Key to fields, online appendices, *Wild mammals of Wyoming and Yellowstone National Park*

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INTRODUCTION

The data described here constitute the online appendices for the book, *Wild mammals of Wyoming and Yellowstone National Park*, by Steven W. Buskirk (University Press of Colorado, 201?). They are intended to support the state-level geographic range maps for which individual locations are presented with information about each of the detections of mammals. The data are presented as tabs in a single spreadsheet, and are of two types. Tabs with the notation "spec" (specimens) are compilations of specimens in museums for which locality, date, collector, and other data are available, typically online. Tabs without that notation are compilations of captures for which no specimen is available. For bats, this is typically animals either captured in mistnets or examined closely in hibernacula for which no corresponding specimen is available. For some other species (e.g. Wyoming pocket gophers) the observations were of animals caught in traps and released at the site.

"SPECIMENS"

Data acquisition

The original data making up these spreadsheets were obtained from three primary sources: the Mammal Networked Information System (MaNIS - http://manisnet.org/) an online collection of museum records, ARCTOS (http://arctos.database.museum/home.cfm) another online museum data distribution service, and the University of Wyoming Museum of Vertebrates (UWMV) collection records. Only mammal records which were collected in Wyoming were included in the downloads. The original data records, as downloaded from the above sites, are presented as spreadsheet tabs for each species. Specimen information was compiled from five sources spreadsheets (ARCTOS, MaNIS, KUM, USNM and UWMV) and combined into a master list for each species containing the data fields explained here.

Note that some field names are preceded by "Verbatim_" or "Added_". "Verbatim_" refers to field values provided in the original download with no modifications; all formatting, capitalizations, and apparent misspellings and other errors were preserved. "Added_" refers to field values that were added to the original records to clarify or express values in common units. In parentheses following each description is a list of the equivalent fields from each original museum download, which are used to form the new field (note: KU, USNM are combined with MaNIS, because the fields are the same). Columns consisting entirely of missing values were deleted from the spreadsheets presented here.

Database fields

Source #: a field added to each of the original spreadsheets to uniquely identify each record within the master spreadsheet and allow each to be traced back from the master to the originals.

The first part (e.g., "ARCTOS") refers to the original data source. The second part refers to the record number within that datasheet. (ARCTOS, MANIS, UWMV = "Source #")

Collection: the specific museum or collection in which the specimen is located. See Table 1 for a list of all source collections. See also the section on Long (1965). (ARCTOS, UWMV = "Collection"; MaNIS = "Institution")

Verbatim_Catalog#s: the catalog or tag number of the specimen as originally reported in download. (ARCTOS = "CAT_NUM" + "OTHERCATALOGNUMBERS"; MANIS = "Catalog number text"; UWMV = "Catalog #'s")

Verbatim_Genus: the genus of the organism as originally reported. (ARCTOS, MaNIS, UWMV = "Genus")

Vebatim_Species: the specific epithet of the organism as originally reported. (ARCTOS, UWMV = "Species"; MANIS = "Species epithet")

Verbatim_Subspecies: the subspecific epithet of the organism as originally reported. (ARCTOS, UWMV = "Subspecies"; MANIS = "Subspecies epithet")

Verbatim_Family: the family of the organism as originally reported in download. (ARCTOS = "FAMILY"; MANIS, UWMV = "Family")

Verbatim_CollDate: the original (non-standardized) date on which the specimen was collected as originally reported. (ARCTOS = "VERBATIM_DATE"; MANIS = "Verbatim collecting date"; UWMV = "Collection_Date")

Verbatim_Collector: the person or group responsible for collecting the specimen as originally reported. (ARCTOS = "COLLECTORS", MANIS, UWMV = "Collector")

Verbatim_Location: originally reported location where the specimen was collected. These values range from detailed latitude/longitude coordinates to relative directions to the name of a town, county, or other geographic feature. (ARCTOS = "VERBATIM_LOCALITY"; MANIS = "Locality"; UWMV = "Verbatim_Locality")

Verbatim_County: this column contains the county in which the specimen was collected if recorded. (ARCTOS, MANIS, UWMV = "County")

Verbatim_DecLatitude: latitudinal coordinates as reported, typically in decimal degrees format. (ARCTOS = "DEC_LAT"; MANIS, UWMV = "DecimalLatitude"). "0" values should be read as missing values.

