Domestic/Wildlife Interactions:

Mycoplasma ovipneumoniae

in Alaska

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Alaska Situation

- Proposals to Board of Game // Alaska Dept. of Fish and Game (ADF&G)
  - Remove Sheep and Goats from the “Clean List”
  - Permit required by ADF&G:
    - To import sheep or goats into the State of Alaska
    - To own sheep or goats within 15 air mile of wild sheep habitat
  - Health certification – free of *Mycoplasma ovipneumoniae*
  - Containment of sheep and goats in an “approved facility”

Mycoplasma ovipneumoniae (M. ovi)

- Sporadic Pneumonia outbreaks; some large die-offs (75-90% mortality) of bighorn sheep (BHS)
- Some reports of reduced BHS lamb survival following the pneumonia outbreaks - *sustainability*
- Wild sheep – reports of *low resistance* to some respiratory pathogens of domestic sheep/goats

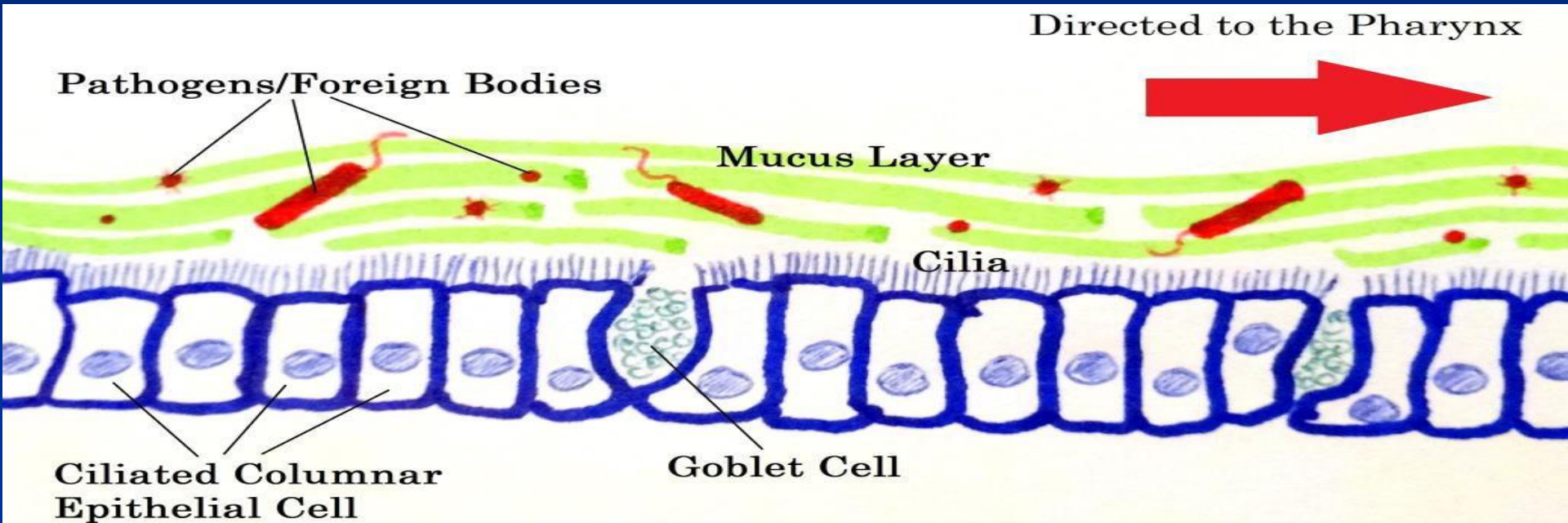
M. ovi typically causes relatively mild disease in domestic sheep

- ‘Coughing syndrome’ in young lambs
- Reduced growth rate and weight gains
- Severe pneumonia has been reported, especially in young goats

- NAHMS Sheep study:
  60 -80 % of large farms had M. ovi detected
- USDA Pack Goat Study:
  < 4% of farms (+) detected

