WAFWA Wild Sheep Working Group Winter Meeting <u>NOTES</u>
@ Wild Sheep Foundation Convention
January 16, 1 pm – 5 pm & January 17, 8 am – noon
Reno Sparks Convention Center, Room A-8
Reno, NV

Introductions and Announcements (15 min)

WSWG Members in attendance: Amber Munig (AZ), Bill Jex & Helen Schwantje (BC), Tom Stephenson (CA), Andy Holland (CO), Hollie Miayasaki (ID), Bruce Sterling (MT), Todd Nordeen (NE), Mike Cox (NV), Eric Rominger (NM), Don Whittaker (OR), Chad Lehman (SD), Froylan Hernandez (TX), Jace Taylor and Rusty Robinson (UT), Rich Harris (WA), Doug McWhirter (WY), Melanie Woolever and Jenny Powers (NPS), Kevin Hurley and Clay Brewer (WSF)

> Others representing members: Brad Wendling (AK), Sandra Brewer (BLM), Rick Truex (USFS),
> A total of 70 people signed in on the Attendance Roster.

Genetics/Genomics Research Collaboration (60 min)

- Presentation by Josh Jahner, UNR post-doctoral student on bighorn sheep genomics research in Nevada.   Presentation Josh – Nevada. (see slides) Genotype by sequencing. Results from Desert BHS. 5 distinct genetic ancestries in Nevada.
    - Describing bighorn genetic structure for all Nevada bighorn herds using SNPs though focused on desert bighorn source herds; so far genotyping-by-sequence of 1,141 individuals (364 California, 657 Deserts, and 120 Rocky Mtn)
    - Highlight advantages of using SNPs
    - Compare genetic structure and diversity to history of desert bighorn remnant, reintroduced (single or mixed origins), and pioneering herds
    - Detected 4 main source desert bighorn herds using PCA and Bayesian clustering
    - Used a "wheel spokes" diagram to display the relatedness of herds shaped by translocation histories
    - Relatively low genetic diversity in source herds; acknowledged that SNPs tend to result in lower heterozygosity values than microsatellites
    - Detected 5 distinct genetic ancestries for desert bighorn in Nevada
    - Found Rocky Mtn bighorn where quit distinct from California bighorn; likely associated with distinct source stock used for both subspecies from Canada and U.S.
    - Future focus on source populations of pioneering herds, quantify hybridization among the 3 subspecies, and collaborate with other states on genetic structure and diversity across entire range;

- **Q&A**
  Rich – is heterozygosity low? Josh - Multiple ways for heterozygosity to happen. Was lower than expected.
  Don – Is 5 animals enough to characterize the population? Any fitness issues with low heterozygosity?
  Josh – With more loci you can get by with fewer animals and using simulations.   Mike – the Muddy Mtns had low genetic diversity but averaging 40/100 lambs and we have a ewe hunt on that herd to slow it down.
  Don – what about pioneering herds, did you have enough individuals. Josh – Only focused on one pioneering herd so far.

Bill – To get 17,000 SNPs did you use all of the animals. Josh – No we used a subset of the total samples; have confidence in those samples. Bill – are you calling hybrid herds distinct? Josh – hard to determine with cross borders, etc.…

Daniella– Lone Mt herd doing well but has Movi. Mike – Yes, one of those herds that we want to better understand why they have good herd performance; is it because of animal genetics or Movi strain or both?

- **Summary of current bighorn genetics research in other jurisdictions**
  Hollie – Evaluating genetic structure in all herds in Idaho.   California sheep populations look similar to each other and much different from Rocky Mtn populations. Some confounded by translocations. Also, looking at collection of historic horns and looking at genetic structure of those vs modern.
  Clay – Texas Tech University conducting similar effort on Texas bighorn herds
  Doug – Univ of Wyo and Holly Ernest doing something similar as well across Wyoming herds
  Tom – California past research. Michael Buchalski, CDFW staff genecist is careful about genetic sub-structures in desert sheep. California unique in that they have never had any translocated bighorn from other states survive. But recently do have accounts of bighorn along the OR and NV that occasionally venture into CA.
  Kevin – 2015 wild sheep translocation publication if anyone wants a copy
  Helen – How many folks are looking at health genomics? Interested in collaborating on that topic.
- **Merits of reaching out to all researchers and wild sheep managers on recent and current wild sheep genomics/genetics research and developing a collaborative group**
  Mike – hoping for endorsement on this type of collaboration. Rich and I reached out to geneticists and wild sheep managers in states/provinces active in genomics research through Survey Monkey (10 questions) and Doodle Poll. So far 14 folks identified for meeting next week.
  Don – Must be careful with this group potentially going in a lot of directions. Try to keep its focus on a management perspective (i.e., if genetic diversity is detected to be low in concert with low lamb survival, then work to improve herd performance).
  Mike – stay tuned as we move forward with this.
  Kevin – Thinking ahead to NWSGC, at minimum can we expect a single paper that synthesizes all the various work that is being done westwide on wild sheep genomics?
  Mike – Open for potential symposium updates from specific states. Can commit to a single overview presentation at NWSGC. Add to overview of those states that have a genetic sample bank
  Clay – just a reminder of the sample repository set up at Texas Tech Univ. In the process of transferring the past bacteria samples that were housed in ID that Caine Vet Lab had before they closed. Everyone can use the facility in Texas Tech (nitrogen storage and they have strict sharing rules from the state that provides the samples.

