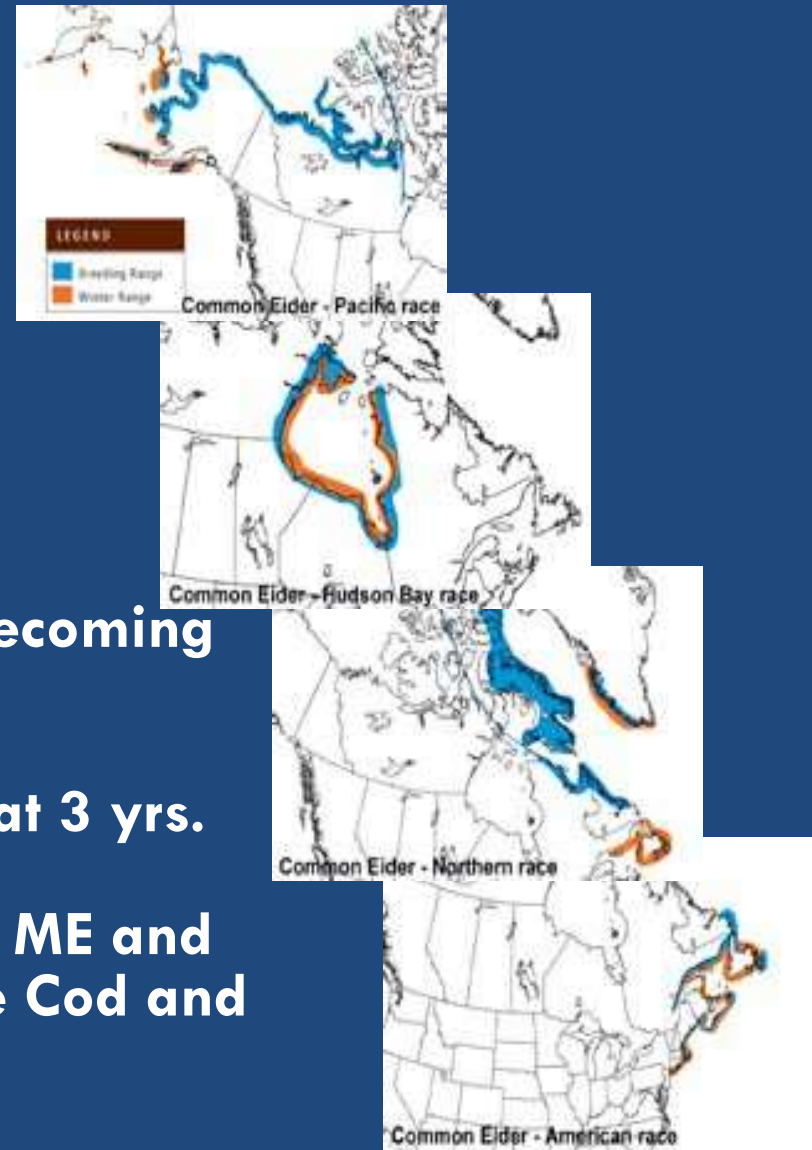
Common Eider (*Somateria mollissima*) = COEI