Mycoplasma ovipneumoniae (M. ovi)

- Illness sheep and goat species (Caprinae)
  Reported that clinical illness may be more severe in wildlife
- *"Carrier status"* in sheep and goats
- Diagnostic testing challenging
  - Bacteria difficult to culture
- Pathology by disrupting lower airway function



Yukon Order 10-30-18

- No farms above 1,000 meters elevation
- Premises registration, annual inspection
- Fencing requirements
- Animal ID, inventory and records
  - Any births, purchases, imports, deaths recorded
- Annual testing for pathogens of concern
  - Animals that are (+) or carriers > destroyed
- Movement by permit only
- Immediately report any escapes

Impacts of Pathogen Exposure

- Ecosystem Approach – "**One Health**"
- Science based evaluation
  - Need for an objective approach
  - Defensible data
- Risk Analysis: after gathering the facts
  - Risk vs benefit and Cost of proposed action
- Do we really know enough to make a sound decision?
  - Can you afford to delay taking action?

Respiratory Disease

- Pneumonia Outbreak :**Multifactorial** and involve **Multiple Pathogens**

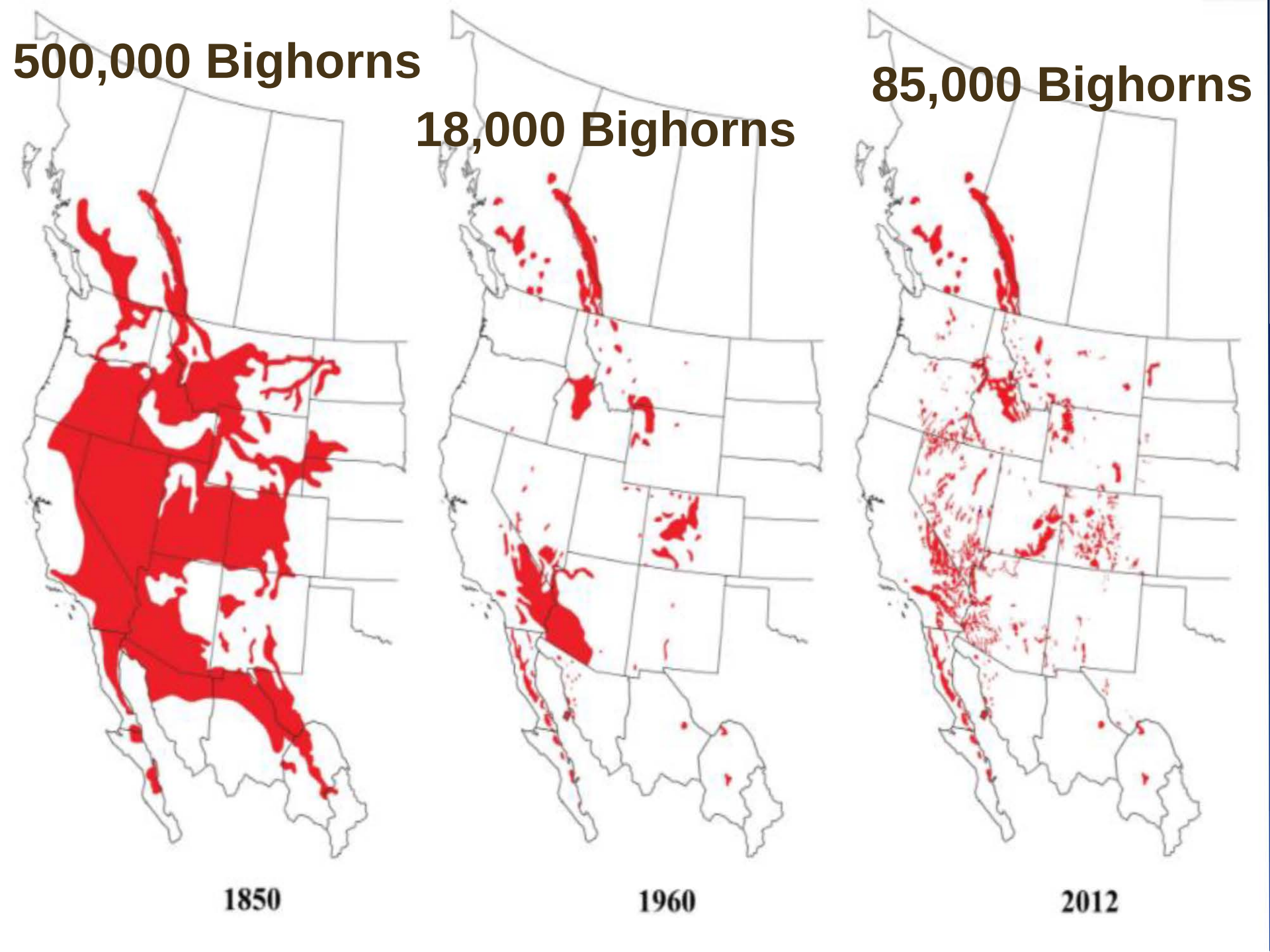
- *Mycoplasma ovipneumoniae* (*Movi)*
- Pasteurella bacteria
  - *Pasteurella haemolytica*
  - *P. haemolytica*
  - *P. trehalosi*
- *Fusobacterium necrophorum*
- Other bacteria (*Truperella pyogenes*)
- Respiratory viruses