Interest in developing a committee to explore the pros and cons of Rocky Mountain and California bighorn as single vs. separate subspecies for population and harvest management (30 min)

Rich – gave powerpoint presentation. Suggest a committee to delve into this topic. Wehausen and Ramey paper suggested that a subspecies status for California and Rocky Mtn bighorn is not warranted. They have found in Washington that California bighorn subspecies have lower heterozygosity than Rocky Mtn bighorn subspecies.

Don – their published research in Oregon: they found low heterozygosity in their California bighorn herds and then augmented the herds with California bighorn from a different source in BC and detected a small increase in heterozygosity and in lamb recruitment.

Rich – Almost all of the 17 California bighorn herds in WA were from Junction BC source stock.

Univ. of Idaho Kim Andrews looked at WA's California and Rocky Mtn bighorn herds and did find genetic separation but that is likely due to an "artifact" of management efforts to keep them separated. She also looked at MHC locus and found slightly higher heterzygosity in the Rockys. But based on microsatellites of

general locus, heterzygosity was much higher for Rockys. Does it mean lower fitness??   Can you solve low genetic diversity?   How to manage, hard to do.   I would like a group of managers and geneticists to ask the question: is the California subspecies real and if so, then we should manage for it. If it is not real, then what should we do?

Kevin – in Wyoming they experimented by introducing California bighorn from Oregon (lower Deshutes) and Missouri River Breaks Rockys and into a residual herd of 40-50 Whiskey Basin Rockys in the Wind Rivers in the Devils Canyon area has been hybridized over 12-13 years and remains very healthy and thriving.
Bill – published in 2016 Molecular Ecology genome wide assessment of thinhorn sheep; we can take similar tack to look at historic origin of Rockys vs California bighorn in BC using SNPs. Mitochondrial DNA is like cement blocks (large) whereas SNPs are a pinpoint in describing genetics at a much finer scale.
Don – He agrees with this type of evolutionary approach to what bighorn genetics used to be. Are we simply seeing phenotypic differences between Rockys and California due to environment? Along with current day wild sheep management.
Andy – in CO only 5 or 6 out of 90 herds have never been augmented. Like to see recommendations that recognize the threat of moving sheep around to solve low genetic diversity may make a bigger problem of spreading disease - "don't settle for a cure that is worse than the disease". The value of the remnant herds' genetics (which likely have low diversity) may outweigh the need to increase heterozygosity.

Helen – What is normal heterozygosity. It may be different compared to other animals because of the nature of wild sheep living on mountain tops.
Marjorie, UNR – The genetic information is only useful when coupled with the demographic levels of a species. So we let existence define what level of genetic diversity is needed. And on California and Rocky Mtn subspecies, we need adequate samples across the entire native range in BC, so we now the natural gradient of variation within the native range and be able to compare that to the translocated herds.
Helen – BC has more natural genetic sources because of limited translocations and she has archived genetic material to share.   Genome BC – Is a funding source that can help with genetic work in BC
Marjorie – regarding DNA from microsatellites vs. SNPs we all need a common yardstick across the different studies since we are sequencing different loci; there needs to be developed a set of panels applied across all studies and pool of genetic datasets combined
Don – If working with actual loci we need to make sure the loci (functional or neutral) response to evolutionary changes like fecundity.
Doug – No regrets mixing California with Rockys. They were more interested in matching up the habitat with source stock. He realizes you can't lose sight of potential ramifications of introducing new pathogens.
Rich – Not suggesting to begin with translocation experiments. Still should manage for separation. Suggesting a combined management group to work on this topic first and answer the questions 1st before we take action.
Mike – Do we want to look into genetics of herds and origins?
Helen – Can we have some young geneticist write up a white paper that synthesizes in simple terms for managers of the state of art in both genetics and health genomics? Lots of nodding. Good idea.
Mike – Conference call next week. Will send out email to all WSWG members. Can we get a summary of the basic genetics then decide where to dive into a specific topic of Rockys and California bighorn subspecies
Kevin – What about Rockys and Deserts
Mike – Historic assumptions of 3 subspecies living in Nevada was "wrong". Historically the entire state was desert bighorn. But in the end the bighorn subspecies chosen for source stock have done well overall. Today trying to document hybridization, etc….
Kevin – Reminded all of us of the comprehensive westwide translocation document has a ton of information to greatly assist geneticists in their research.
Mike – Hope this genetics group can develop that yard stick in regards to diversity.

