

Yellowstone Bison Subpopulations

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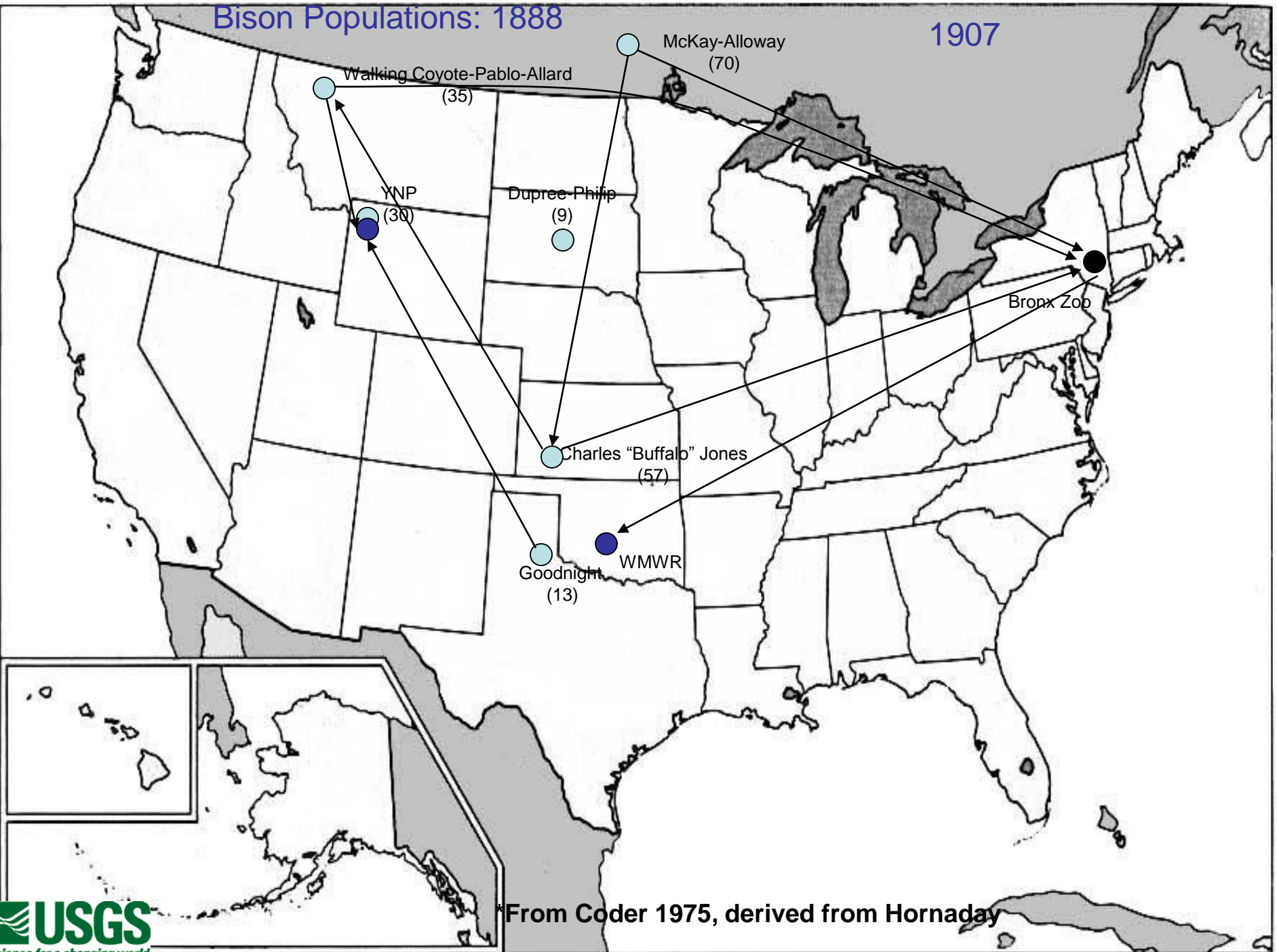
School of Life Sciences, Arizona State University

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Department Ecology, Montana State University

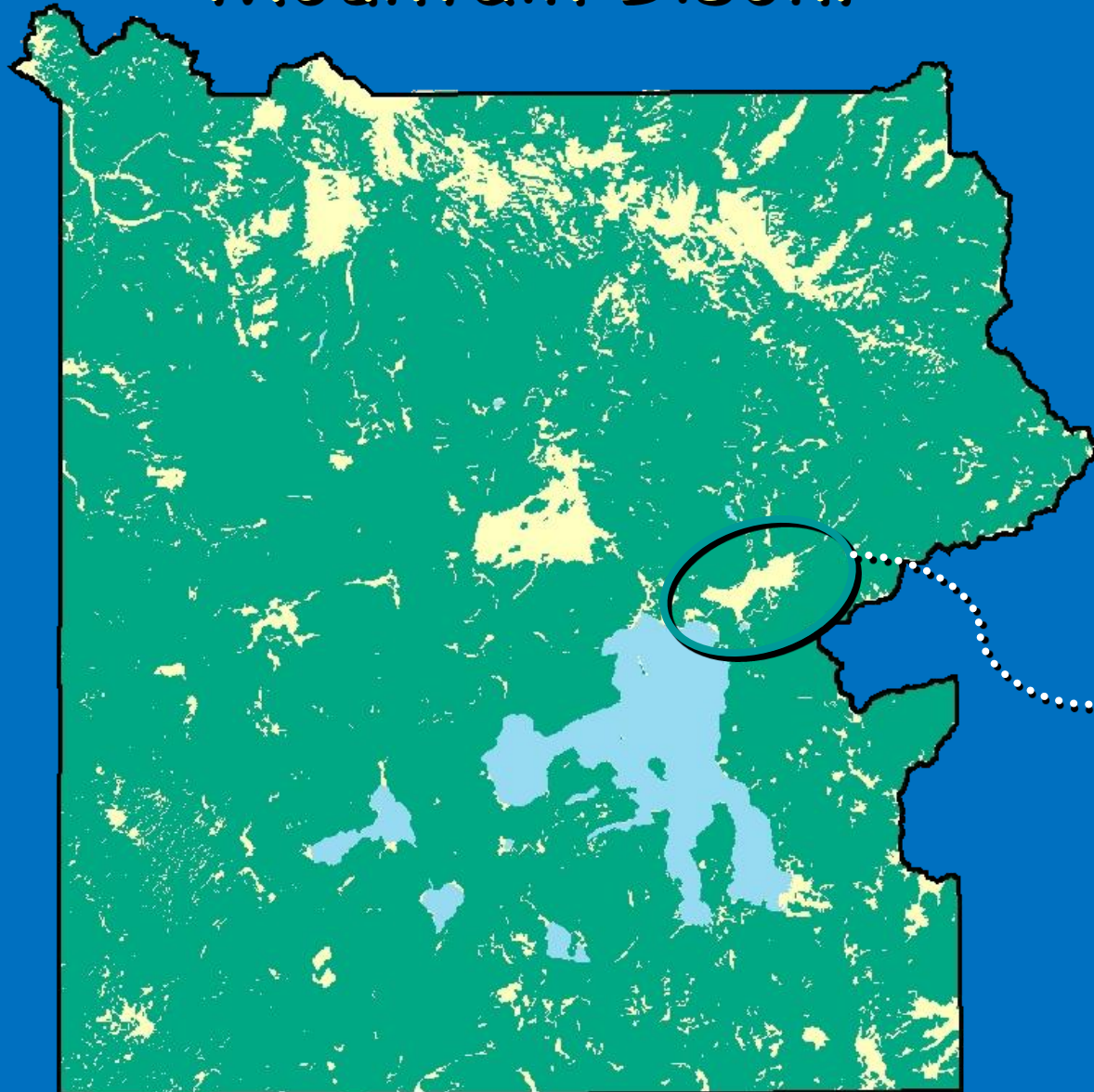
Bison Populations: 1888

1907



*From Coder 1975, derived from Hornaday

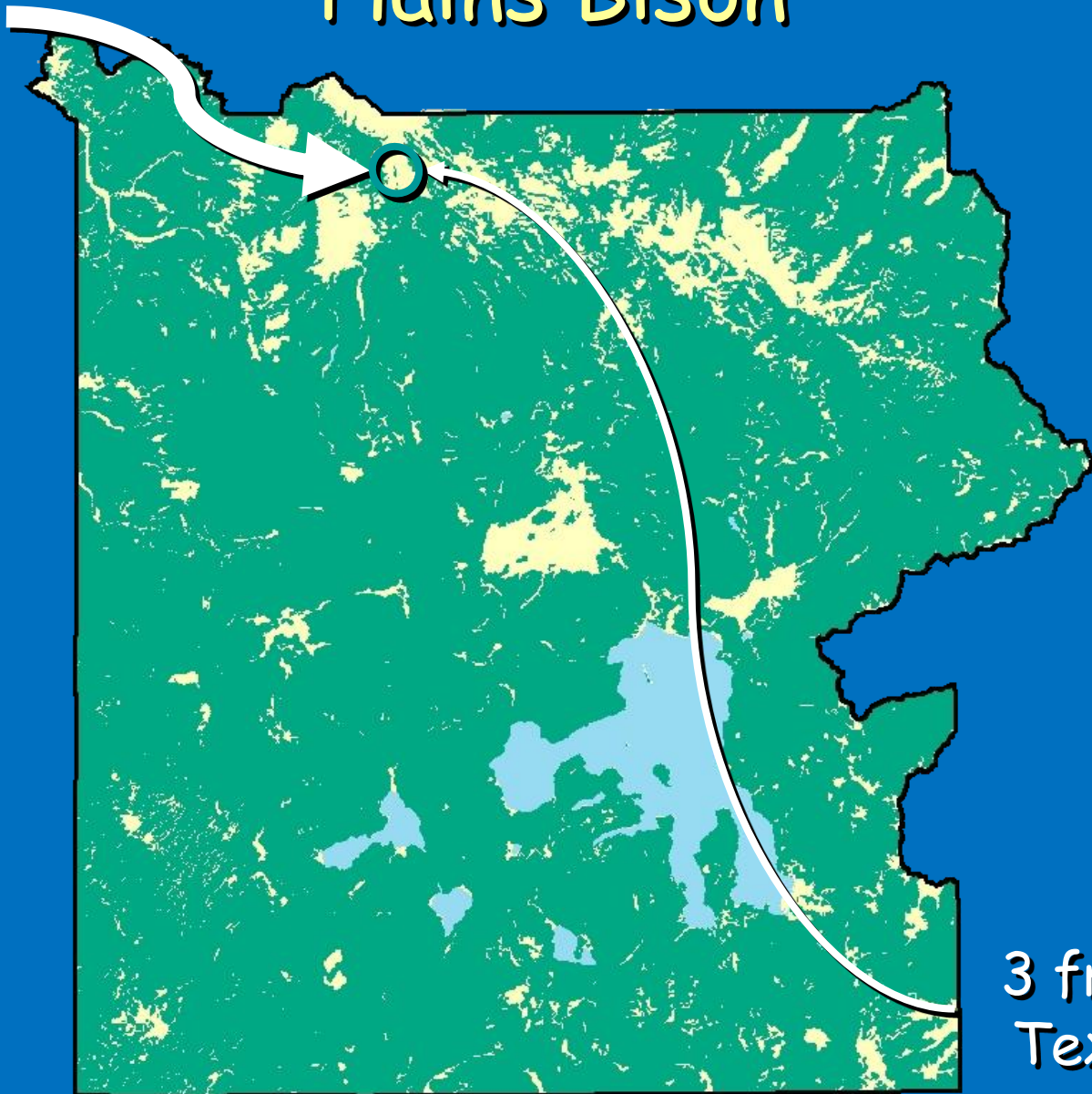
Remnant Herd 1902 Mountain Bison?