Disease is Multifactorial

- Presence of the Pathogen – dose, virulence
- Combination of many factors are involved:
  - Health stressors – other parasites, pathogens
  - Population density -
  - Nutrition –protein, energy, mineral, water
    - Quality of graze/browse – carrying capacity
  - Fragmentation and restriction of range/habitat –
    - Wildlife may be more susceptible to clinical disease
  - Human interaction: *competition for resources*
    - tourism, hunting, urban expansion
    - Interaction with livestock
- Not a simple issue, no easy solution

What is the situation in the Western States?

- Bighorn sheep: Population Decline 15,000 - 18,000 estimated in 1960….
- Urban expansion = Habitat loss, hunting pressure, competition with domestic livestock
- Morbidity/Mortality events: respiratory disease
- Focus on wildlife conservation: Recovery
  - habitat preservation, reintroductions, focused management efforts


500,000 Bighorns
18,000 Bighorns
85,000 Bighorns
1850
1960
2012

Alaska: Unique Situation

- Not comparable to Western U.S. or Canada
  - No history of morbidity/mortality events
- Minimal fragmentation or loss of habitat
- Smaller number of farms and livestock
  - **~110** Sheep/Goat farms (NASS statistics)
  - Average <13 animals/farm (**~2,000** sheep, goats)
  - Low density: ⇩ probability for interaction
- Fewer importations/year
- No free grazing, animals are contained /fenced, some degree of separation


WASH.
OREG.
CALIF.
NEV.
IDAHO
MONT.
WYO.
UTAH
ARIZ.
COLO.
N. MEX.
N. DAK.
S. DAK.
NEBR.
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MD.
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N.J.
CONN.
R.I.
MASS.
VT.
N.H.
ME.
San Francisco
Jacksonville
0
250
500
MILES

Wild Sheep Working Group

- Organized by the Alaska Farm Bureau and the Wild Sheep Foundation
- Discuss options and strategies for prevention of wildlife / livestock interaction
  - Regulations
  - Separation – no contact
  - "M. ovi free status" – must be defined
- Need for Alaskan data. Evaluate prevalence of M. ovi in domestic sheep and goats