Break (20 min)

Presentation (by Marcus Blum, UNR Ph.D. student) and discussion on using the current technology of ewe satellite collar and UHF communicating VITs and lamb collars; pros and cons, animal welfare, precautions; consider developing westwide standards? **(30 min)**

Marcus - Powerpoint Presentation – see slides. Use of VITs for resource selection to quantify the actual activity and habitats selected. VITs can also help identify how old the lambs are where they are "good to go" with high survival.

2 types of VIT technology – VHF only, GPS linked devices via UHF (VIT and neonate collar) with adult collar. ATS has temperature and photo sensor and separation (distance) to detect VIT expelled. Lotek uses only a temperature sensor and separation. Vectronic Aerospace uses temperature and activity sensor, and distance separation to alert user of likely lamb birth through text message and emails. Can detect and be alerted to mother and lamb distance separation at about 100 meters. Beyond 2-day old lambs will be too agile and strong to allow you to hand capture.   Minimize the direct contact with lambs; survey where the lambs could run off after processing and attempt to release in safe area; bad weather is a no go, wait for storm to blow through. Capture process: install PIT tag attached expandable collar (but the collar does have bolt/nut fastener which was commented on by others to take too long to attach), weigh, morphometrics - body and metatarsus length, chest girth; sex, DNA sample from saliva.

Used an 8-hr cluster of GPS points from the ewe if the VIT prematurely was expelled to estimate lamb birth.

30 ewes VITed first year

Todd – Abandonment? Marcus – had 4 or 5 out of 45 lamb captures; 2 of them may have been due to scent of experimental neonate collar with epoxy odor.

Bill – Will be deploying ATS VITs on Stone Sheep in northern BC this February; will be good to compare the 2 types of systems. Has investigated domestic lamb survival and abandonment rates of are 90% or higher for lambs that don't nurse the 1st 3 hrs after birth; Do not go within first 3 hours; also wind alone is the worst weather factor above rain/snow that cause lamb mortality.

Andy – Did you change abandonment tactics from beginning or as you went? Marcus -Started with our own guidelines but modified it as we went along. Marcus thinks you going to have abandonment regardless (based on what?).

Vern – Available technology. Be careful of using equipment just because it is available. Focus on the biology and key research questions first (New Zealand journal article speaks to this issue).

Don – hard to fit standards, agency budgets can impact. Agree with Vern

Becky – have captured caribou and moose calves and we limit them to 2-3 minutes. Think 7 min was a long time. Suggest using a slip-on collar. Marcus - Vectronics collars hard to put on. ATS better. Becky – A lot of measurements – are they necessary? Could reduce time.

Chad – SD was doing lamb captures in 3 minutes; Todd – NE and Tom – CA - 5 minutes.

Bill – suggest we build table on collars with feedback from others. Share information with each other.

Holly – What was failure rate for the entire system? Marcus – 1 total, For parts --one VHF on adult, 5-6 collars not transmitting data, VITs – one premature expulsion, 2 not sending data. Neonate – 1 collar. All this from about 50 sheep.

Are there other research and management activities we should consider for having standards and guidelines in being more effective, progressive, safe, and with greater awareness of animal welfare? (e.g., capture related standards {time of year, collars, ferry distance, translocations, drug/prophylactic injections}, ground & aerial population surveys, removal of wandering sheep, sheep separation, etc.) **(45 min)**

Mike – are there other activities that we all do to discuss possible standards?

Don – A lot in the NWSGC capture guidelines written by Craig Foster, pub. Jan 2005, in NWSGC proceedings. A lot covered for captures in that document.

Tom – He has been involved in many bighorn captures in multiple states; keeping handling time short on adults, but folks sometimes get in too much of a hurry and don't collect critical data; many don't weigh sheep. In California, may keep animal hobbled and blindfolded for up to an hour and we have had low capture myopathy on these animals. Cool with water and administer Banamine.