40 - 50
Bison

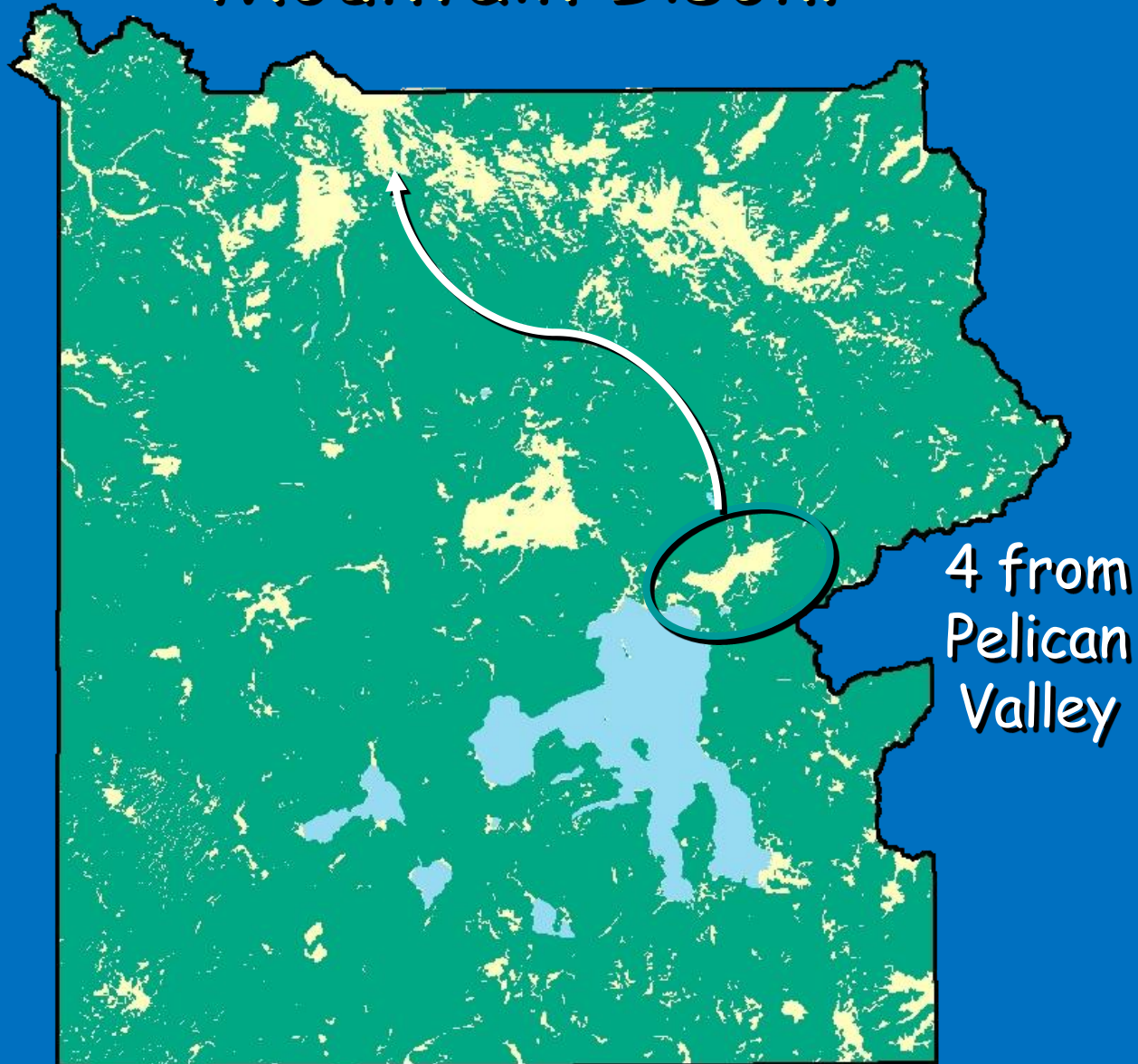
Introductions 1902 Plains Bison

18 from
Western
Montana



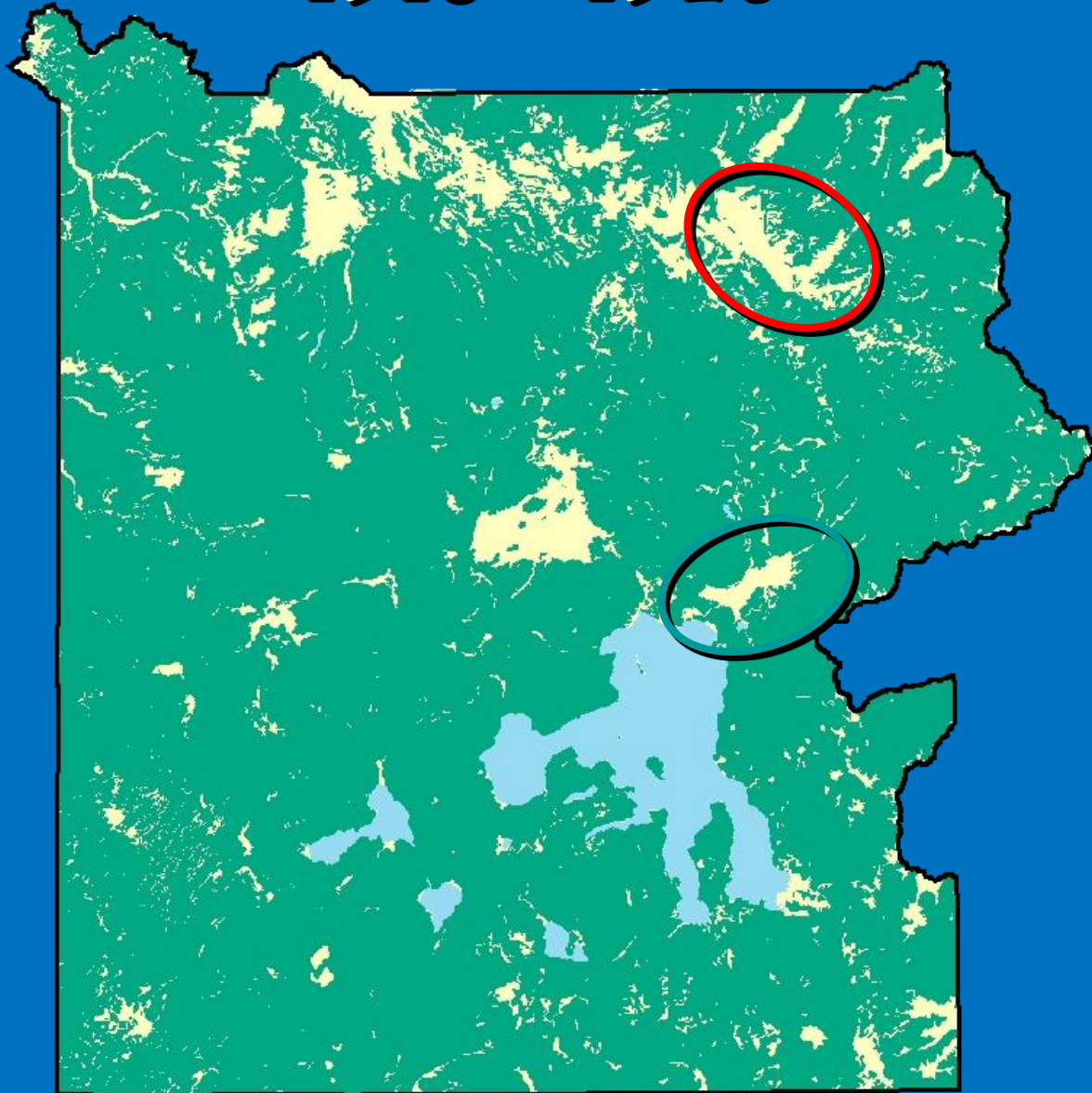
3 from
Texas

Translocation 1903-1909 Mountain Bison?