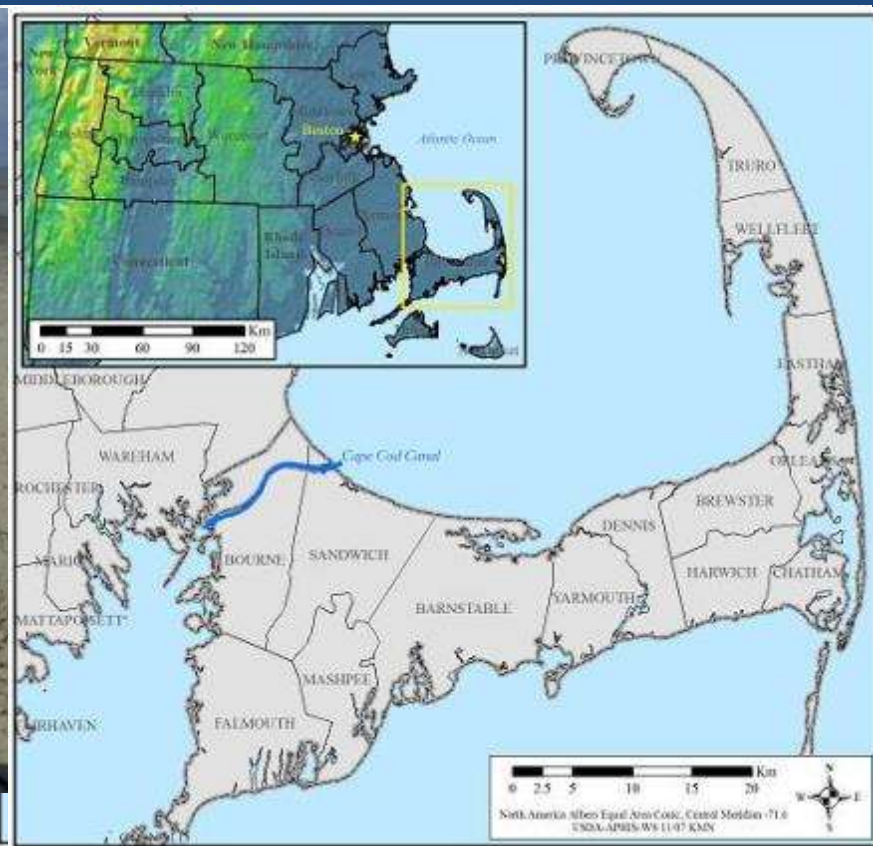
Photo Courtesy Andreas Trepte

Common Eider Natural History

- Four subpopulations in N.A.
- Feeds on mollusks, crustaceans, and echinoderms.
- Ground-nester on coastal islands. Clutch size of 1 – 6 eggs.
- Hens incubate eggs continually for 24-26 days, often to the point of becoming emaciated.
- Females mature at 2-3 yrs., males at 3 yrs.
- Thousands of common eiders from ME and eastern Canada overwinter at Cape Cod and Nantucket Sound.



Jeremy Point, Wellfleet, MA



Clues Left Behind



Source Population: Genetics (USGS AK Science Ctr), Isotope Patterns (Canadian Wildlife Service) and Band Recoveries (USGS BBL)



Clinical Signs

- **Lethargy, low/no coordination, respiratory distress, diarrhea, seizures and emaciation.**



Diagnostic Findings:

Southeastern Cooperative Wildlife Disease Study & USGS National Wildlife Health Center

- Systemic viral infection, multi-organ necrosis/inflammation, some high acanthocephalan/cestode parasite loads.
- Novel Orthomyxovirus (Genus Quaranjavirus) isolated from livers, tentatively named the Wellfleet Bay Virus (WFBV).



Phylogenetic relationships

Influenza A/B/C virus



Thogotovirus



Isavirus



Quaranjavirus



Quaranjavirus genus

Tyulek (Tjuloc) virus (TLKV)



Quaranfil virus (QRFV)



Cygnat River virus (CyRV)

Johnston Atoll virus (JAV)



Wellfleet Bay virus (WFBV)

Lake Chad virus (LKCv)