Mike – NV basecamp protocol changed by Peri specific to body temps; if they are 106 or above, we administer IV fluids which always brings temp down.

Vern – Examine completely. It's how animal comes in and not necessarily how long the animal stays restrained at basecamp; can eliminate stress by completing in less time.

Peri – Darted sheep had no major changes in their lactose levels, but netgunned sheep did have high lactose levels. Capture chase time is critical.

Froy – Worked well in Texas. Cool animals down on the table for better survival success.

Rob – chemical panel values. Animals processed at the capture sited did better than ones that were ferried back to a basecamp

Helen – sheep biologists have come so far in capturing and welfare.

Rusty – Agrees, getting temps to drop. Have crew spray alcohol or water on animals on the mountain before they are brought back. Cool down before Sling distance.

Eric – Neonates need to work quickly. Like to hear more on mid-summer captures

Vern – did summer captures, animals handled well with light coats. Used water when needed. Need to have great communication and understanding with capture crew.

Tom – Incident with collar fitting. BHS collaring of rams. Get experience. Can go almost as tight as possible. Can put two collars on.

Mike – Another topic: Removing wandering animals, what distance is optimal with disease risk? Will send out in an email asking everyone's opinion

Don – need revision of Foster's capture protocol

Telemetry/GPS Collar Companies – Can we collaboratively encourage them to raise the bar of their product and services to reduce failure rates, lost data, missed opportunities, and wasted funding? (20 min)

Mike – Seems all the telemetry companies have quality control issues. Is there enough interest to develop a forum to convey to companies about quality and raising the bar of their products?

Don – Get venders to attend the WAFWA meeting in Oregon.

Andy – Can we force it through market, buy the better collars

Don – All vendors having issues

Rusty – new ATS iridium collars. 600 out with 2 failures. It's the new Iridium model

Kevin – Letter from WAFWA Directors to vendors.

Becky – The market will bear out the results but lots of money being wasted. Lowest bid gets award. Create a Facebook page to allow users to comment on collars. Have an on-going conversation.

Helen – is it good to leave collars on?

Kevin Monteith – Be good to have universities involved too. Technologies continue to advance. Companies may market before completely tested. Develop standards for testing.

Mike – will work with Jim H and consider social media.

Andy – social media pressures out there help

Kevin – Liable, be careful with comments.

Paige – would it be a closed group or public?

Alaska Dept. of Fish and Game Dall Sheep Horn Morphometric study, Brad Wendling, ADFG wildlife biologist (20 min)

Powerpoint Presentation – Brad. Horn Morphometrics in Alaska Dall Sheep

Overview of the presentation:

Major Dall Sheep populations in the Brooks Range, Alaska Range, and Wrangell St Elias Mtns; with smaller populations in the White Mtns, Yukon Uplands, Talkeetna Mtns, Chugach Mtns, and Kenai Mtns. Since 1968, most herds have had ¾ curl harvest strategy, then 1979 -1983 to 7/8 curl, and 1984 went to a full curl/ 8-yrs of age harvest strategy statewide. Observational data on mineral lick in early 1980's by Wayne Heimer showed that heavy harvest of ¾ curl rams resulted in the accelerated mortality of smaller rams. But in a 2001 a review of this data, was concluded that rams didn't have as much fidelity to mineral lick as thought and that there were more mature rams likely alive but not observed.

Lots of over-the-counter general harvest tickets in more of the north populations and to the south more are draw areas with any ram regulation.

Is Selective Harvest a problem? It is suggested that it may slow gene flow, cull genetic traits desired by hunters, decrease genetic fitness through selective ?, and decrease fecundity.

Ram Mtn study by Coltman and et al. showed favoring of the reproductive contribution of fast-growing horn rams vs. slow growing horn rams. Other scientific camps say horn growth is affected by demographics, nutrition, and/or environmental factors. Recently Alaska Game Commission has received over 200 requests for alternative harvest strategies. Not until 2003 was there compulsory sealing and check in by ADFG employees involving horn measuring