Verbatim_DecLongitude: longitudinal coordinates as reported, typically in decimal degrees format. (ARCTOS = "DEC_LONG"; MANIS, UWMV = "DecimalLongitude"). "0" values should be read as missing values.

Verbatim_DerivedBy: information about how the latitude and longitude were derived from the verbatim location; included as originally written. (ARCTOS = "LAT_LONG_DETERMINER" + "LAT_LONG_REF_SOURCE"; MANIS = "Georeferencing Method"; UWMV = "Derived By")

Verbatim_Datum: geographic datum associated with the latitude and longitude appearing in the Verbatim_DecLatitude and Verbatim_DecLongitude fields. (ARCTOS = "DATUM"; MANIS, UWMV = "Datum")

Verbatim_CoordUncert: an estimate of the precision of the Verbatim_DecLatitude and Verbatim_DecLongitude relative to the collection location. These calculations were made by the

reporting museums using unknown protocols. (ARCTOS = "COORDINATEUNCERTAINTY INMETERS"; MANIS , UWMV = "Coordinate uncertainty in meters"). "0" values should be read as missing values.

Verbatim_Lat/LongComments: text comments and notes referring to latitude and longitude fields originally reported. (ARCTOS = "LAT_LONG_REMARKS"; MANIS = "Lat/Long comments"; UWMV = "Lat/Long comments")

Verbatim_References: references to additional sources of information pertaining to a specimen record. Values for this field were found only in the MaNIS database and are in the form of hyperlinks to archived field notes. (ARCTOS = N.A.; MANIS = "Field notes"; UWMV = N.A.)

Verbatim_Notes: additional remarks pertaining to the specimen found in the original record. (ARCTOS = "REMARKS"; MANIS = "Remarks"; UWMV = "Notes")

Added_CollDate: collection dates from **Verbatim_CollDate** standardized into a mm/dd/yyyy format for easier sorting and analysis.

Added_County: county in which specimen was collected; taken from the Verbatim_County or added based on derived location if no Verbatim_County was present. These were standardized to a similar format and correct spelling.

Added_DecLatitude: for all records unaccompanied by verbatim latitude and longitude coordinates in the original museum record, we calculated such coordinates manually using the Verbatim_Location information. In some cases, this was also performed for records for which the original latitude and longitude values were in question, for example, coordinates given without a datum.

Added_DecLongitude: same as for Added_DecLatitude.

Added_DMSLatitude: same as for Added_DecLatitude, except expressed as degrees, minutes, and seconds.

Added_DMSLongitude: same as for Added_DMSLatitude.

Added_DerivedBy: for all records unaccompanied by verbatim latitude and longitude (i.e., all records with values for Added_DecLatitude and Added_DecLongitude), this field records how those coordinates were derived and by whom. Records plotted using the GIS freeware GoogleEarth are designated as "GE." Some locations were obtained using the U.S. Geological Survey's Geographic Names Information System and are designated as "GNIS." Locations obtained from paper topographic maps are designated as "USGS topos" and those taken directly from the original data source are designated as "Original."

Added_Datum: the geographic datum in which the "Added_DecLatitude" and "Added_DecLongitude" categories were generated.

Added_CoordUncert: for each derived set of coordinates a measure of precision was assigned according to the protocol outlined below.

LocationCertainty: Since most of these records are mapped from text descriptions, the "LocationCertainty" field was added as a rough estimate of how accurately the derived geographic coordinates reflect the actual collection location. There are four possible values for this field:

> Yes – indicates a high degree of confidence in the derived geographic coordinates. Usually, a well-known landmark or very detailed location description.