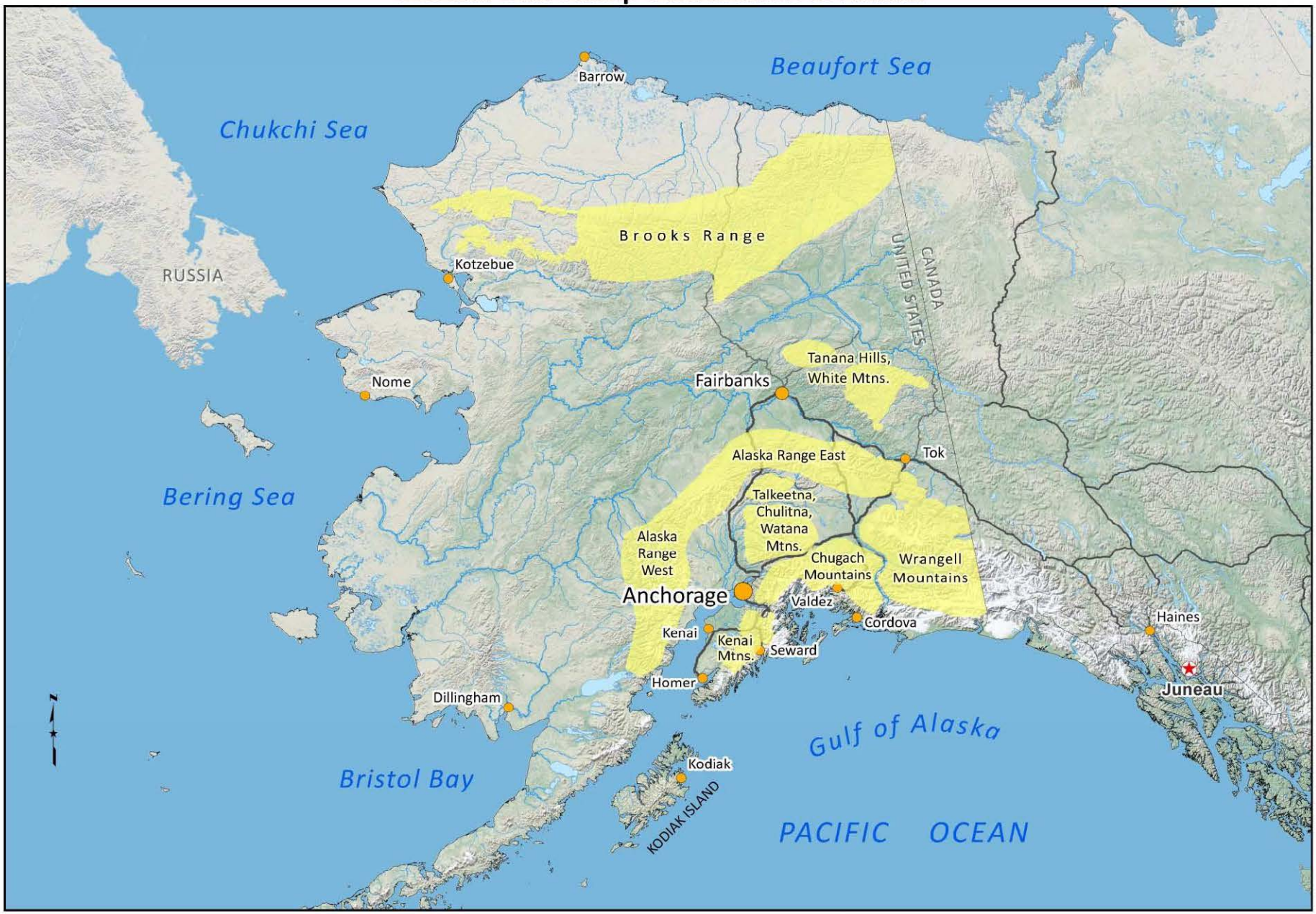
Livestock Study Protocol

- Using USDA, NASS statistics develop a sampling plan to evaluate AK farms
- Domestic livestock sample collection:
  - Veterinarians to collect samples
    - Client/patient confidentiality – used farm code
  - Follow protocol established protocols
    - Nasal, conjunctival swabs and serum
  - Nasal Swabs submitted to 2 Laboratories:
    - Animal Disease Research, (ARS-USDA) Lab
    - Washington State Animal Diagnostic Lab: WADDL