Started statewide project in 2016 with statewide harvest of 783 rams; measured 60% of these primarily in the Anchorage, Fairbanks, and Palmer offices. In 2017 measured 483 out of 798 rams. Used central angle and circumscribed angle theorems to quantify the degree of horn growth from photos and then determine age, total horn length, total degree of curl, length between angle of segments, and degree of angle of segments for both horns. Compared to 2016 to 1968 - 1970 (still under ¾ curl strategy) datasets. Place horns in a jig, align lamb tip with base of horn, take photo and import into Adobe Illustrator with a circle fitted around the horn. Allows you to measure the amount of degrees the lamb tip has grown past the horn base. By 6 yr of age rams typically reach 360 degrees but are 2 yrs before they are legal age. Under ¾ curl strategy harvest ram ages ranged from 4 – 8. In 2016, under full curl strategy, ages ranged from 7 – 10. Tremendous amount of variability horn growth within an age class and also horn length vs. degree curl. In 2016, 19% of harvested rams failed to make a full curl with either being 8 yrs of age or taken in any ram area. 28% of the rams were taken the 1st year they attained a full curl. 32% of the rams had a legal full curl for 1 year prior and 16% had a legal full curl for 2 previous hunting seasons (53% total were legal for 1 or more previous hunting seasons). From the old dataset, 10% of the rams were shot during the 1st year they grew into 270 º curl vs. 90% of rams that had been at this ¾ curl for 1 or more previous hunting seasons.

Bill – did a review of pictures of their harvested Stone sheep in BC and found 23% weren't legal on full curl (but made minimum age) which is similar to what Brad found.

Mike – with having data to show you have rams harvested that have been legal for 1 to 3 years; will that support your current harvest strategy?

Kevin M. – how can you connect this to Ram Mountain research. What does it mean for your sheep populations? Brad – next step is looking at historical data set to look at trends and changes over time.

Rich – Is successful breeding related to horn size or age? Brad – Gets dark in Alaska, haha. Big rams participated early and smaller rams later. He is trying to mark rams and measure their reproductive contribution as they age.

Kevin – Explained that we had earlier video call with limited # of WSWG members and Dr. Kevin Monteith and graduate student Tayler LaSharr. We felt that more people would want to hear that presentation so tonight WSF is sponsoring a beer and pizza night at the Peppermill wedding chapel! Big laughs from all! Limited to 50 people; presentation starts at 7 pm.

Wed Morning, Jan. 17

Mike – opening remarks, great presentation by Kevin and Taylor Tuesday night with good Q&A. A Nevada bighorn herd was shown last night to have slight decline in horn size over a short time frame which was immediately prior to the entire herd die-off, so we just need to keep things in perspective that if you don't keep the herd alive and safe from disease risks, horn size won't matter. It's all important.

Disease Management Venture (75 min)

- **Presentation by Rob Spaan, Oregon State Univ. Ph.D. Student   -"Characterizing the spread and consequences of respiratory disease in California bighorn sheep herds in Southeastern Oregon and Northern Nevada"; discuss management implications.**
  Powerpoint Presentation – Rob. Observational based study to detect lamb mortality and assess causes – disease specifically. Involves 4 primary herds in Oregon (Rattlesnake/Tenmile, Blue Mtn, Trout Creek, and Upper Owyhee) and 4 subherds within Santa Rosa Range along the border in Nevada. Primary Research Objectives: investigate resource selection of bighorn in OR and NV, demographic consequences of Movi in OR and NV, determine predictors of immune phenotype in OR and NV bighorn, and develop a risk of contact model for OR and NV bighorn herds.
  Initial disease event in Santa Rosa Range (NV) in 2003 (Movi detected in banked sample); then GPS collared rams from NV shown to make consistent annual movement between the 2 states as early as 2010 and continuing through 2017; then disease event and chronic lamb mortality detected in Rattlesnake/Ten Mile and Upper Owyhee herds in 2014-2015 or earlier. During 2016 and 2017 field seasons, Rob has detected clinical pneumonia in several lambs and collected most of the carcasses and confirmed pneumonia on necropsy and presence of Movi. 50 sheep left in the Rattlesnake herd; from Rattlesnake herd Rob collected 11 lamb carcasses; typically deaths occurred from 42-65 days after birth.

  This information is from a study in progress; please do not use or cite these unpublished data.

  Mike – Rattlesnake herd. What was population 5 years ago? Don – 90-100, poor recruitment for 3 years. One single PCR positive ewe.
  Mike – Adjacent herds and intermixing. Had a ram with notable movements, got within 4 miles of Santa Rosa's (coming from the south) so removed that ram. It was positive for Movi and sinus tumors.
  Don – for Rattlesnake herd. Got this project going to identify risks and show data to public and commissioners. Large movement has been shown but also large area. Not brave enough to remove a mobile animal yet but will consider. Increasing hunter harvest. Have not detected sinus tumors yet.
  Don – need information and answers with this project to provide management direction