Mostly – Derived geographic coordinates are believed to accurately reflect collection location, but there are complicating factors, such as a more obscure location with the same name, a record mapped to a town instead of the building specified, records mapping to a large town etc. These potential issues are described following the descriptor "Mostly."

Vague – This descriptor usually indicates an unclear location description or conflicting information. For example, a record mapped to a town which is not within the boundaries of the county it was reported as collected in. If this record alters results (i.e. significant range expansion), it was discarded.

No – Used for records which were unmappable; these should not have been included.

Added_Lat/LongComments: any comments regarding how coordinates were derived as well as any possible issues or concerns. Includes landmarks used in mapping process (e.g., "Mapped from post office")

Added_Notes: Any additional comments about the record

Added_InLong?: See section on Long 1965

Added_LongComments: See section on Long 1965

LONG (1965)

The results of museum downloads were compared to the specimens mentioned or depicted by Long (1965) in his book "The Mammals of Wyoming." The field "Added_InLong?" was added to the spreadsheet to document the overlap between the present museum specimens and those reported by Long as having been examined.

Specimen records in the downloads that apparently match those reported in Long (1965) are noted in the spreadsheet with the value "In Long" in this field.

Specimen records which appear similar to, but not identical to those reported in Long (1965) are noted with the value "Long?" This denotes specimens where the number of specimens Long reported from a location does not match the number of specimens from that location in the museum download; it also includes records in which location descriptions are approximate, but not exact matches (e.g., "6 mi N, 3 mi E of Baggs" vs "9 mi N, 3 mi E of Baggs").

Long also occasionally referenced additional records of specimens not examined, but found in the species literature. These specimens are noted with the value "Ref in Long from [source]."

Finally, specimens referenced in Long that did not have matches in the museum downloads were added to the database as new records, with a value of "From Long" in the "Collection" field. These records also have a unique key in the "Source #" column of "Long_[pg#]_[record#]". Any additional comments about specimen records as they relate to Long (1965) are found in an additional field "Added_LongComments." This field is especially important for all records classified as "Long?."

Table 1. Codes used to denote sources of specimens included in the "specimen" appendices of Wild mammals of Wyoming and Yellowstone National Park.

Name of Collection/Organization	Abbreviation	Type
California Academy of Sciences - Mammal Collection Catalog	CAS	Museum
Cornell University Museum of Vertebrates - Mammal Collection	CUMV/CU	University
Denver Museum of Nature and Science (formerly Denver Museum of Natural History)	DMNS Mammals	Museum
Field Museum of Natural History - Chicago, IL	FMNH	Museum
Florida Museum of Natural History	FLMNH	University
Harvard University - Museum of Comparative Zool. Mammalogy Collection	MCZ	University
Illinois State University	ISU	University
James R. Slater Museum, Univ. of Puget Sound - Terrestrial vertebrates	PSM	Museum
Kansas University Museum of Natural History	KU	University
Museum of Texas Tech University - Mammal specimens	TTU	University
Museum of Vertebrate Zoology Mammal Catalog - Berkeley, CA	MVZ	University
National Museum of Natural History, Smithsonian Institution - Vertebrate Zoology Mammals Collections	USNM	Museum
Natural History Museum of Los Angeles County	LACM	Museum
New Mexico Museum of Natural History and Science - Mammal specimens	NMMNH	Museum
New Mexico State University, Department of Biology Mammal Collection	NMSU	University
New York State Museum	NYSM	Museum
Royal Ontario Museum - Mammal specimens	ROM	Museum
Santa Barbara Museum of Natural History	SBMNH	Museum
University of Alaska Museum, Mammal Collection	UAM	University
University of California, Los Angeles - Dickey Collection	UCLA	University