USDA NASS 2012 Farm Census

# Farms	Aleutian -Kodiak Islands	Southcentral Anchorage-MatSu-Valdez-Cordova	Kenai Peninsula	Interior/ Fairbanks Delta - Yukon to Canada	Southeast	Total farms
Sheep	2	25	7	14	2	50
Goat	1	27	10	15	3	56
Total	3	52	17	29	5	106
# Animals						Total animals
Sheep	42	326	147	216	42	773
Goat	6	343	52	177	18	595
Total	48	669	199	393	60	1,368

General Dall Sheep Distribution in Alaska



Data Sources:
ADFG
ESRI Data & Maps, 2004

0 50 100 200 300 400 500 Miles

Alaska Dept. of Fish & Game
2014

Study Protocol

- Voluntary participation
  - Evaluate farms in each region
- Survey completed by farmer
  - Focus on management and husbandry practices
- All animals tested on the farm, repeated (3x) sampling at ~ 4 and then 8 weeks later
  - Duplicate Nasal Swabs ~ 20% of animals on farm
- Data returned to the Veterinarian/client and summary data to State Veterinarian

Acknowledge the **Collaborative Partnership**

- Office of the State Veterinarian
- Department of Fish and Game
  - Kimberlee Beckmen
- USDA-ARS
  - Maggie Highland
- Washington State Animal Diseases Diagnostic Laboratory
  - Jim Evermann, David De Avila

Current Results for the Study

- 43 farms: (samples from 656 animals)
  - 7 of 43 were sheep farms
  - 4 of 43 had both sheep and goats
  - 32 of 43 were goat farms
- 11 of 43 farms (26 %) M. ovi was detected
  - sheep farms 4/7 (57%)
  - goat farms 4/32 (12%)
  - consistent with finding of some other studies
- 32 of 43 **(74%)** had no Movi detected

M. ovi: Summary Data

	#	Non - Detect	Detected	% Prevalence
Total # Animals	656	631	25	3.8%
Goats	485	473	12	2.5%
Sheep	171	158	13	7.6%

Comparison of Laboratory Data

- **Study not an inter-laboratory comparison**
  - Duplicate samples - not identical**
  - Test (PCR) Methodology was not identical
- Total of 573 duplicate samples:

	Detected	Non-Detect	% detection
USDA-ARS	**33**	**540**	**5.8 %**
WADDL	**19**	**555**	**3.3 %**

- Results were extraordinarily similar
  - 95% concordance or agreement

ADF&G Wildlife Study Goals (2017-2020)

- Determine the distribution of M. ovi and other respiratory mycoplasma in Alaskan wildlife ungulates
  - Evaluate proximity to domestic animals
  - Culture and isolate as possible, genotype and then compare genotype (strains) of Mycoplasma spp. found in Alaskan wildlife

ADF&G Wildlife Study Goals

- Evaluate the impact of *Mycoplasma* spp. on herd health of wild ungulates
  - Herd performance and survival over time
- Evaluate the interaction of different wildlife species and the threat of pathogen spread
- Establish a sound study design for future surveillance:
  - Laboratory concordance study
  - Evaluate factors influencing detection probabilities

ADF&G Wildlife Study

- Nasal swabs, blood samples collected:
  - Routine wildlife population surveys
    - (Dall sheep, Mtn Goat, Moose, Caribou, Bison, Muskox)
  - Morbidity/Mortality investigations
  - Evaluation of captive wildlife populations
- Nasal swabs collected from hunter harvest
- Summer to Fall 2018: (collection continuing)
  - > 800 samples to USDA ARS
  - > 500 samples to WADDL

2018 Hunter Harvested Sampling: Priority Species

- Dall's sheep: (>331 sampled)
  - Sheep were collected 2017
- Mountain goats: (>113 sampled)
- Caribou: (>120 sampled)
  - Collaboration with Canadian colleagues
- Moose: (> 94 sampled) - includes road kills