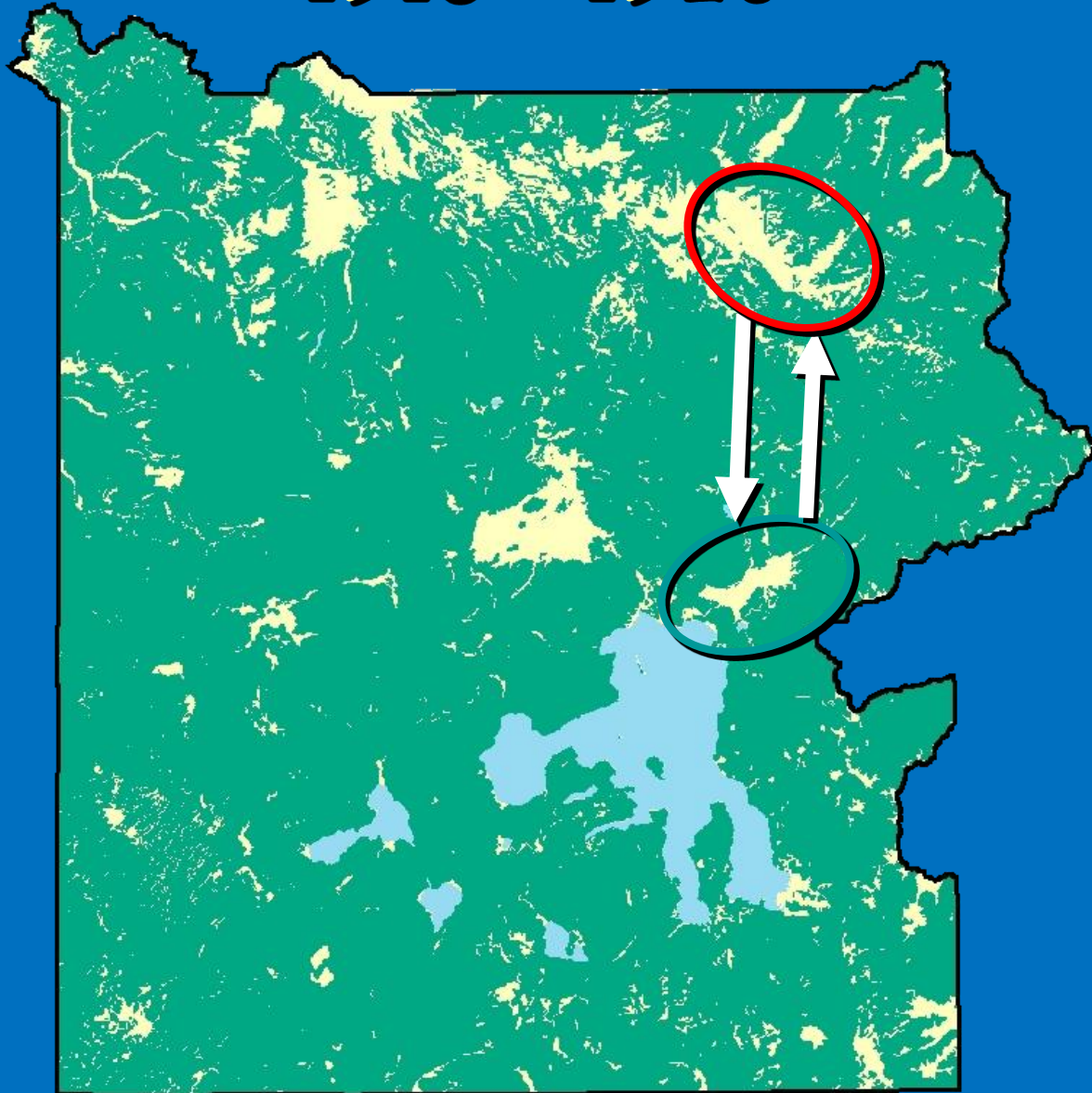


4 from
Pelican
Valley

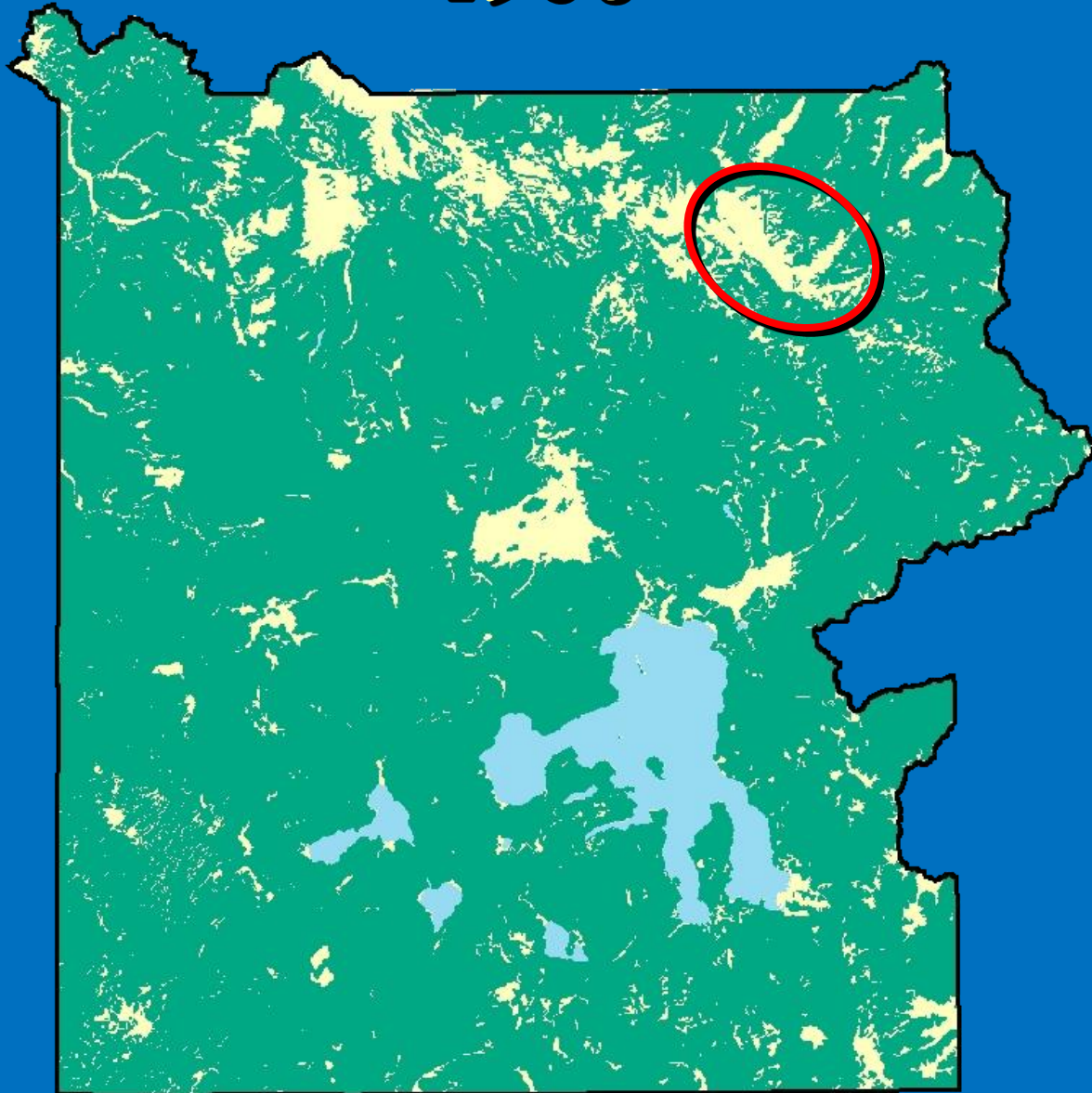
Herd Status 1915 - 1920



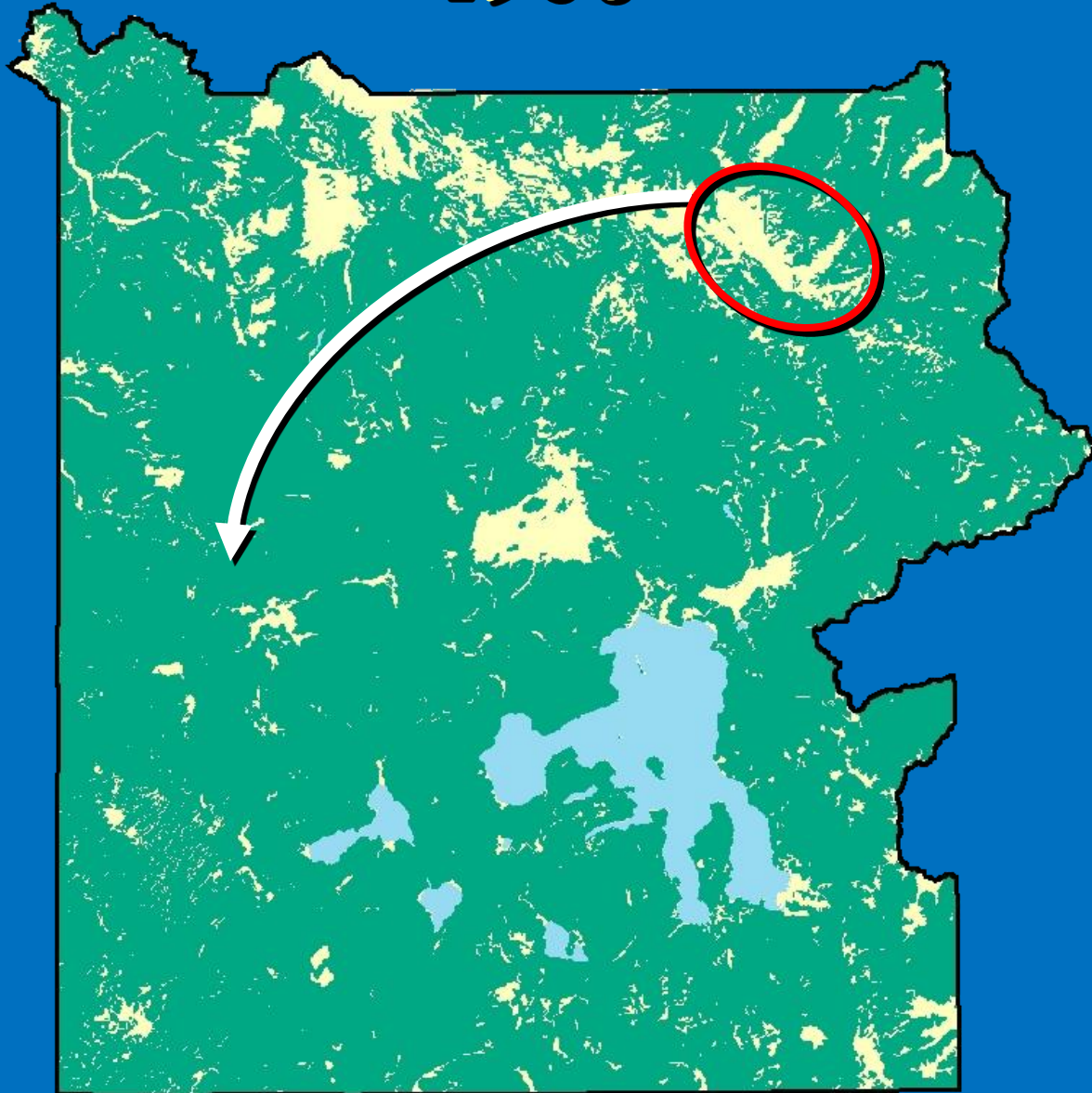
Herd Status 1915 - 1920



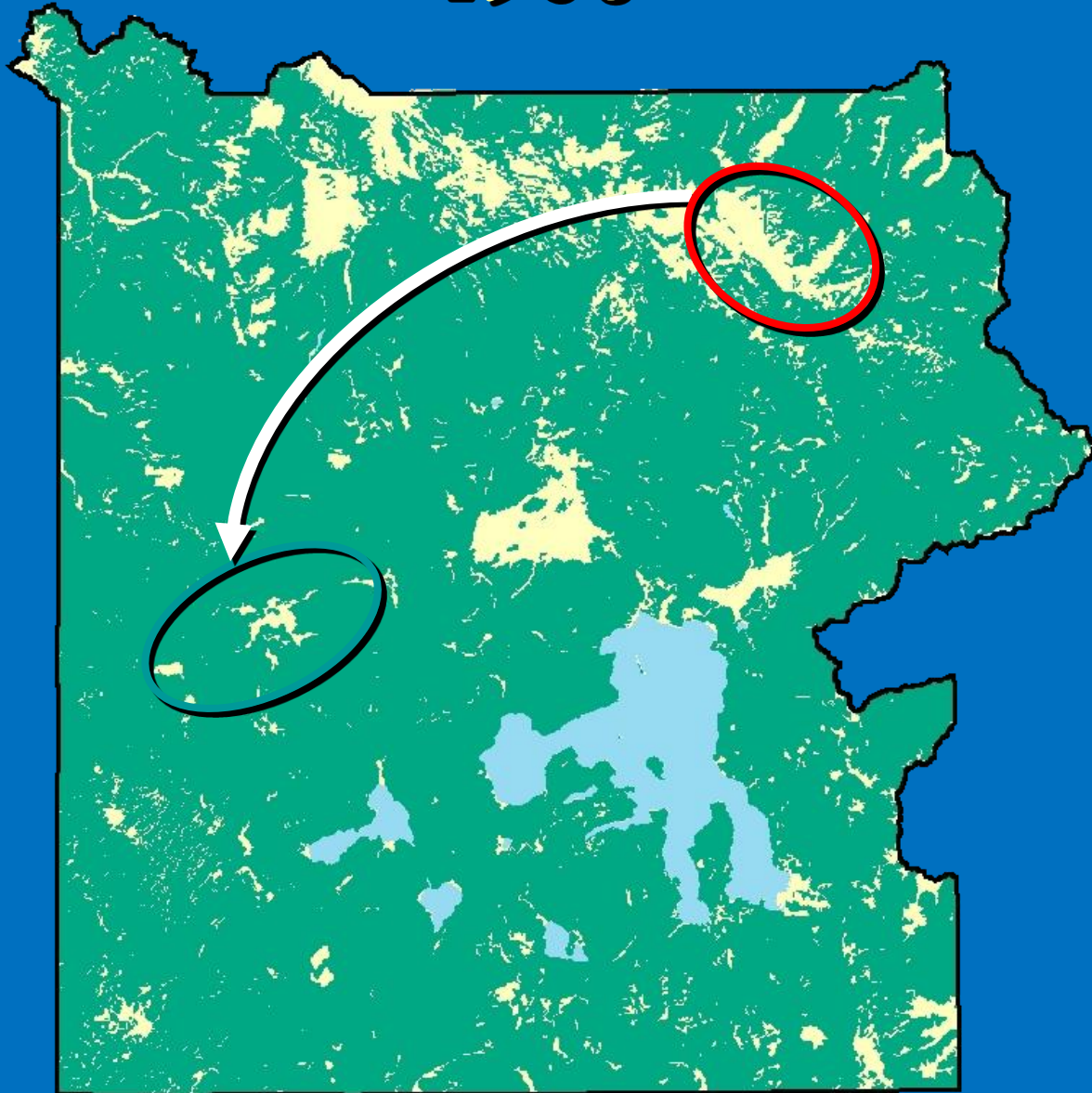
Management 1936



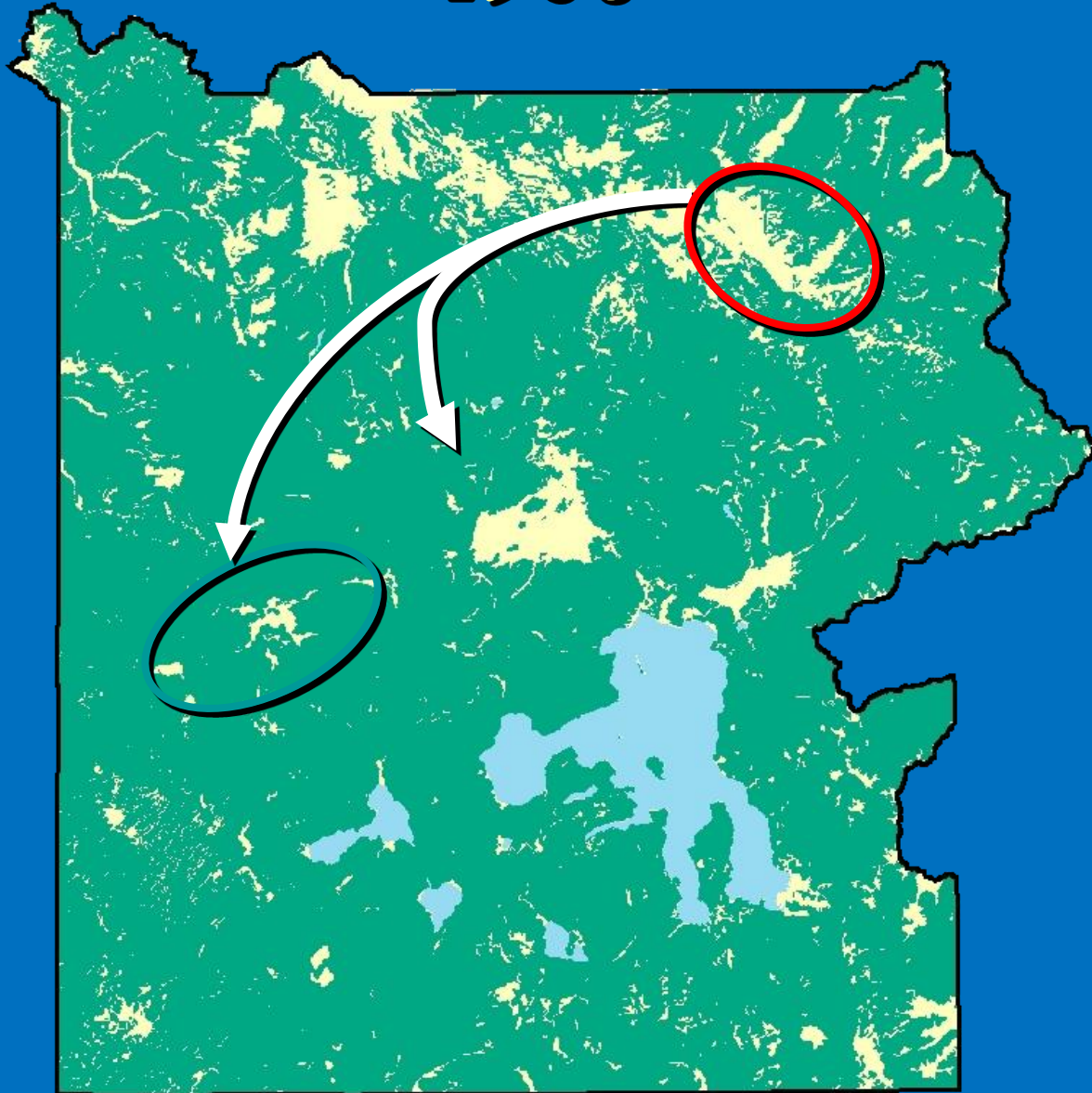
Management 1936



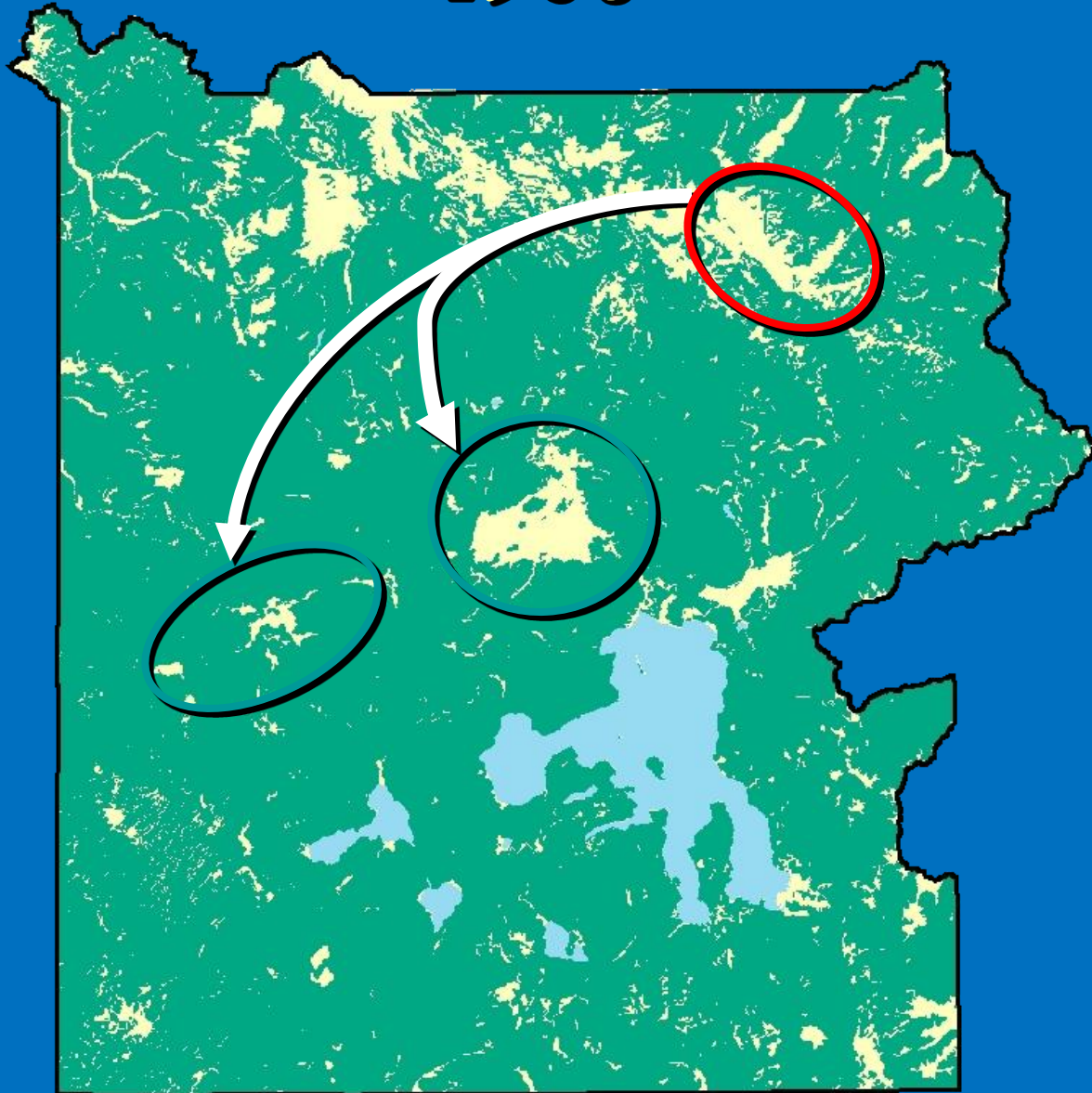
Management 1936



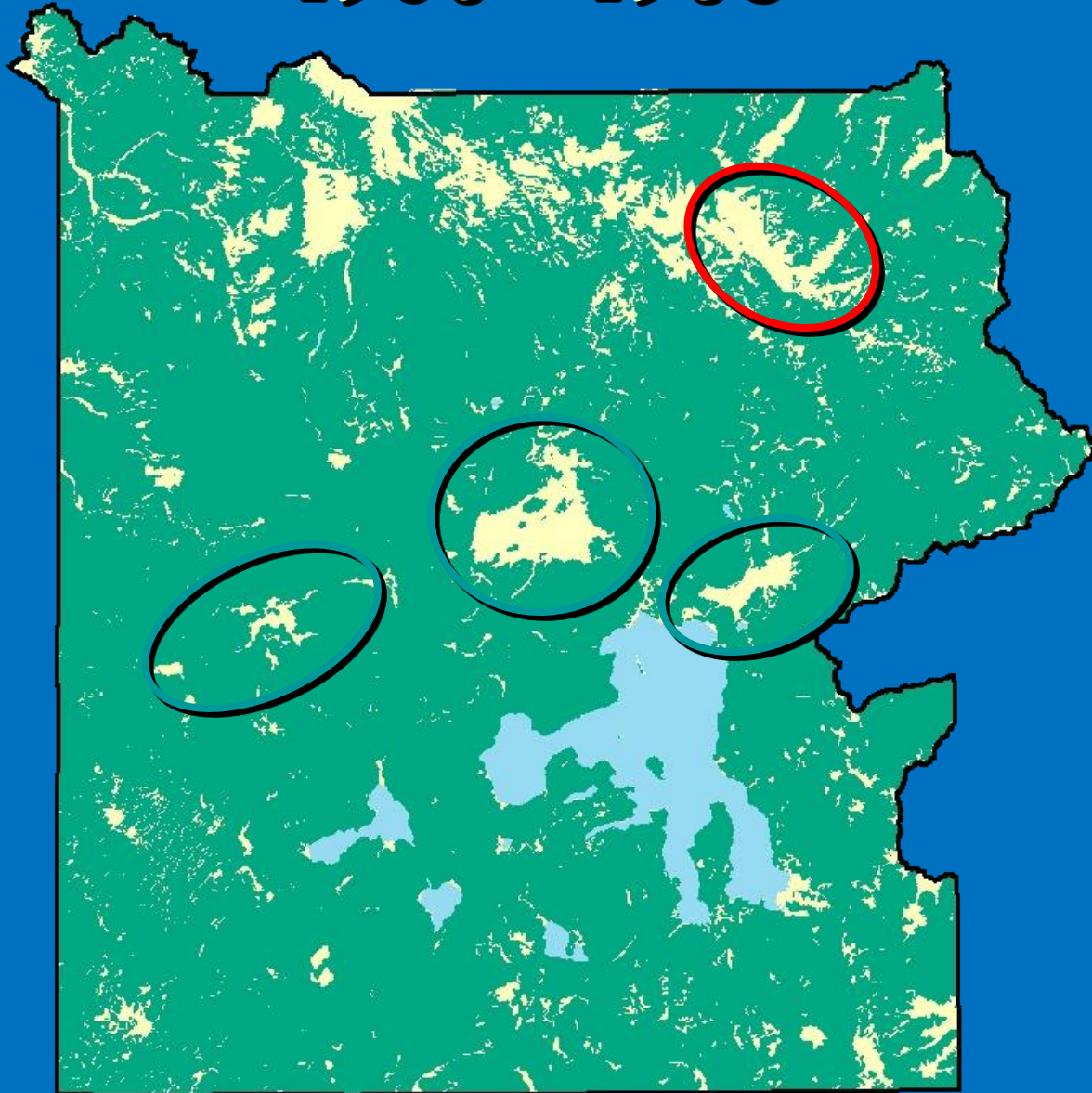
Management 1936



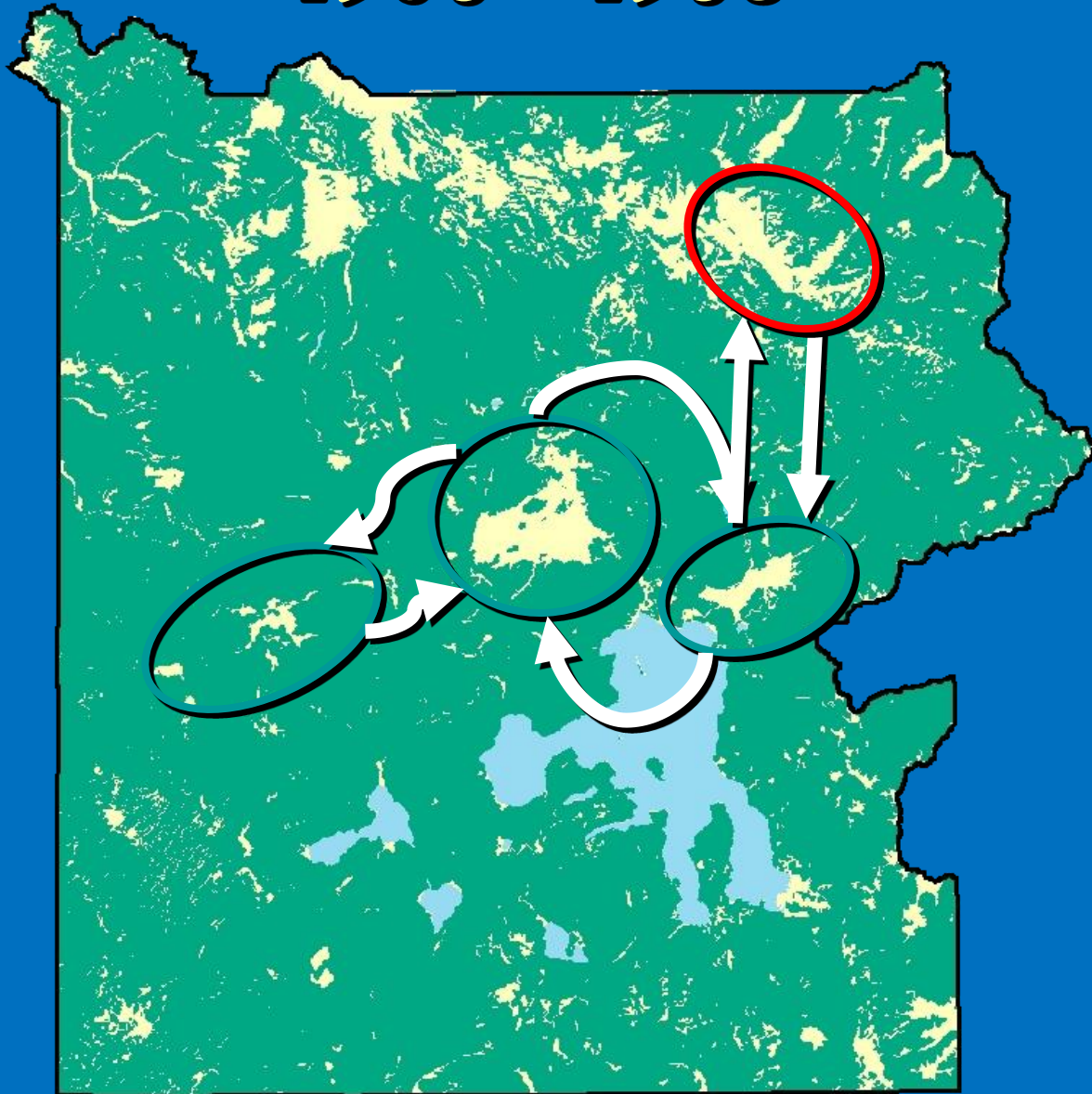
Management 1936



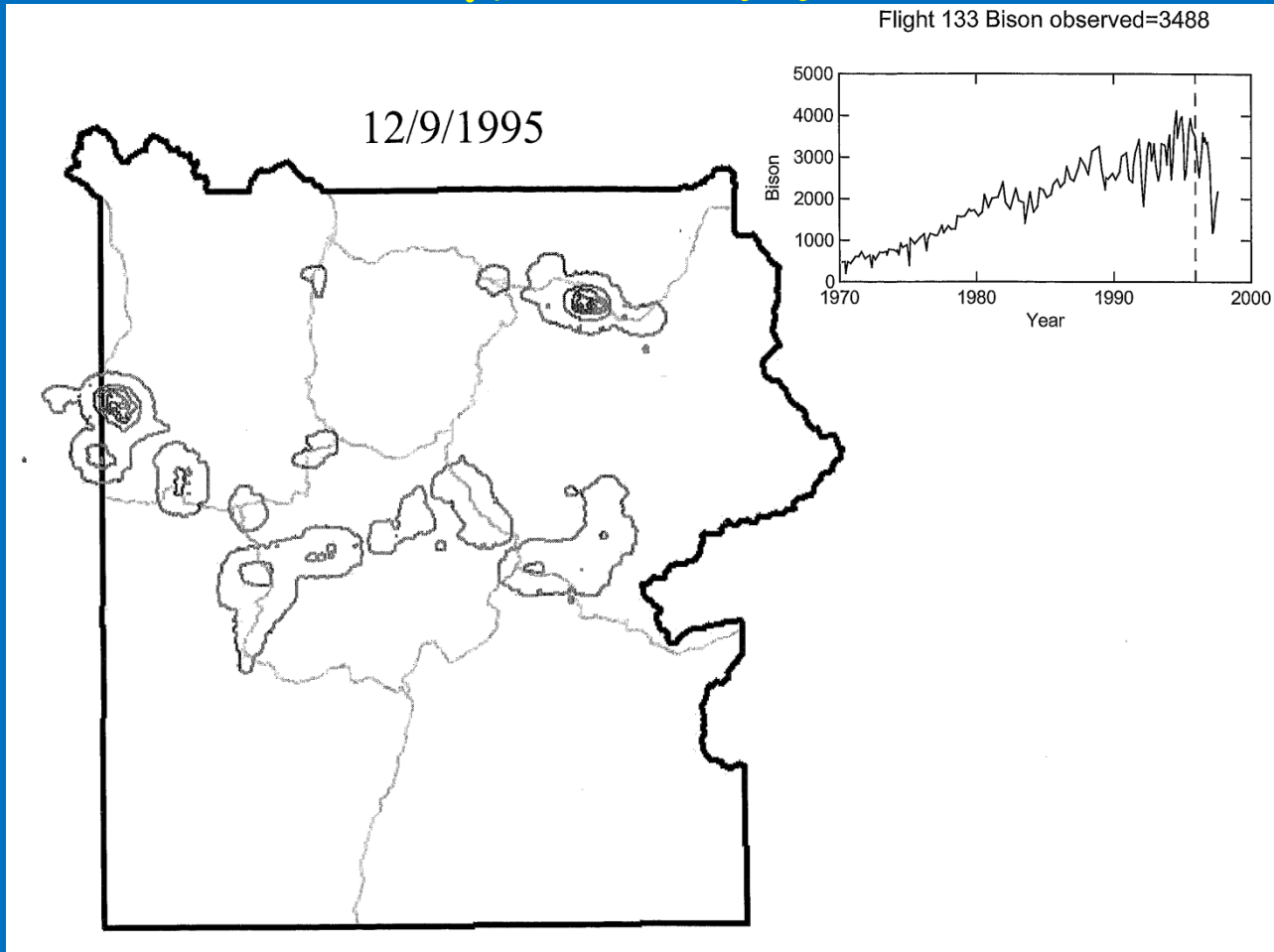
Herd Development 1936 - 1968



Herd Development 1936 - 1968



Herd Development mid - 1990s



Taper, M. L. , M. Meagher and C. L. Jerde. 2000. The Phenology of Space:
