GEOGRAPHIC VARIATION AMONG BROWN AND GRIZZLY BEARS (URSUS ARCTOS) IN NORTH AMERICA

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(Ursus arctos) in North America

By

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E. RAYMOND HALL

Three species of bears of the genus *Ursus* inhabit the North American continent (Fig. 1), and up to the present (1983) at least 96 names have been proposed for American bears of the *Ursus arctos* group. These names are to be found in Merriam (1918 and 1929), 84 having been proposed by Merriam himself. All 96 names were proposed for material of Recent geologic age (material of post-Pleistocene age).

Rausch (1963) commented meaningfully on geographic variation in *Ursus arctos* in North America and introduced (pg. 43) the term “local demes” to account for local variations, many of which Merriam had named as subspecies or even species. Rausch did not, however, formally synonymize these names.

Kurtén (1973) explained the morphological variation in skulls of *Ursus arctos* and color variation in its pelage as inheritance from an ancestral population in eastern Asia and western North America and in the connecting land (now under water) that joined the two continents at an earlier time. Kurtén expressed variation in terms of “isophenes” at right angles to clines showing gradual changes in characters from one place to another.

Hall and Kelson (1959) and Hall (1981) listed all names based on North American specimens of *Ursus arctos* (without formally using that name for a single inclusive species) and showed on a map (no. 498, 1981) the type localities and some marginal records of occurrence.

The ninety-some names proposed for supposed kinds of these bears in North America is only about a third as many as the number (271) that Kurtén (1973:2) wrote have been proposed for the corresponding bears in the Old World—a number he characterized as a waste of systematic effort.

The time of arrival in North America of the ancestral stock of the modern Grizzly—Big Brown Bear (*Ursus arctos* Linnaeus) is not certainly known at this time. However, the species now occurs on both sides of the Bering Strait that narrowly separates (presently less than 80 miles of water) the New and Old World continents (Figs. 3, 4). The Diomede Islands near the center of the Strait reduce the land-to-land distance to less than 50 miles. Snow-covered ice may in season completely bridge the water in the Strait.

Against the preceding background of information, nine subspecies of *Ursus arctos* are here recognized as having occurred in North America in Recent time (Fig. 2). Were it not for uncertainty about the provenience of some specimens from certain islands and the adjoining mainland of southern Alaska, it might be possible to recognize in North America a few more than the nine subspecies listed below.

In the period 1962-1968 I measured certain dimensions of the crania of adults and some subadults of *Ursus arctos*, and dimensions of the upper permanent teeth of those and younger specimens. Most measurements were recorded by my wife, Mary F. Hall, or by Charles Long as a Research Assistant, or by some other assistant. For rearrangement and other help with the measurement forms, I acknowledge the invaluable skill of Mrs. Eleanor Lohmann. Of the 2,476 skulls examined, 912 were from adult or old animals. The remainder were: juveniles (permanent dentition not all in place); young (certain bones less than full size as shown by open cranial sutures); and subadults (sagittal crest short or wanting in males and in fe-
males temporal lines separated or barely touching).

Anyone especially interested in cranial change with age should consult Zavatsky (1976) who listed dental and cranial features characterizing individuals of the "Brown Bear" according to eleven age groups ranging from group 1 ("Cubs to 5 months of age") to group 11 ("Both sexes—older than 18 years").

Any person who works with variation in American grizzly and big brown bears and wishes to understand why Merriam named as "species" many specimens that subsequent taxonomists would have identified as "subspecies," or "local demes" (to use Rausch's 1963:43, terms), should read Merriam's two articles "Criteria for the Recognition of Species and Genera," and "Why Should Every Specimen be Named?", in volume one, number one of the Journal of Mammalogy.

The kinds recognized by Merriam are here regarded as belonging to nine subspecies of one species. Most of the morphological variants are regarded as "local demes" or individual variants of one or another of the nine subspecies. The precise assignment of each name and of the minor variants it represents is shown in the following synonymies.

Detailed measurements and notes on which the following summary is based are on file at the Museum of Natural History, University of Kansas, and are available for study by later students interested in geographic variation of these bears. Three facts that complicated such study are an unusual amount of variation, the unavailability of adequate material from some areas, and the impossibility of obtaining specimens now that the bears have been exterminated from much of their original range.

**Ursus arctos alascensis** Merriam
Grizzly or Brown Bear


In the northern third of Alaska, males average 16 percent smaller in condylobasal length than in gyas of the Alaska Peninsula, and the one female available from northern Alaska is 18 percent smaller than the average in gyas on the Alaska Peninsula. The average difference in zygomatic breadth for males is 17 percent. Zygomatic breadth is not available for the female from northern Alaska. The M² is 8 percent shorter and 10 percent narrower in the males from northern Alaska. The length of M² of the one female from northern Alaska (33.2) is near the minimum for the Alaska Peninsula (32.0) and width is 17.1, which is less than the minimum (17.7) for the Alaska Peninsula.