**** All samples must meet collection guidelines

ADF&G Wildlife Data

- Results were unexpected and surprising
- M. ovi detected initially in southcentral:
  - Mountain Goats
  - Dall's Sheep

  Then detected in other ungulate species:
  - Moose
  - Caribou
- (+) Dall's Sheep herds across entire State: Kenai Peninsula to North of the Brooks Range
- 1 Caribou respiratory mortality: (+) detection

In Press (Emerging Infectious Disease, online Oct, in print Dec 2018)

Emergence of *Mycoplasma ovipneumoniae* in wildlife species beyond the subfamily *Caprinae*

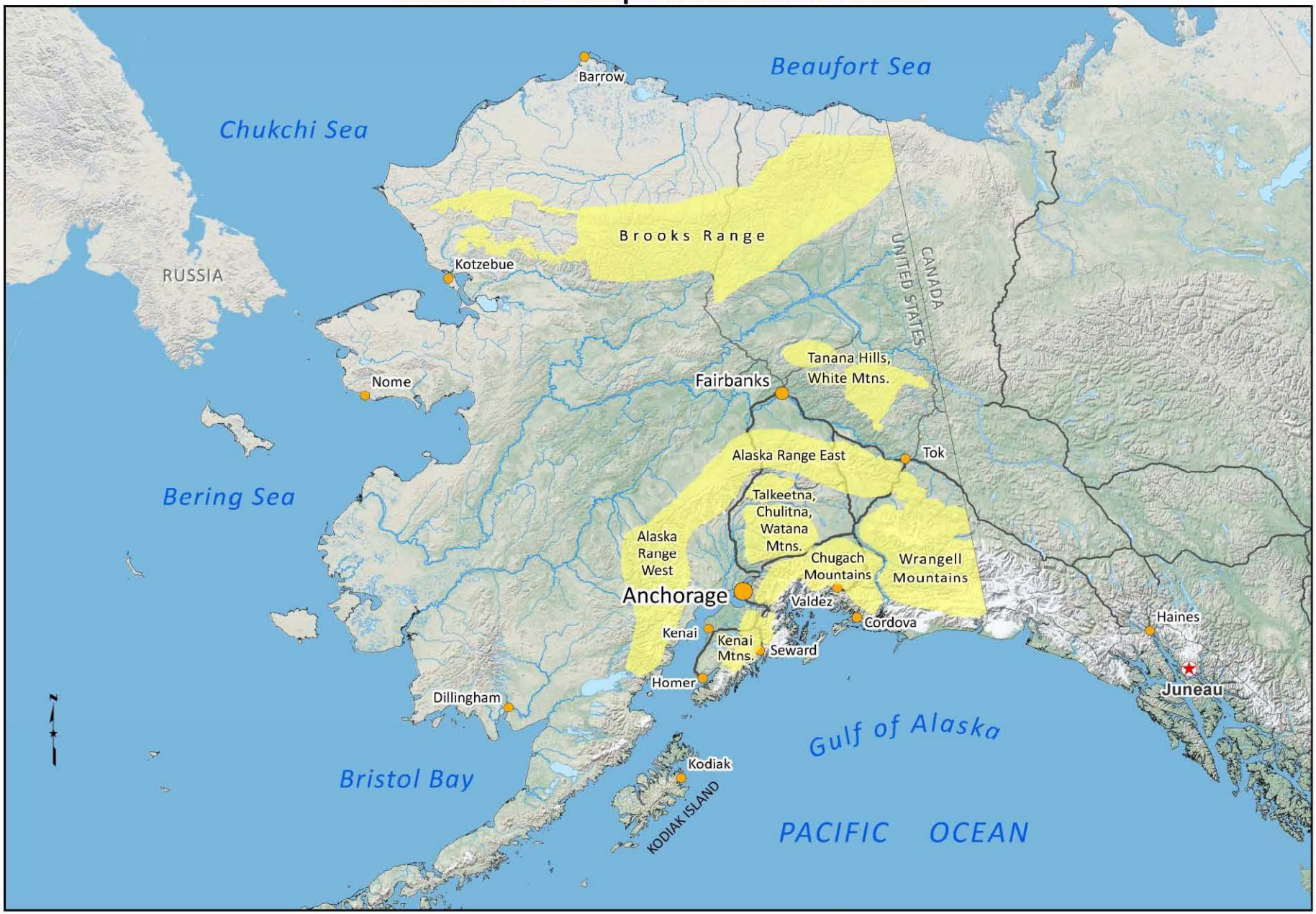
Highland, Herndon, Bender, Hansen, Gerlach, Beckmen