Spatial Aspects of Bison Density Dependence in Yellowstone National Park.
Typewritten

Population Substructure

Not a Question of
Substructure Existence

but of

Extent of Interchange Between
Herds

Distinctive Herd Characteristics

Aberrant molar teeth in Central Yellowstone Bison

Shupe, J. L., A. E. Olson H. B. Peterson and J. B. Low. 1984.
Fluoride toxicosis in wild ungulates. *Journal of the American
Veterinary Medical Association* 185:1295-1300.

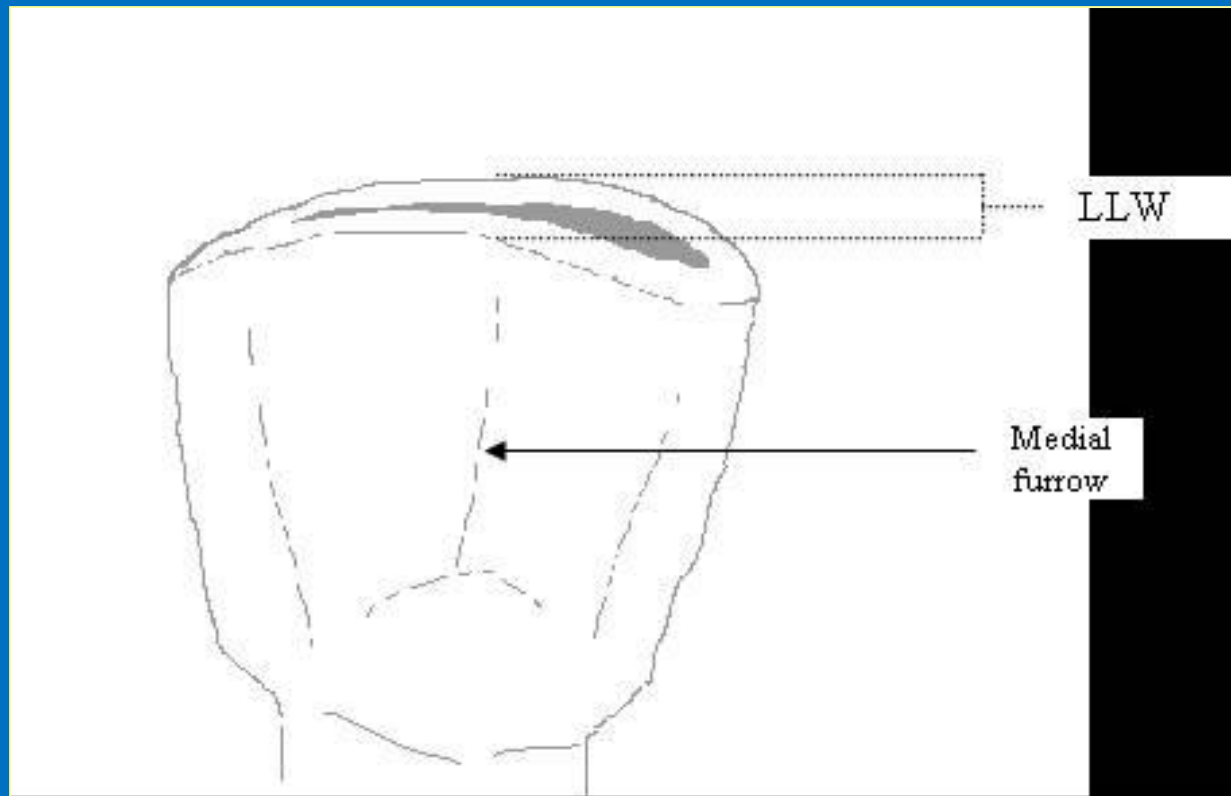
Different Pregnancy Rates Between Subpopulations

Kirkpatrick, J. F., J. C. McCarthy, D. F. Gudermuth, S. E. Shideler, and B. L. Lasley. 1996.
An assessment of the reproductive biology of Yellowstone bison (*Bison bison*) subpopulations