The difference in measurements between specimens from northern Alaska and those of alascensis from the southern mainland of Alaska (including the Kenai Peninsula) east of the range of gyas is much less than between the northern sample and gyas, being nine percent smaller for males in condylobasal length, 11 smaller in zygomatic breadth, 4 shorter for M², and 6 narrower for M². The female from northern Alaska is 13 percent smaller in condylobasal length. The length of M² of the female from northern Alaska (33.2) is near the minimum (28.5) for the southern mainland, and the width (17.1) is near the minimum (16.7) for the southern mainland. The change in size in alascensis appears to be gradual from north to south instead of abrupt at any particular latitude.

Comparisons with U. a. dolli and U. a. horribilis are made in the accounts of those subspecies.

MARGINAL RECORDS.—Alaska. Vicinity of Barrow, 1 MVZ; Colville River, 1 MVZ; Barter Island, 1; British Mts. between Barter Id. and Demarcation Pt., 1 NMC; Alaska-Yukon Boundary, about 50 mi. S of Arctic Coast (lat. 69°00'30") 1 NMC; Kodiak R., 40 mi. from junction with Yukon R., 1 MVZ; Chitina Glacier, 1; Mt. St. Elias, 1; Malaspina Glacier, 2, thence westward along coast, including Montague and Hinchinbrook islands, to Cape Douglas, 3; Bristol Bay, Kogguing, 1, thence westward along coast to Good News Bay, Kuskokwim Bay, 2, northward along coast to South Coast Range, Norton Sound, 1; Port Clarence, 1; Pittmegua River, Cape Sabine, 2 MVZ.

Ursus arctos beringianus Middendorff
Grizzly Bear

1853. Ursus arctos var. beringiana Middendorff, Sibir. Reise, 2, 2:4, pl. 1, figs. 1-6, type from Great Shantar Island, Sea of Okhotsk.

Color pale brown (Geist, 1934:317): for cranial characters of this Asiatic subspecies, see Heptner and Naumov (1967).


Ursus arctos californicus Merriam
California Golden Bear


from Long Valley, N of Sherwood, Mendocino Co., California.

Compared with *U. a. stkeenensis* directly to the north, the skull of *californicus* averages larger in condylobasal length, zygomatic breadth, depth of skull, and length and breadth of M² in males. The same is true of females except that the depth of the skull is less.

Comparison of *californicus* with *horribilis* of Utah (the geographic ranges of which may not ever have met in historic time in Nevada nor south thereof), reveals that males of *californicus* average larger in condylobasal length, average smaller in zygomatic breadth and depth of skull, and average larger in length and breadth of M². These average differences might disappear if more specimens were available.

**MARGINAL RECORDS.**—California. End Siskiyou, near Beswick, 1; Baird, Shasta County, 1; Los Biacitos, head San Onofre Canyon, Santa Ana Mts., San Diego County, 1. Baja California. Sierra Juárez near Santa Catarina Mission (Hall, 1981:953), thence up coast to California. 10 mi. from Blocksburg, Humboldt Co., Lassen Peak Canyon, 1.

*Ursus arctos dalli* Merriam

Brown Bear


Compared with males of *U. a. alascensis* of the southeastern mainland of Alaska, males of *dalli* average larger in condylobasal length and smaller in zygomatic breadth and are essentially the same in depth of skull; M² averages shorter and narrower.

Females of *dalli* average larger in condylobasal length and in zygomatic breadth but smaller in depth of skull; M² averages shorter and broader.

Compared with *U. a. sitkensis* males of *dalli* average essentially the same in condylobasal length, zygomatic breadth, depth of skull, and length and breadth of M².

Compared with *sitkensis*, females of *dalli* average larger in condylobasal length and zygomatic breadth, and less in depth of skull; M² is longer and broader than in *sitkensis*.

Compared with *U. a. horribilis* from the Yukon, *dalli* differs as follows: males average larger in cranial measurements and smaller in length and breadth of M²; females average larger in all cranial measurements and in length and breadth of M².

**MARGINAL RECORDS.**—Alaska. Chaiks Hills, between Mt. St. Elias and Yakutat Bay, 1; N side Yakutat Bay, between Dalton and Hubbard glaciers, 1; *Hd. Disenchantment Bay*, 2; Alsek River, near forks, 3; Dry Bay, mainland, 3 USNM, 1 MVZ; *Alsek River, near coast*, 1, thence up coast to Yakutat Bay region (Ankow River), 1 MVZ; Point Manby, N. Yakutat Bay, 1.—Italicized type for place names denotes omissions of symbols on the map in order to prevent overcrowding.

*Ursus arctos gyas* Merriam

Brown Bear


Skull averaging largest (Fig. 6) in condylobasal length and zygomatic breadth of the seven American mainland subspecies, and M² averaging 10 percent longer in males and 8 percent longer in females than in the
population of alascensis from the northern third of Alaska.