University of Colorado Museum of Natural History - Mammal Collection	UCM	University
University of Michigan Museum of Zoology - Mammal specimens	UMMZ	University
University of Nebraska State Museum - Vertebrate Specimens	UNSM	University
University of New Mexico - Museum of Southwestern Biology, Division of Mammals	MSB	University
University of Washington, Thomas Burke Memorial Washington State Museum	UWBM	University
University of Wyoming - Mammal Collection	UWMV	University
Utah Museum of Natural History - Mammal specimens	UMNH	Museum
Western New Mexico University Mammal Collection	WNMU	University
Wyoming Natural Diversity Database Biotics Records	WYNDD	Agency
Yale University - Peabody Museum of Natural History	YPM	University

Coordinate Determination Protocol

Geographic coordinates for each record have been derived from the original location description associated with that record ("Verbatim_Location" Field). These derivations have been made independently of any previous attempts to determine geographic coordinates. All information in the "Verbatim_DecLatitude" and "Verbatim_DecLongitude" fields was assumed to have been derived secondarily from the original location information and in many cases was vague or incomplete. That information has not been included in our efforts to derive geographic coordinates for specimen records.

The three procedures outlined here are presented in order from finer- to coarser-scale information. The locational information for each record has been evaluated in this order; for

example, it was first evaluated for precise coordinates; if none, then township-range-section information; if none, then narrative text information.

1. Precise coordinates: finest locational information for many records was lat/long coordinates in dd/mm/ss format, or in decimal degrees, as reported in the download. More modern records may be accompanied by UTM coordinates. We made no attempt to interpret whether such coordinates were reported by the original observers, or were later added or modified by another person.

> *Location* – the record was mapped as a point defined by the finest reported coordinates, verbatim. All points were mapped in decimal degrees and converted to North American Datum of 1983 (NAD83) using a conversion tool developed by Montana State University's Research Coordination Network.

> *Uncertainty* – If available, the original uncertainty distance corresponding to the given coordinates was reported. If no uncertainty distance was given, it was reported as the distance, in meters, corresponding to the last non-zero digit in the coordinate system (i.e., we interpreted ending zeroes as expressions of uncertainty).

2. Township-range-section: the finest locational information for some records was reported as township/ range/ section, ¼ section , ¼ ¼ section. In these cases the record location was mapped to the center of the finest unit described (i.e., some records were located only to township; others possibly to ¼ ¼ section).

Location – record was mapped as a point at the center of the finest unit described, verbatim. TRS units were plotted manually in ArcGIS 9.3 in NAD83.

Uncertainty - uncertainty distance was the distance, in meters, from the center to the corner of the finest unit described. Township = 6828 m; Sec = 1138 m; ¼ sec = 569 m; ¼ ¼ sec = 284 m.

3. Text description of the vector from a mappable feature; e.g., "30 MI W, WAMSUTTER". We assumed that such notation specified a point at the given distance, along the given true compass bearing, from the given feature. Dual distances, such as "9 MI EAST 2 MI N, BAGGS" defined a point similarly, but at the end of two additive vectors instead of one. In cases where the text description included an additional mapped feature, for example "9 MI SOUTH, DUBOIS (JAKEY'S CREEK)" – we did not use the additional feature to modify the location defined by the vectors, because the intent and meaning of the additional feature notations were not knowable with any reliability. In the given example, "JAKEY'S CREEK" may have been noted to simply identify the watershed of observation; or perhaps because the observer could see Jakey's Creek from the observation point; or perhaps because the observation was made precisely in the creek itself. The exception to this rule was when a location is specifically mentioned as having been mapped along a linear feature, e.g. "10 mi. E. of Carter along UP Railroad" or "2 mi. N of Colorado Boundary on HWY 287." In this case, the distance was mapped along the reference feature rather than in a straight line path.