"Elucidating the emergence of *Mycoplasma ovipneumoniae*-associated respiratory disease in ruminants requires identification of pathogen host range. Preliminarily concluded to be host restricted to *Caprinae* subfamily species, we describe identification of this bacterium in moose, caribou, mule deer, and diseased mule and white-tailed deer."

Comparison of Preliminary Results Domestic and Wildlife

	Dom. Sheep	Dom. Goat	Dall Sheep	Mtn. Goat	Caribou	Moose
# Tested	171	485	184	43	421	362
# M. ovi Detection	13	12	12	5	21	9
% (+) Detection	7.6%	2.5%	3.4%	11.6%	5%	2.5%

General Dall Sheep Distribution in Alaska



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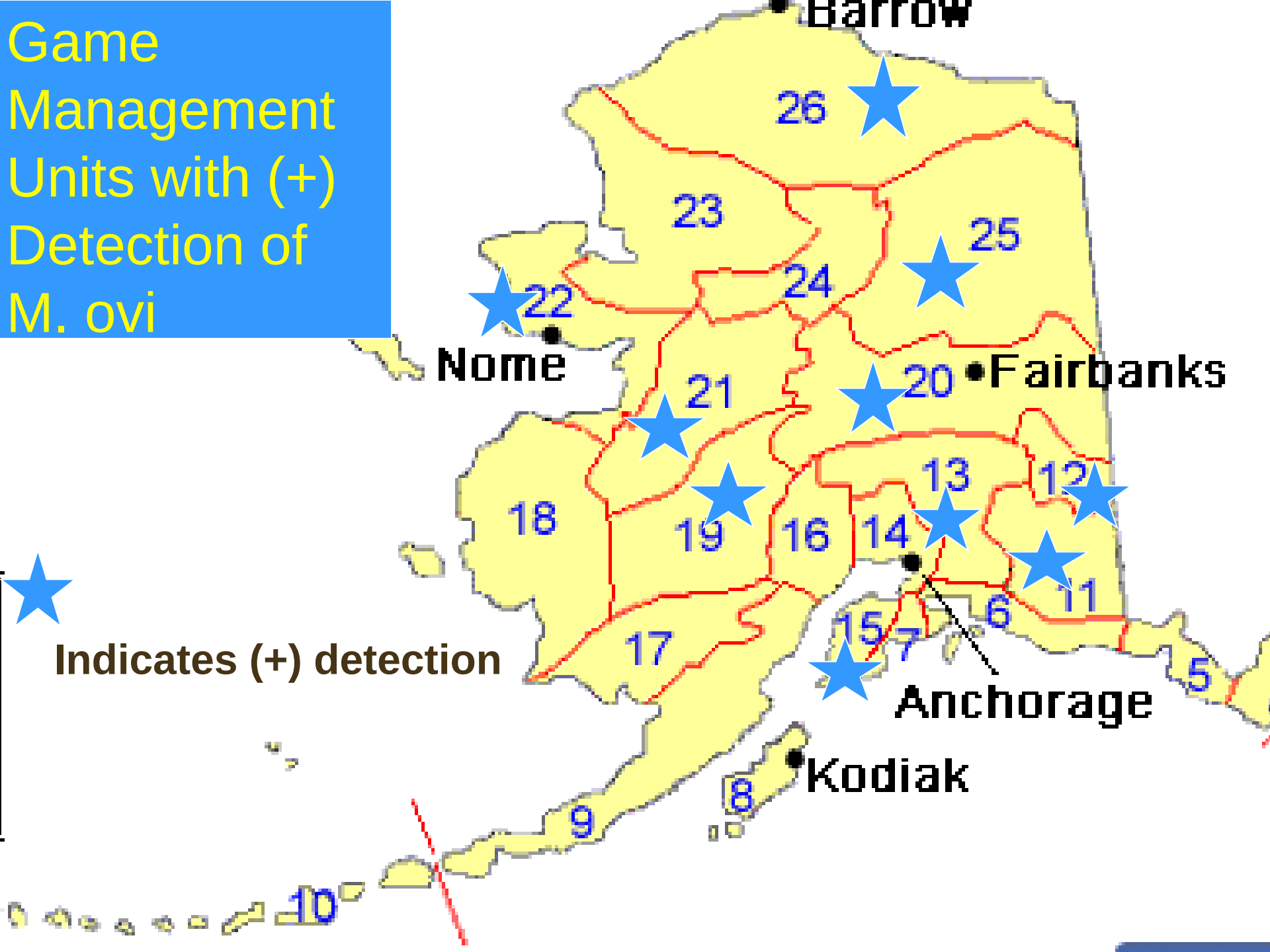
Game Management Units with (+) Detection of M. ovi