Floating Mist Net for Live Capture



Photos Courtesy K. Mueller

Hand Nets for Live Capture



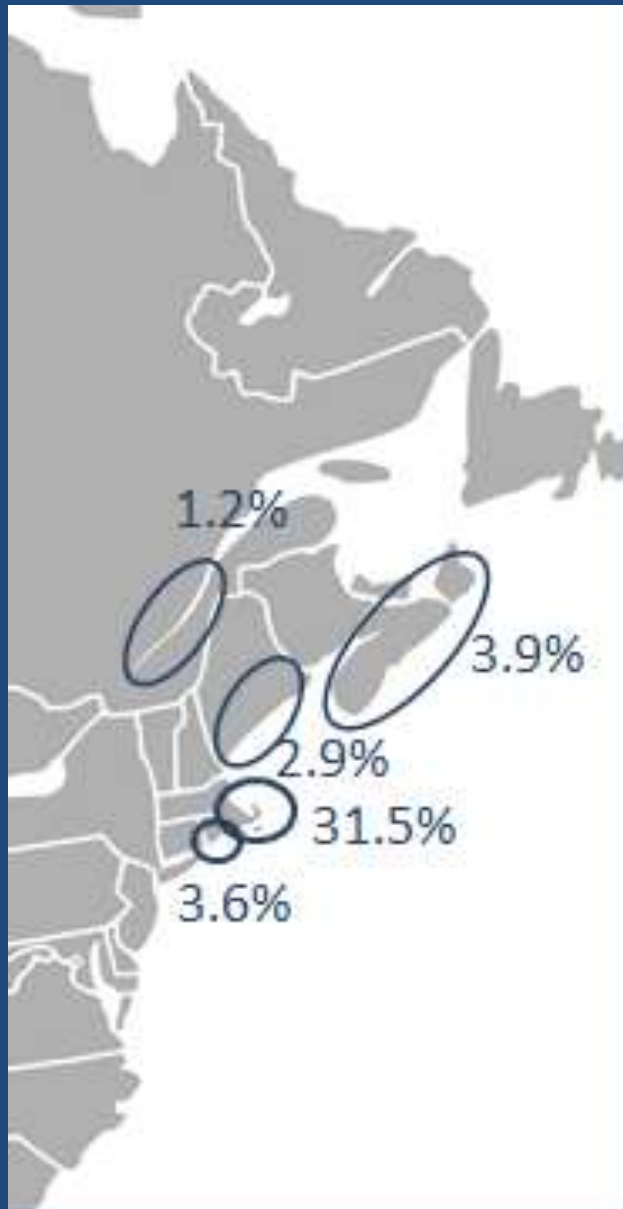
Sample Collection Process Providing Virus Surveillance Samples to Researchers



COEI Serology Study

- Targeted collections in Québec, Nova Scotia, and Maine (2012-2013)
- Opportunistic samples Québec, Maine, Nunavut, Iceland
 - Serum banks (2004-2010)
 - Concurrent research (2011-2014) Apparently healthy birds nesting on Calf Island
- Total data points: 2516
- Antibodies detected in Eastern Subspecies
 - Not detected prior to 2006
 - Seroprevalence highest in Massachusetts
- No antibodies detected in Northern Subspecies (*S.m. borealis*)

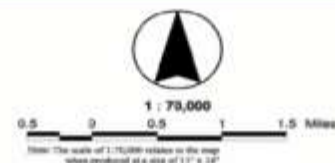
Serology Study



Results

- Nova Scotia 7/179
- Maine 11/383
 - After 2006, 11/344 (3.2%)
- Massachusetts 57/181
- Rhode Island 5/137
- Québec 8/669
 - After 2006, 8/493 (1.6%)

Boston Harbor Islands National Recreational Area



This map was produced by the U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Region 5, Hattley, MA.