using noncapture methods. *Canadian Journal of Zoology* 74:8-14.

Field Sampling

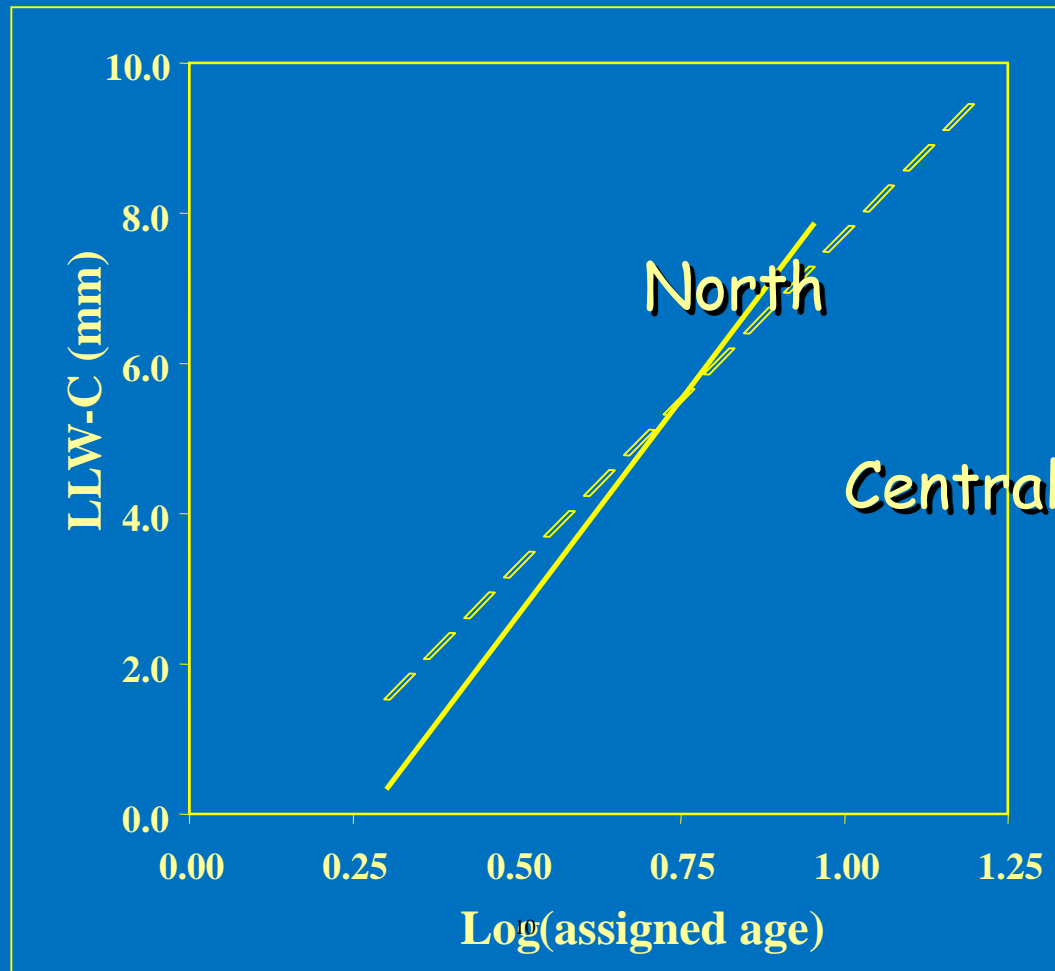
- Sampled slaughtered bison 1996 - 2003
- Followed movements of radio-marked bison 1997 - 2000
- Collected samples for study of Interior bison genetics

Distinctive Characteristics Female First Incisor Wear



Christianson, D. L., P. J. P. Gogan, K. M. Podruzny and E. M. Olexa. 2005.
Incisor wear and age in Yellowstone bison. *Wildlife Society Bulletin*
3:669-676.

Distinctive Characteristics Female First Incisor Wear



Christianson, D. L., P. J. P. Gogan, K. M. Podruzny and E. M. Olexa. 2005. Incisor wear and age in Yellowstone bison. *Wildlife Society Bulletin* 33:669-676.