In Review (JWD)

Mycoplasma ovipneumoniae associated with polymicrobial pneumonia in a free-ranging yearling caribou (*Rangifer tarandus tarandus*) from Alaska, USA

Rovani, Beckmen, Highland

"*Mycoplasma ovipneumoniae* has to date been reported in association with respiratory disease only in members of the taxonomic subfamily *Caprinae*. This report represents the identification of *Mycoplasma ovipneumoniae* in a free-ranging caribou (*Rangifer tarandus tarandus)* calf with polymicrobial bronchopneumonia. "

- Detected by universal PCR at WADDL, then on M. ovi PCR, confirmed and cultured by USDA.

New Dynamic

- M. ovi : Present in Livestock & Wildlife
  - Prevalence ~ 4% in both groups
- M. ovi present in non-Caprinae Species
  - Changes the epidemiology dynamics significantly
- Environmental stressors – no change
  - Healthy, well managed habitat, ↓ fragmentation
  - Nutrition, population density, genetics
- Livestock / Wildlife interaction - very minimal
  - Farmers are controlling this factor and Improved guidelines are being developed to further ↓ risk

Next Steps in Alaska

- Dependent on the study results
  - Await results wildlife study (spring 2019)
  - Continue to collect samples from livestock (12/18)
  - Use data for RA and **Science Based Decision**

- Evaluate options for mitigation action:
  - No action *What are the costs?*
  - "M. ovi free status"
  - Management of livestock to decrease wildlife interaction or separation

Use a "One Health or Ecosystem Approach"

In Summary

- Domestic/Wildlife interactions may pose a threat to both wildlife and domestic animals
- Alaskan Collaborative Partnership:
  - Producers, wildlife biologist, veterinarians, Farm Bureau, State, Federal Agencies
- Acknowledge collaborative management strategies to reduce / mitigate Livestock/Wildlife interactions – ***the Agricultural community must <u>continue</u> to take the lead on this issue now***

Management Strategies

- Herd Health Plan / Biosecurity Plan - *written*
  - Veterinary Oversight: nutrition, vaccine, wormer
  - Animal ID
  - Report Morbidity / Mortalities – treatment plan
  - Disease Testing / Herd Certification
- Manage Fencing: clear both sides of fence
- Storage Feeds, isolate feed/water troughs
- Use of Livestock Guardian Dogs
- Reporting Escapees, strays - inventory
- Reporting Wildlife Sightings

Ecosystem approach: consider ***All*** impacts and consequences

Questions ?