- **Is it time to consider pulling together everyone's results from disease surveillance efforts we all have been doing for last few years and compare/contrast what we found and variables involved; development of a reporting template?**
  Mike – See spreadsheets. 2 years ago DMV started and tried to have jurisdictions identify herds with pneumonia and conditions/variables involved in each. We put together a survey of "DMV candidate herds" on a Google Drive and asked all jurisdictions to enter basic information on their herds (category of health and pathogen exposure, mgt option to try, demographic data collected, major pathogen and genetic sampling effort, subherd structure, funding needs). See spreadsheet. Identified about 100 herds of all subspecies. Where is everyone at with all that monitoring of their candidate herds? Using Nevada herds (n = 20, including Movi and non-Movi herds and doing poorly and recovered/doing well with Movi) as example showed what we would like to see others do. See spreadsheets.
  Two main datasets: Demographic parameters (lamb ratios, pop estimates and herd rate of increase by year) and Pathogen Sampling results (specific pathogen/type of test, sample size, prevalence rates)

Also, Karen Fox last year developed 2-stage flow chart to help jurisdictions evaluate/categorize herd performance in relation to pathogen sampling and to decide future sampling effors to for all to use.

Peri – Explained Nevada's pathogen spreadsheet. Could add strain typing at some point.

Mike – This exercise of developing a herd response/pathogen profile dataset was to summarize and reveal patterns, unique responses, and possible predictor variables. Could other states do the same exercise?

Andy – Are management actions being applied?

Mike – Yes, Test and Cull, but haven't identified other actions to try.

Andy – add columns for test and cull, depopulate/restock, etc… CO going to issue management permits to remove sheep one at a time from a specific herd.

Mike – this is just a start. Can add or remove columns.

Tom – Sinus tumor prevalence of PCR positives and tumors?

Peri – Snowstorms had a high prevalence. Those had Movi. Don't have sample size for confidence. Montana Mtn herd in NV had a high prevalence during an active outbreak (that herd was depopulated after 85% of herd died from pneumonia). See a lot of sinus tumor associated with Movi but not all.

Jenny – Do you see chronic or active outbreaks of Sinus Tumors?

Peri - Both. Cut all heads now and look. Did have a ewe Movi negative but with ST – was not as extreme.

Mike – Will send out spreadsheet for others to fill out

Don – Need to include healthy herds as well.

Peri – think Nevada has a population clearing Movi

Mike – Will accept more feedback

Rich – Interesting aspects are Movi herds that are not declining, important to see strain type.

Tom – would like samples from those herds.

- **Jurisdictional updates on DMV related projects, activities, findings**
  Mike – any other jurisdictions with information to share?

  Brad – Alaska – powerpoint presentation. They collected nasal swabs from 100 harvested Dall sheep rams; Sent out 150 kits and got 54 back from hunters; collaborating a lot with Dr. Bob Gerlach (state Ag vet) and USDA; voluntary study to sample 27 domestic sheep farms involving about 376 animals; 7 of the farms had Movi detected; no leukotoxins detected

  Becky – Alaska chapter of WSF - initial sampling started in 2008, so far no Movi detected in captured Dalls. Found Pasteurella species. Has been painful in looking at pathogens with domestics in the state.   Have a disease working group on this. Trying to keep out any Movi positive domestic. May have a Movi free program.

  Kevin – Yukon – made hunter swab kits, replicated from what BC has done.

  Helen – education outreach to give workshop on disease with domestic producers.

  Kevin – Yukon has never captured and collared wild sheep

  Helen - They don't like change.

  Kevin – Yukon is planning to collar 45 Dall sheep next winter to get more information

  Hollie – Will test and cull in the Redbird Herd in Hell's Canyon. Will recapture 4 adults that will be removed if positive again. Also looking to possibly cull in herds with high prevalence rates. Getting good hunter harvest information with swabs.

  Don – Need a management perspective

  Rich – Update for Francis. The Asotin herd that they conducted Test and Cull on has had good lamb survival (26 surviving lambs). No Movi detected since removal of last tested Movi+ animal 4 years ago. Expanding operation where Movi still present.

  Tom Besser – Field testing unit that conducts PCR for Movi. Improve testing time. Going to test on as many animals as they can. Would be functional for a helicopter capture operation.

  Peri – In Nevada, we stopped asking hunters to take nasal sample and are now more focused in collecting heads from taxidermists to look for Sinus Tumor and to swab sinuses for Movi unless there is a herd with special sampling needs.

Rich – What is value of looking for ST in a Movi negative herd?

Peri – Important to document on the landscape. ST may not be a translocation killer but if know you got it; it may impact the disease process and outcome if a herd also gets exposed to Movi and other pathogens

Mike – good to have samples in advance. Will send out candidate herd pathogen and population spreadsheet for jurisdictions and monitoring report template to fill out.