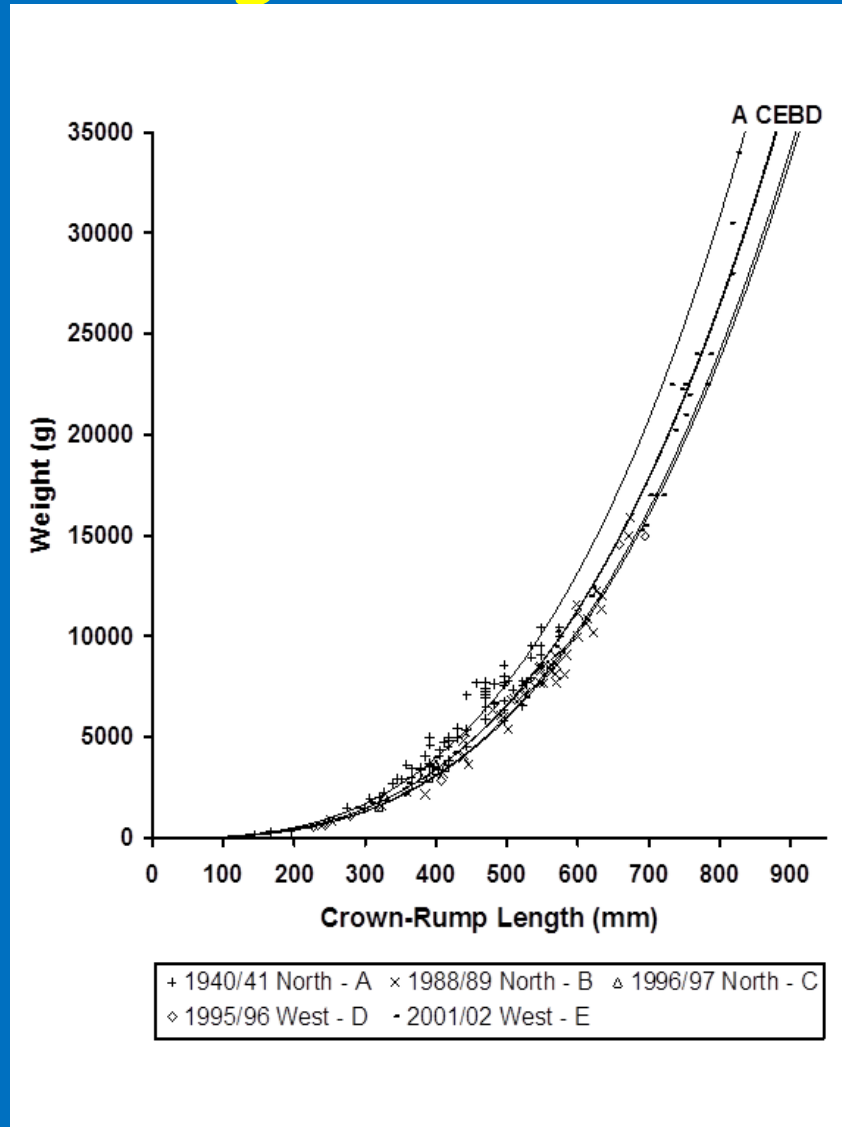
Distinctive Characteristics Timing of Parturition

Methods

Collected Fetuses from Pregnant Cows

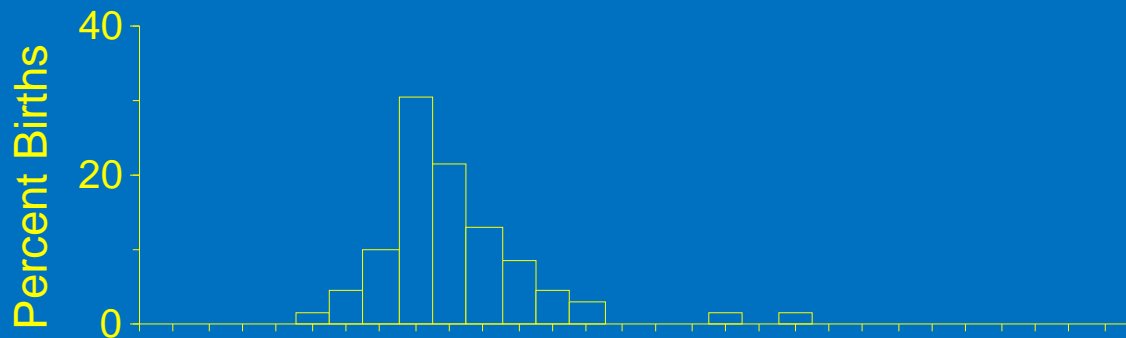


Distinctive Characteristics Timing of Parturition

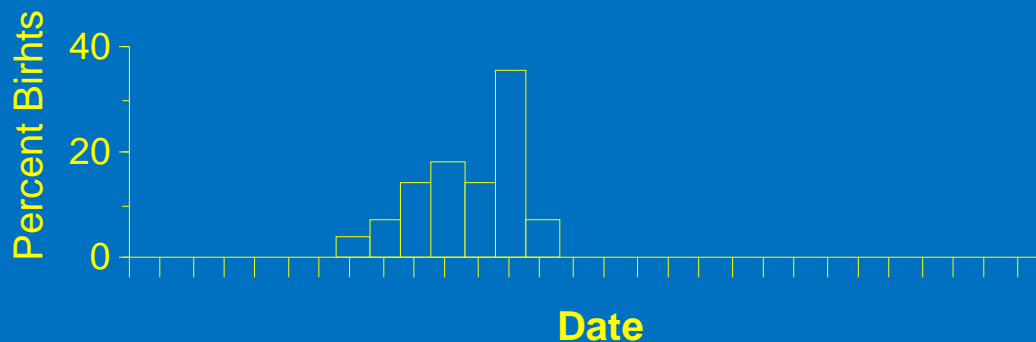


Distinctive Characteristics Timing of Parturition

Northern



Central



Yellowstone Bison Distribution 1997 - 2000

- Pooled all locations for select periods of year for radio-marked bison over 2.5 years
- Conducted cluster analysis
- Defined group membership by majority of locations for each bison
- Identified a bison as cross-classified when its initial group assignment differed from the majority of locations for that bison

Olexa, E. M. and P. J. P. Gogan. 2007. Spatial population structure in Yellowstone Bison. *Journal of Wildlife Management* 71:1531-1538

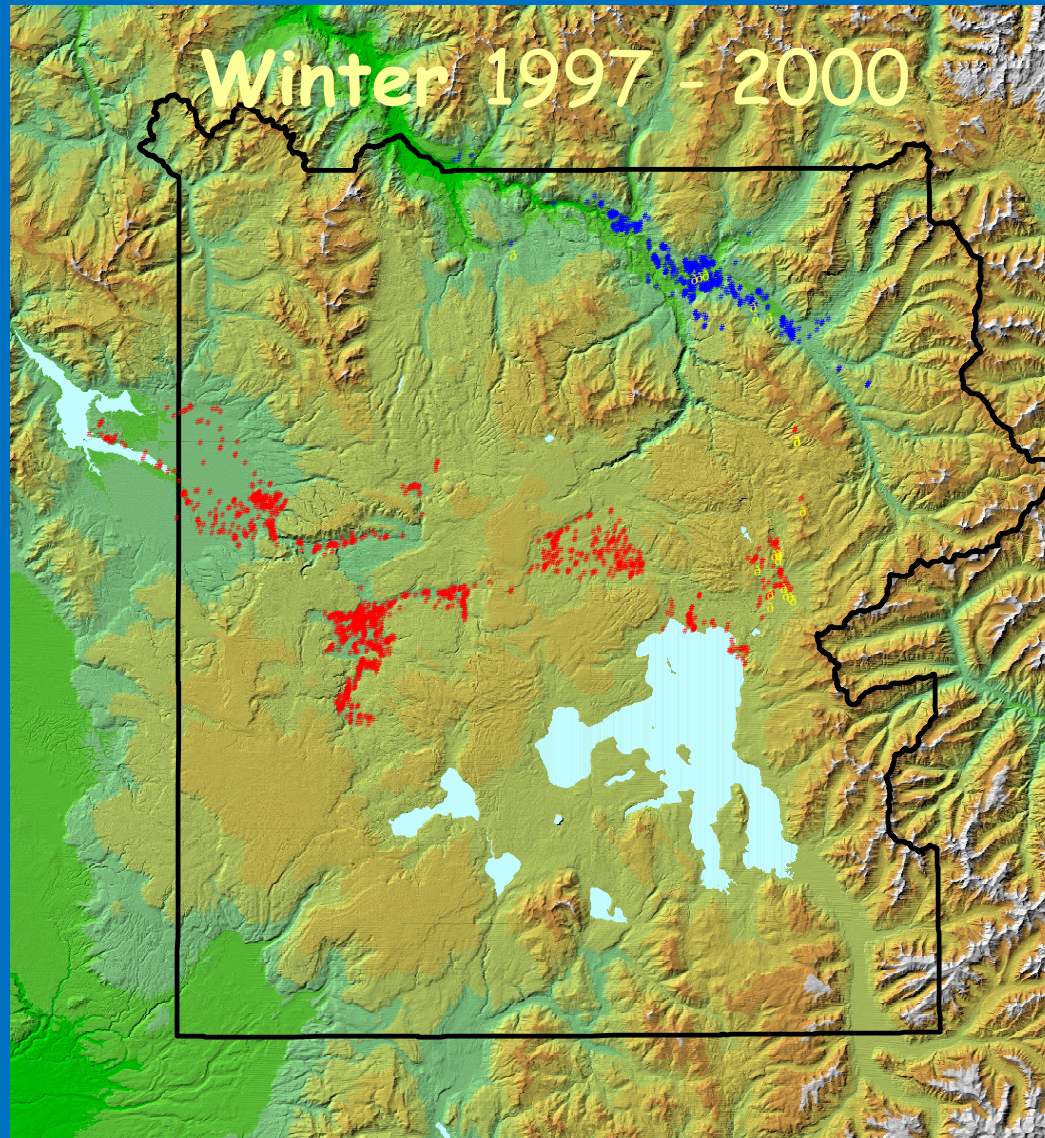
Yellowstone Bison Distribution 1997 - 2000

Winter (1 November - 31 May)
103 bison and 1977 locations
Exchange rate: 4.85 - 7.77%

Peak Rut (15 July - 15 September)
92 bison and 488 locations
Exchange rate: NONE

Olexa, E. M. and P. J. P. Gogan. 2007. Spatial population structure in Yellowstone Bison. *Journal of Wildlife Management* 71:1531-1538.

Yellowstone Bison Distribution

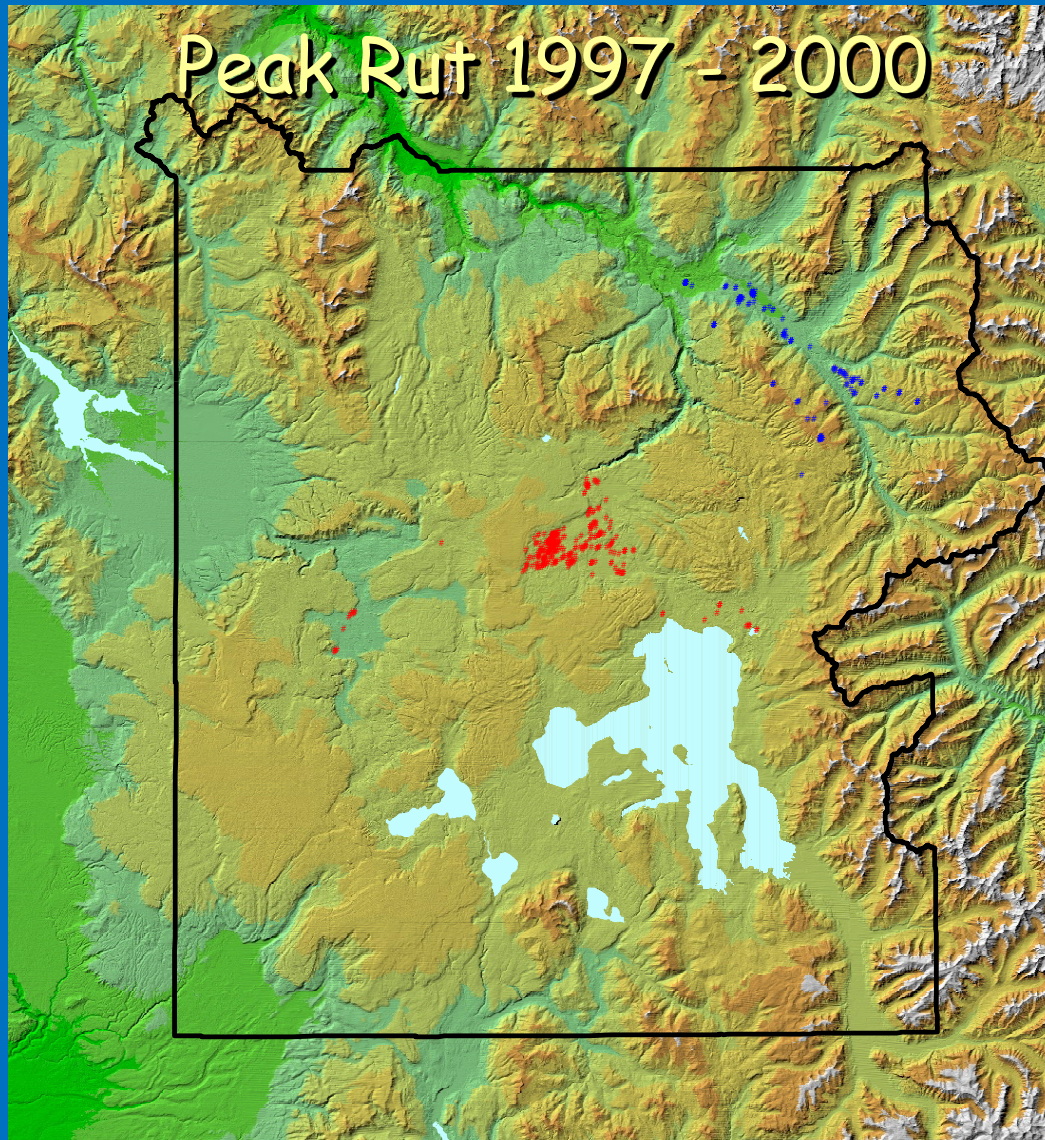


Winter 1997 - 2000

- # Northern Herd
- * Central Herd
- ø Cross-classified Location

Winter
(November - May)