Location – the record was mapped as a point at the end of all vectors described in the text entry, verbatim. When plotting points from a town, major landmarks were used as starting points including post offices, town halls, major crossroads or in the case of very

small towns, the approximate geographic center of town. This was typically done using GoogleEarth, a GIS freeware. For more obscure localities, the U.S. Geological Survey's Geographic Names Information System (GNIS) was used to identify reference points.

Uncertainty - uncertainty distance was the distance (m), as follows:

If a location and vector:

For records where distance is reported to nearest mile: 6828 m (equivalent to Township-level precision, as described above).

For records where distance was reported to nearest 0.1 mile or finer: 1138 m (equivalent to Section-level precision, as described above).

If just a location:

For records mapping to a small town or feature (<1 mile across): 1138 m (equivalent to section -level precision, as described above).

For records mapping to a city or feature (> 1 mile across): 6828 m (equivalent to township-level precision, as described above).

If multiple features:

For records mapping the intersection of two features (e.g. roads, rivers): 569 m (equivalent to section -level precision, as described above).

If measured along a linear feature (e.g. river, road, railroad):

For records where distance is reported to nearest mile: 6828 m (equivalent to township-level precision, as described above).

For records where distance is reported to nearest 0.1 mile or finer: 1138 m (equivalent to section-level precision, as described above).

If mapped to an exact street address: 284 m (equivalent to ¼ ¼ section level precision, as described above)

4. Unmappable Features: A record was considered unmappable, and was not included in the distribution maps, for one of four reasons:

- The collection location covered too large a geographic area. This included descriptions consisting of streams, roads, or mountain ranges, without supplemental information (e.g. "Wind River Mountains," "Spring Creek").

- The feature described could not be found. Some locales or topographic features have had multiple names over time, which were not always recorded. Errors in handwriting or transcription might also have resulted in unidentifiable collection locations.

- Multiple features of the same name were located. If multiple locations or features with the same name were located and there was no additional information available for clarification,

the feature was considered unmappable. For example, according to GNIS there is a Split

Rock Peak in Natrona County and one in Albany County. Without additional information

it is impossible to know which is being referenced.

- No location – if there was no location information associated with the record.

"MISTNET"

Spreadsheet tabs with the notation "mistnet" represent captures and other close examinations of

bats (for example, in hibernacula) for which no specimen was retained. They also include

acoustic detections of hoary bats and spotted bats; both species are reliably identified from

acoustic data. These records are archived by the Wyoming Natural Diversity Database, and

modified here to delete non-essential fields (columns).

OBS_ID: unique observation number for each observation.

DATA_SENS: the sensitivity of the location data. Some location data are sensitive and made

available only at the township level. Others are non-sensitive and made available at a higher

resolution (section or ¼ section or degrees, minutes, seconds). "Y" or "yes" indicates sensitive

data.

SENS_NOTES: information about the sensitivity of the data.

LAND_OWNER: the owner of the land, if known and not sensitive.

DATA_DONOR: the person or entity that made the data available to the Wyoming Natural

Diversity Database.

MAPPING_CO:

SNAME: scientific name.

COMNAME: common name.

OBS_DATE: date of observation.

OBSERVER: name of observer.

OBS_DATA: details of observation.

ID_CONFIRM: indicates whether the species identification has been confirmed by a reliable person. "y" or "yes" indicates confirmed.

ID_NOTES: details, in the case that ID_CONFIRM is "n" or "no".

OBS_TYPE: type of observation (e.g. specimen, mistnet survey).

LOCAL_CODE:

REFERENCE: source of information.

LOCATOR: township, range and (for non-sensitive data) section.

TRS_NOTE: details about how location was determined; "SENSITIVE" for sensitive locations.

LOC_NOTE: additional information about how location was determined; "SENSITIVE" for sensitive locations.

MAP_PRECIS: estimated mapping precision. See "Added CoordUncert" above.

C_LAST_MOD: date of last database modification for source feature attributes.

O_LAST_MOD: date of last database modification for observation attributes

A_LAST_MOD: date of last database modification for additional source feature attributes.