Rusty – Utah Update – They wanted to restore their San Juan desert bighorn herd that they thought had declined to about 20 sheep. They pretested the herd and detected Movi and found more than 20 animals. Tried test and cull; collared and tested every sheep they found, culled 5 that were shedding to start with, but ended up culling 38 total! They translocated 50 bighorn from Zion National Park to the North San Juans some distance away from the test and cull area. Will be conducting intense monitoring for next couple years. Also, sending out test kits to hunters.

- **Funding opportunities**

   Mike – Thanks to WSF for the $50,000 for use on DMV related monitoring projects. Funding to be used in Oregon, Nebraska, Nevada, and Northwest Territories

   Kevin – Heather in NWT was able to get sampling kits to hunters summer 2017 for their Dall Sheep Hunt season; no results yet

Affirmation to continue to maintain west-wide datasets for translocations, herd information, population and hunt data, disease events, disease testing, lethal removal of wild sheep in to sheep with pathogens, others? (20 min)

Mike – The Wild Sheep Translocation dataset was last updated 2015. Mike will send out the current dataset and ask for each jurisdiction to update it with captures and translocations. For the Population and Hunt dataset I would still like to have jurisdictions provide the demand for hunts (# of applicants) – what is the interest? Hoping Alaska will provide a statewide estimate/guesstimate?

Brad – Is not aware of any attempt to do that.

Mike – disease event data set. Still thinks that is of great value. We can modify if needed. Mike would like to send out and update.

Clay – Requests for budget information related to auction/raffle tags. Last was 2015. Going to update that and will send out

Kevin – Revenue for sheep. Greater share was auction tags vs lottery tags

Mike – Any information for removal of wandering sheep that has been documented? Industry and general public and even land management agencies need to know how many bighorn are killed each year because we must remove potential disease vectors to wild sheep herds because of the continued threat of domestic sheep and goats . Important to document removals.

Rusty – 5-10 per year.

Rich – It's infrequent but good to have a central database. Research project of wandering domestics

Rusty – Should document for information to add with industries

Mike – Will take some work to document from each of us but its needed and may come in handy in the future.

Don – Advocate for those who also deal with exotics species as well

Tom – What percent of those killed were translocated? What distances moved?

Rusty – believe most were born to that herd, Most interact with hobby farms. A couple allotment interactions

Melanie – Spatial reference to those interactions

Mike – see example of bighorn removal report from NE Nevada on WSWG webpage

Don – pathogen profile needed too

Kevin – Good to have for the politics

Sandra – BLM, this is good information for gov't entities to use. Share that information with Gov't agencies.

Rick FS – Agrees with Sandra, need that information
Mike – Will send out.

Break (20)

Evaluate jurisdictional processes, guidelines and data for setting ram hunting permit numbers; can we improve our process, learn from others, and raise the bar of using more scientific data and rigor and less custom and culture to benefit our hunters, maintain mature ram harvest, and quality experiences (70 min)

Mike – Decade ago Eric sent out similar survey and published the information in the NWSGC proceedings. I sent out the survey after our December 2017 conference call. Currently have 14 reporting jurisdictions. Intent is to challenge everyone on process of using best available data etc..

Nevada and Wyoming are most liberal with permit numbers.

Reviewed questions from survey: Biggest question – what is primary guideline for setting permits? Summarized about 10 questions to discuss.

Rob – Is anyone counting collared animals and using to estimate populations?

Mike – a few states headed in that direction of using mark-resight estimator.

Andy – Will you summarize for NWSGC?

Mike – will do.

Mike developed a matrix to compare results by using Nevada's standard desert bighorn quota array for all hunt units (herd pop by ram and ewe, % mature rams, and survey results, and quota guidelines) and use the primary guideline from each jurisdiction to generate permit #s to compare to what NV was issuing in 2017 – varies amongst states, quite different with many.

Kevin – be good to have NWT results

Mike – including them in emails

Clay – some value with all these varied approaches to permit quotas, good to know the history too

Mike – can others benefit from the opportunity to hunt BHS and be an advocate for wild sheep conservation and future hunting opportunities?

Kevin – Trade off in Montana with unlimited permits in some units and others limited.

Kurt – Unlimited season has value in providing a large amount of opportunity

Bruce – MT has no statewide standard survey and tag/permit process and each biologist decides his own permit #s based on what he or she thinks.

Don – we in OR use the "Xerox method". We all asked what is that? Similar to MT, with each biologist deciding permit #s in his own area; typically they just set permit #'s the same as the last several years.