Yellowstone Bison Distribution



- # Northern Herd
 - # Central Herd
 - ø Cross-classified Location (July 15 - September 15)
- Peak Rut

Yellowstone Bison Genetics 1997-2002

Data Collection

596 samples collected opportunistically from 1997-2002

297 from North Boundary

299 from West Boundary

57 live captured (northern and central)

Used suite of 46 polymorphic nuclear microsatellites

Analysis

Check for random distribution

Hardy-Weinberg equilibrium expected in panmictic population

Genetic substructure analysis (STRUCTURE program)

looks for subpopulations and quantifies differences

Yellowstone Bison Genetics

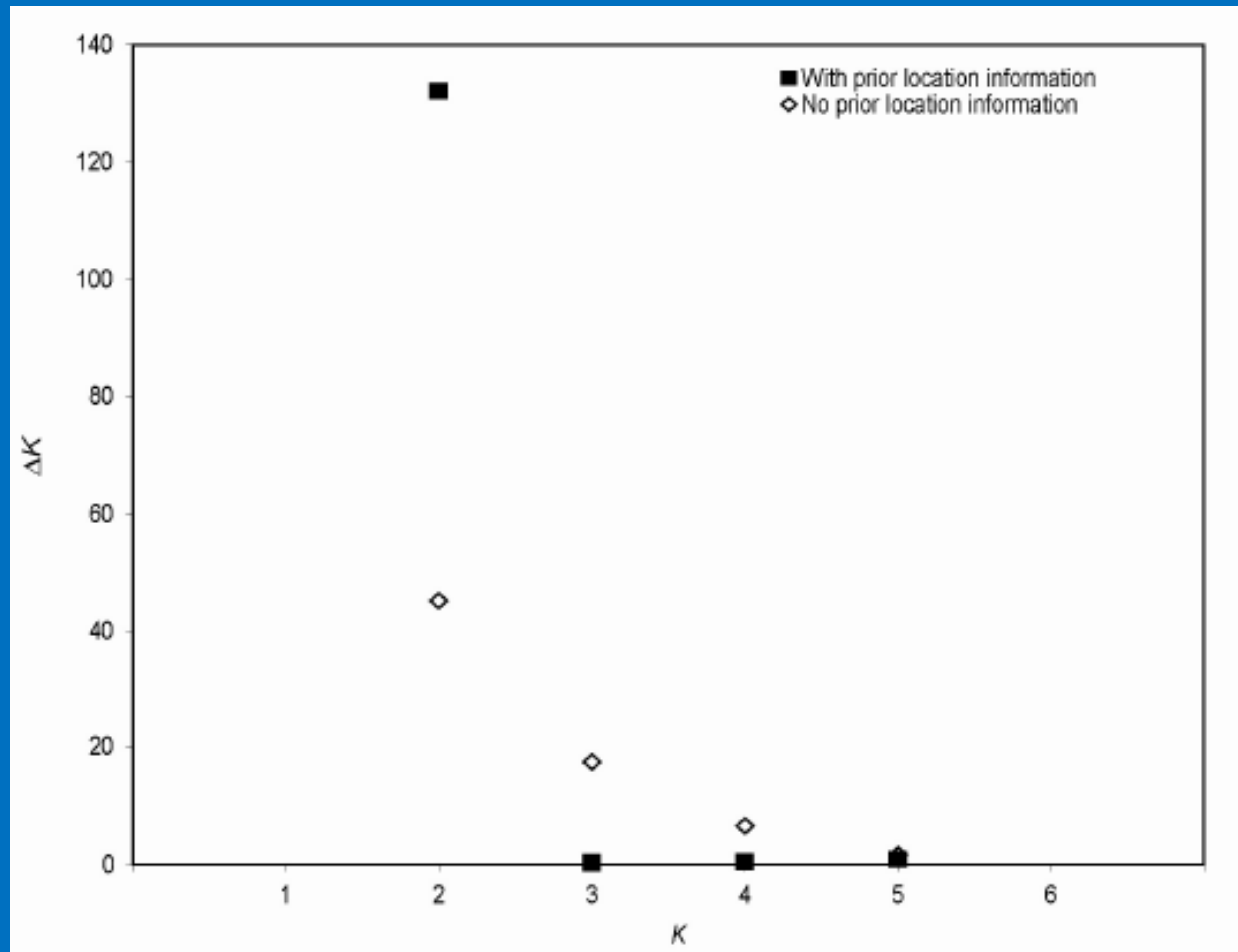
Genotypic distribution

Sample population NOT in H-W equilibrium

Deficiency of heterozygotes noted

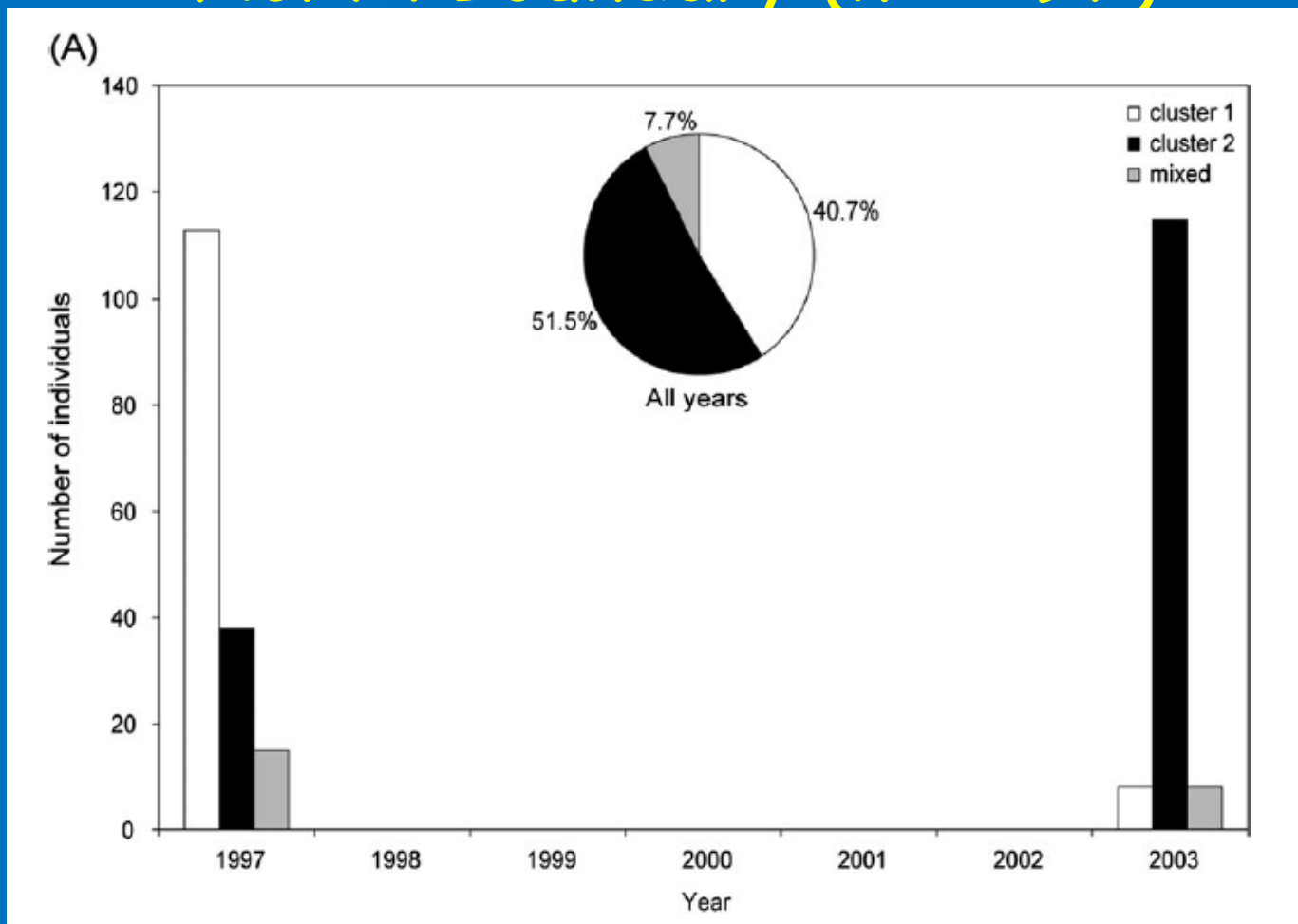
Condition expected when 2 breeding populations are artificially pooled

Yellowstone Bison Genetics Cluster Analysis



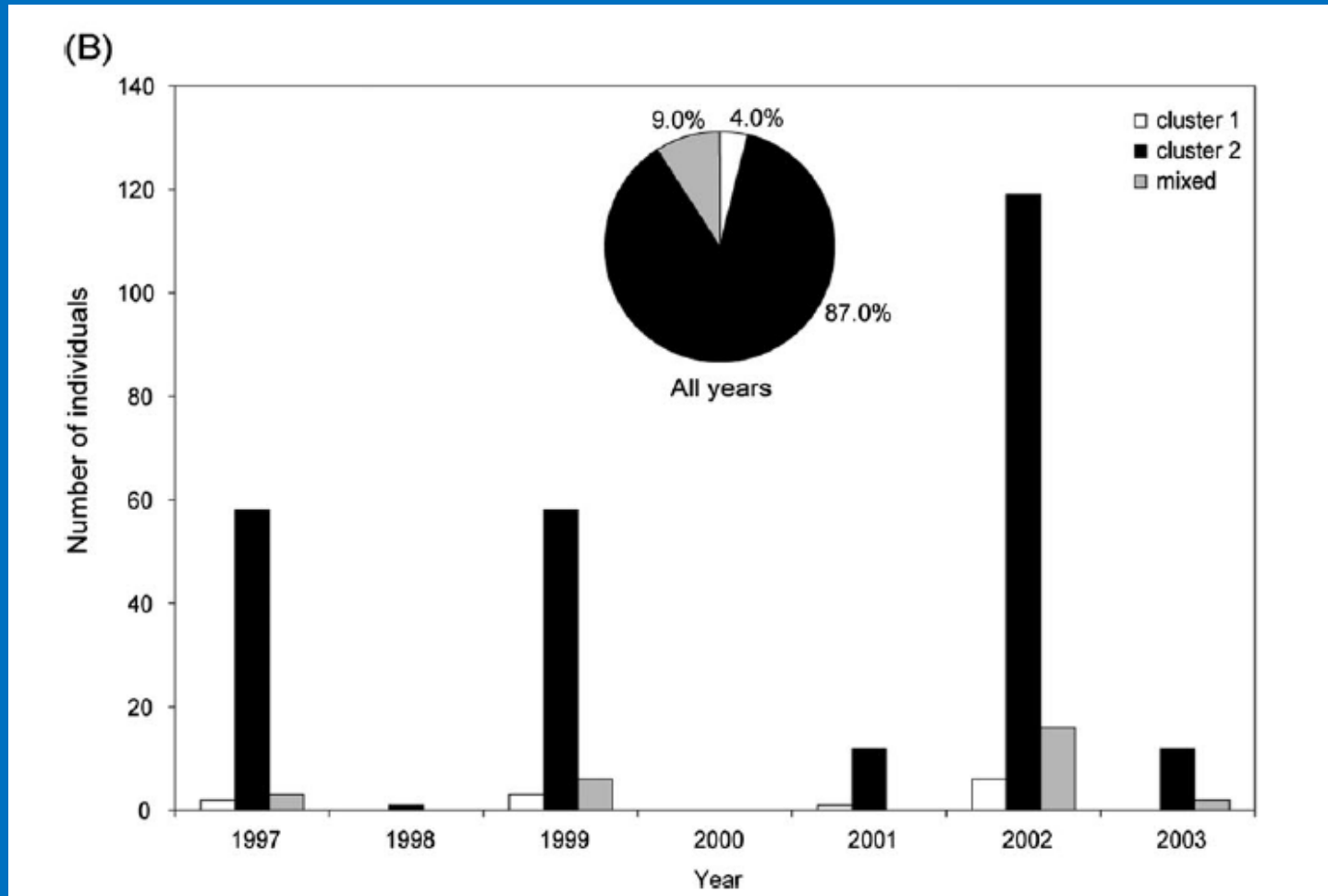
Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population substructure in bison at Yellowstone National
Park. *Journal of Heredity* 103:360-370