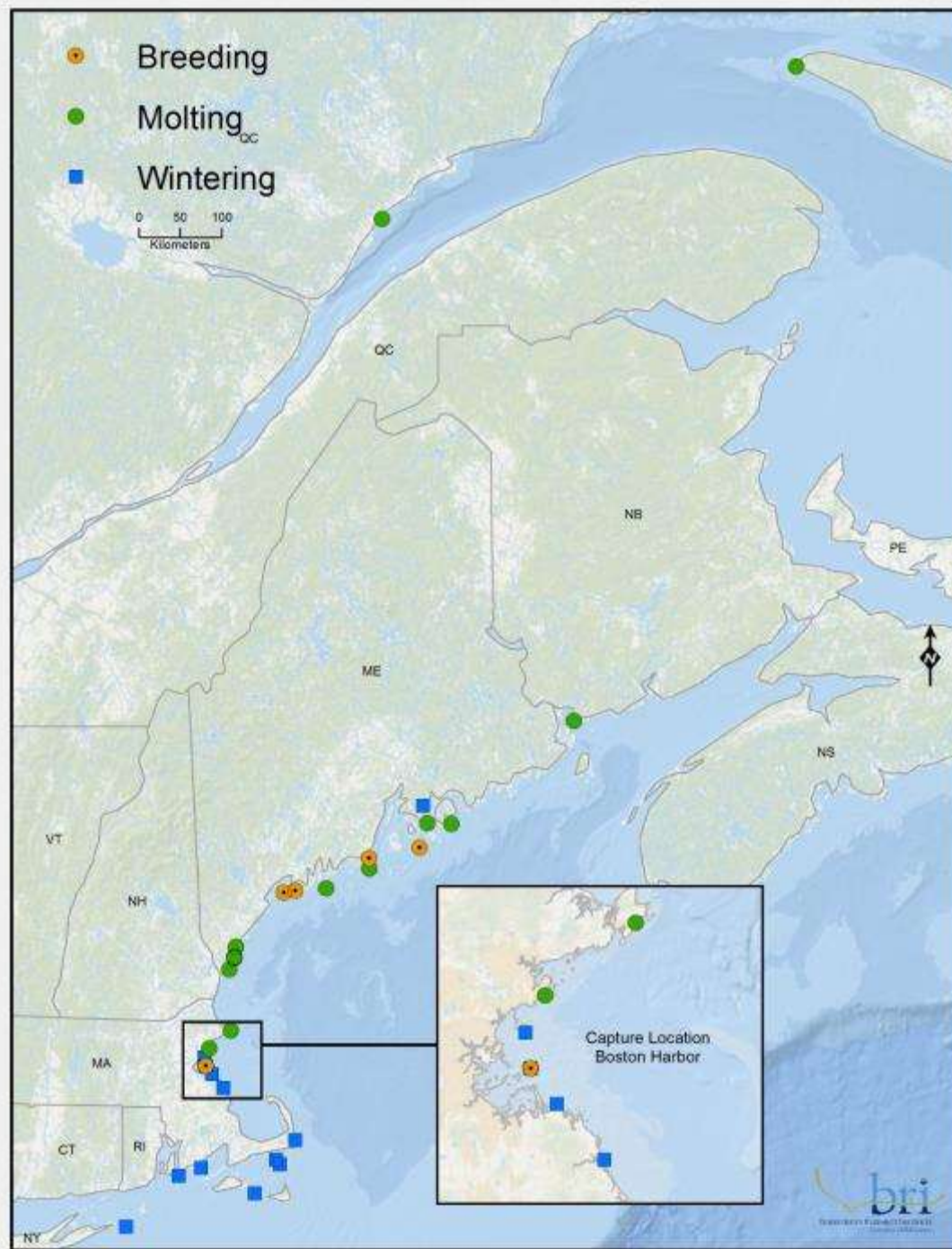


MA DCR & MWRA Facilities/Equipment/Personnel Providing Access to Boston Harbor Islands



Satellite Telemetry – Eider Movement Study





Ecto-parasite Search via CO₂ Tick Trapping & Nest Material Sampling



Genetic Diversity and Evolution: Cyclic Avian Mass Mortality in the Northeastern United States Is Associated with a Novel Orthomyxovirus.

Andrew B. Allison, Jennifer R. Ballard, Robert B. Tesh, Justin D. Brown, Mark G. Ruder, M. Kevin Keel, Brandon A. Munk, Randall M. Mickley, Samantha E. J. Gibbs, Amelia P. A. Travassos da Rosa, Julie C. Ellis, Hon S. Ip, Valerie I. Shearn-Bochsler, Matthew B. Rogers, Elodie Ghedin, Edward C. Holmes, Colin R. Parrish, and Chris Dwyer

J. Virol. January 2015 ; 89:2 1389-1403



What's Next?

- Deploy 16 GPS transmitters on Calf Island COEI.
- Collect comparison serum/swab samples from BOHI COEI.
- Collect serum/swab samples from co-located HERG & DCCO for evidence of other species' involvement.
- Tick/Mosquito infectivity trials (Ft. Detrick, U. S. Army)
- Wellfleet Bay Virus Workshop to report on findings, share information, and plan future study.



<https://www.usajobs.gov/>