Clay – Texas history – he asked Mike what their average score was on their desert bighorn rams

Rich – Auction/raffle and tribal permits could be more accounted for.

Hollie – Idaho does not get information from Tribes regarding their bighorn sheep harvest.

Don – Tribal harvest in OR is not subsistent but trophy harvest

Kevin – Alberta – What will land status be after the Cadomin/Luscar Mine lease expires. What happens after it becomes Crown land again? May happen in next 18 months

Hollie – ID uses a sightabililty model for sheep estimates. Don't have a model for all populations. Working on a ground mark-resight model.

Mike – Are we using our data for permit quotas? Can we do a better job? Is there any interest for more liberal or conservative approaches?

Don – Think it is working for each state the way they have been doing it.

Kevin – Allocation battle for permits should be played out with each agency. If it is working it is probably due to that systems evolution over time.

Kurt – Ram size in relation to harvest. Agencies sell for opportunity or trophy.

Don – Successful hunters are happy

Mike – could we have more happy hunters?

Tom – More information would be good from the research being done.   Length of seasons influence
Mike – general 30-60 day season
Hollie – some split seasons in ID
Rusty – Utah just started an archery only permit
Andy – statewide guideline is ram harvest of 2-5% of total population within a given GMU for permit #s. CO has archery only seasons. Most rifle seasons are 30 days. Splitting seasons now. Trying to increase opportunity where we can. More data means more permits usually. In 90 GMUs, harvest rate is 1.1% to 5% on any given year as % of harvest to total pop estimate with a statewide average of 2.4%.
Bruce – Montana has 75-day season. 80% killed last part of October and early November
Bruce – Montana has 75-day season. 80% killed last part of October and early November
Bill – BC bighorns all draw units and some going to any ram. Hunters seem OK with this. With Thinhorn shepp – increasing permits but now have too many people hunting same areas. Hunter success was lowered - hunters stepping on each other, hunter party competition, and shooting younger rams, etc.. Not getting support to lower permit #s. Crowding appears to be reducing the harvest. Archery becoming more popular. Need older age rams in group. Paternity study would be good.

WAFWA Wild Sheep Working Group Webpage and associated modules (15 min)
- How to improve sharing our knowledge, information, and technical data on the webpage or other internet venues
    Mike – what else should we have on the website?   Let Mike know and he will add it. Website currently has front page of: WSWG purpose, Upcoming Events, Current Issues, Recent meetings and notes, list of members; 2nd page devoted to DMV; 3rd page – Resources: Pop and Harvest tables, presentations, reports, old meeting notes, publications, link to state/province mgmt plans, correspondences; 4th page – Maps; separate page with Map Shapefiles are members only access. Will keep that as is.
    Kevin – maps from BLM and FS hard to find.
    Mike – everyone was asked to update. Need to sit down with FS and BLM
    Melanie – Who is to take the lead for BLM and FS? Melanie asked Rick to pursue
    Sandra – Working on maps and trying to improve those.

WSWG Logo – use of it and thoughts on swag to place it on (10 min)
A lot of folks like it. Should we put on some swag?   Mike will work with Bruce for the NWSGC.
Peri – Does the WAFWA logo need to be a part of it?
Mike – No, lots of committee and working groups have separate logo.

Update on large-scale moutain goat removal from Olympic National Park involving translocations and lethal removal (15 min)
Rich – Reintroductions and where can we put them. Also, lethally removing some; goal of Olympic National Park is to remove 350 mountain goats.
Bruce – Are you testing?
Rich – Yes. Will test as they get them. Hope Park does some in advance. Final EIS is near to move this forward. The first effort will be to live capture as many as possible. Then allow 'skilled citizen volunteers" to remove some lethally. Will try to remove carcasses. Plan is to start in 2019 but could face lawsuits. New legislation for public hearings for any translocation. Hope to start early operations is July.
Mike – how many will be captured to translocate?
Rich – 10 day bouts of work and will do in July and August over 2 years. Washington is receiving them. ID and MT have been discussed to receive some if needed.
Don – What is your capacity for release sites?
Rich – have 12 sites. 25-30 goats in each area.

Helen – what will they do with the kids?

Rich – Zoos and will take as part of translocation

Peri – Why July?

Rich – Having best possible weather for helicopter capture crews.

Upcoming Conferences and Meetings (10 min)
- 2018 Northern Wild Sheep and Goat Council Symposium, Whitefish, Montana , May 21 – 24
- Next Wild Sheep Working Group Meeting @ Summer WAFWA Conference, in Eugene, Oregon, July 15, 2018
- Desert Bighorn Council Symposium, Mesquite, NV, April 2019

Adjourn