Genetic Assignments North Boundary (n = 297)



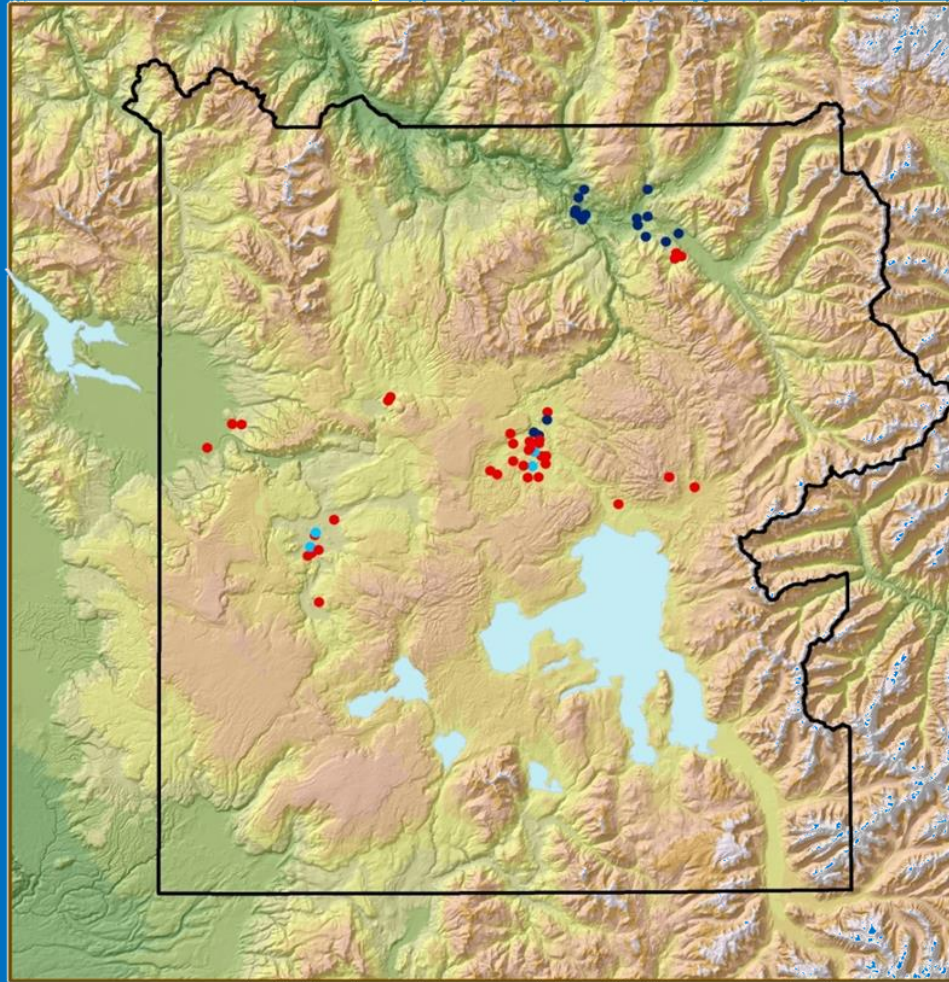
Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population Substructure in bison at Yellowstone National
Park. *Journal of Heredity* 103:360-370

Genetic Assignments West Boundary (n = 299)



Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population substructure in bison at Yellowstone National Park.
Journal of Heredity 103:360-370

Genetic Assignments Live Captures (n = 57)

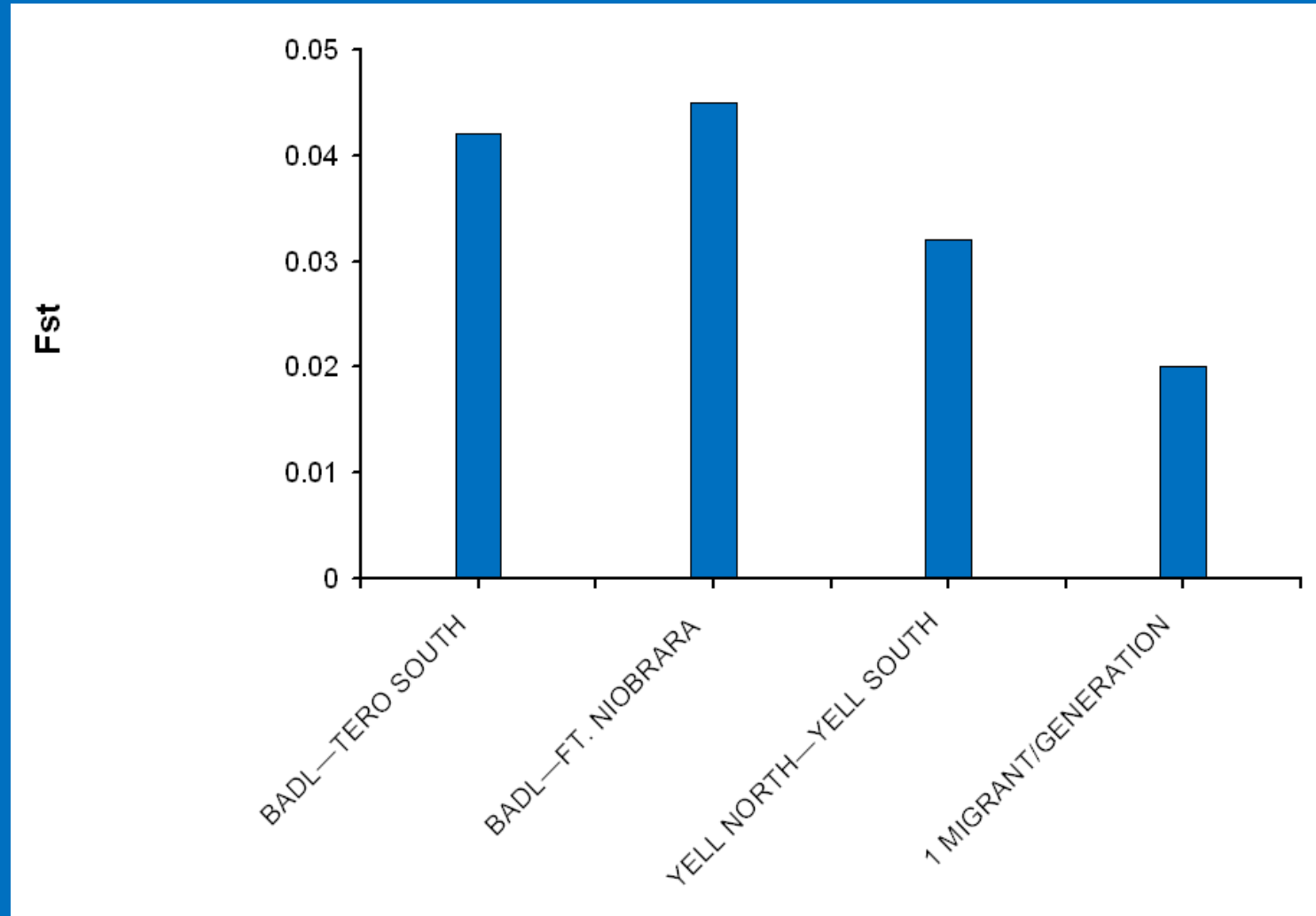


Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population substructure in bison at Yellowstone National
Park. *Journal of Heredity* 103:360-370

Quantify Genetic Divergence - F_{ST}

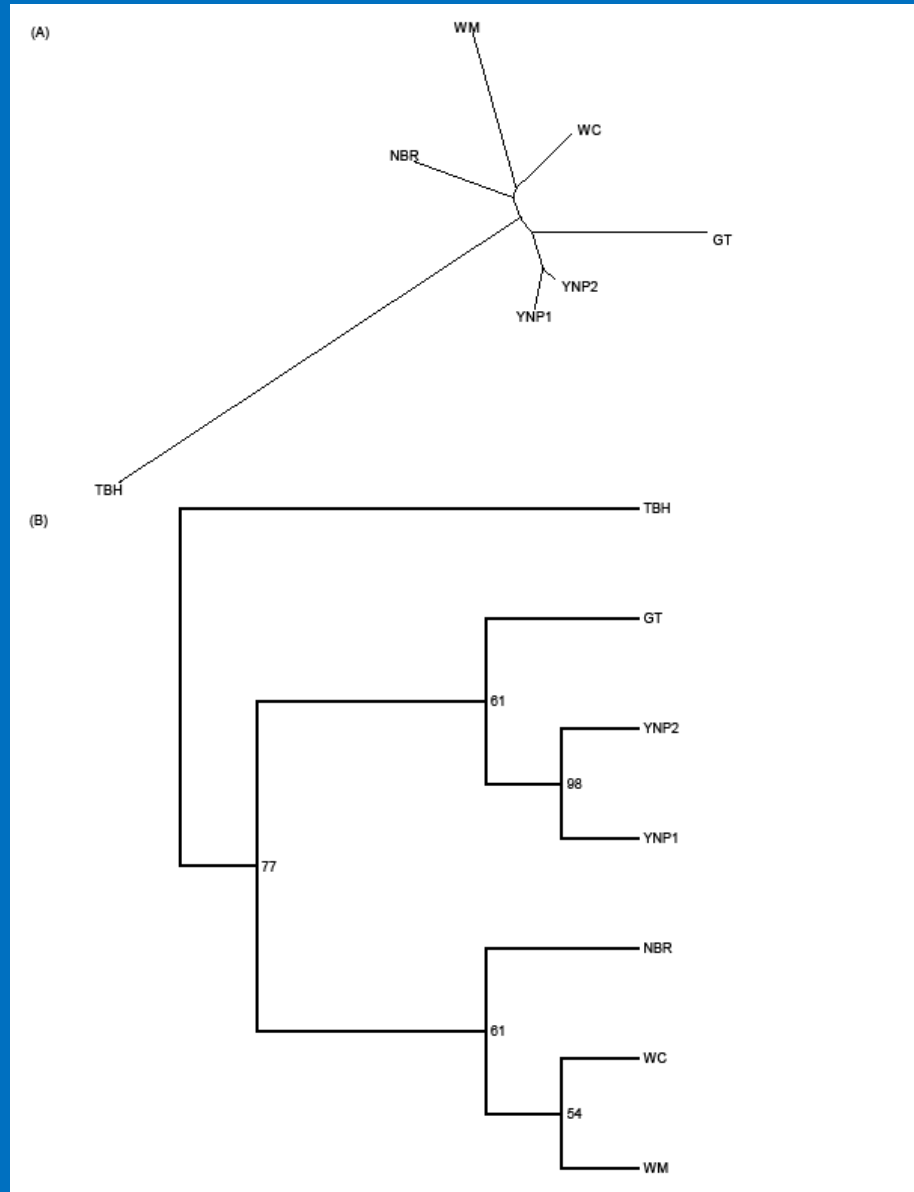
- Genetic Drift Increases Value
- Gene Flow Decreases Value

Genetic Divergence - Fst



Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population substructure in bison at Yellowstone National Park.
Journal of Heredity 103:360-370

Interior Bison Genetics



Halbert, N. D. and J. Derr. 2007. An evaluation of subdivision in the Yellowstone National Park bison population. Typewritten

Yellowstone Bison Genetics

- Multiple breeding populations
(non-random mating)
- Not completely isolated

Halbert, N. D., P. J. P Gogan, P. W. Hedrick, J. M. Wahl and J. N. Derr.
2012. Genetic population substructure in bison at Yellowstone National Park.
Journal of Heredity 103:360-370.

Yellowstone Bison Conclusions

Levels of Separation are:

Dentition

Spatial

Demographic

Genetic

Thank You