Comparison with middendorffi is made in the account of that subspecies.

MARGINAL RECORDS.—Alaska (Alaska Peninsula). Kukak Bay, near Mt. Katmai, 1, southsouthwest along coast to Wide Bay, 1 MCZ; Morzhovoi Bay, 3; Unimak Id., 2 skins only, collection in which preserved not recorded; Eagle Bay [Unalaska Island], 2, thence northeastward to Isenbek Bay, 3; Port Heiden, 1 MCZ; Bécharoff Lake, 1.

Ursus arctos horribilis Ord
Grizzly Bear or Silver Tip


1822. Ursus griseus Choris, Voyage pittoresque autour du monde, Paris (unpaged). Name applied by Choris to the bear of the interior of North America, but Choris identifies his animal with Ursus griseus Cuv. Regarded as a synonym of Ursus horribilis by Merriam, N. Amer. Fauna, 41:17, February 9, 1918.


1838. Ursus richardsoni Swainson, Animals in menageries . . ., p. 54. Type locality assumed to be shore of the Arctic Ocean, on W side Bathurst Inlet about 8 mi. from mouth Hood River, Mackenzie.


1918. _Ursus planiceps_ Merriam, N. Amer. Fauna, 41:37, February 9, type from Colorado, exact locality unknown, but probably in foothills or on western edge of plains.


1918. _Ursus mirus_ Merriam, N. Amer. Fauna, 41:40, February 9, type from Slough Creek, Yellowstone National Park, Wyoming.

1918. _Ursus rungiusi rungiusi_ Merriam, N. Amer. Fauna, 41:49, February 9, type from Rocky Mts. on headwaters of Athabaska River, Alberta.

1918. _Ursus rungiusi sagittalis_ Merriam, N. Amer. Fauna, 41:50, February 9, type from Champagne Landing, southwestern Yukon.

1918. _Ursus macfarlani_ Merriam, N. Amer. Fauna, 41:51, February 9, type from Anderson River, 50 mi. below Fort Anderson, Mackenzie.


1918. _Ursus pulchellus pulchellus_ Merriam, N. Amer. Fauna, 41:55, February 9, type from Ross River, Yukon.

1918. _Ursus pulchellus ereunetes_ Merriam, N. Amer. Fauna, 41:56, February 9, type from Beaverfoot Range, Kootenai Dist., British Columbia.

1918. _Ursus oribasus_ Merriam, N. Amer. Fauna, 41:56, February 9, type from upper Liard River, Yukon, near British Columbian boundary.


1918. _Ursus crassus_ Merriam, N. Amer. Fauna, 41:90, February 9, type from upper Macmillan River, Yukon.


Skulls of males of _horribilis_ from the Yukon, compared with those of _alascensis_ from east-central Alaska, averaging smaller in condylobasal length, zygomatic breadth and depth of skull, but M2 is longer and wider. In females the three cranial measurements average smaller, as in males, but the length and breadth of M2 average less.

Skulls of three males of _horribilis_ from northeastern British Columbia, compared with those of 26 specimens of _U. a. stikeenensis_ from northwestern British Columbia, average larger in the five measurements mentioned above except for condylobasal
length, which averages smaller. The three females from northeastern British Columbia, compared with 23 specimens from northwestern British Columbia, average smaller in all of the five measurements.

Complete intergradation between stikeenensis and horribilis is evident in southwestern British Columbia, as shown by the adult male (USNM 215440) from Kamloops. Its dark but not brown color provides evidence of intergradation, as do the craniual measurements.

Comparison with U. a. californicus is made in the account of that subspecies. More specimens of both subspecies might reveal that the pelage of horribilis always was less brownish. Comparison with U. a. dalli is made in the account of that subspecies.

MARGINAL RECORDS.—Mackenzie. Baillie's Cove, S end of Arctic Sound, Bathurst Inlet, 1 NMC; Staleyton Bay, Union Strait, 1 NMC; Kugaryuak River, Coronation Gulf, 4 NMC; “type locality of U. richardsoni” assumed to be shore of the Arctic Ocean, on W side Bathurst Inlet about 8 mi. from mouth Hood River” (Hall, 1981:956). Keewatin. Baker Lake (Hall, 1981:953). Mackenzie. Beaverhill Lake, 1 NMC; Barren Grounds E of Great Slave Lake, 1 NMC; W tip of Aylmer Lake (109°13'W, 64°08'N), 3 NMC; Contwoyto Lake, 1 NMC; Copper Mines Valley between Great Bear and Dismal lakes, 1 MCZ; East Branch Dease River, near Great Bear Lake, 1 AMNH; Sekwi River, E side of McKenzie Mt., Canol Road, mi. 174E, 1 NMC. Alberta. Smoky River, 5; N of Slave Lake, 1 U. Alberta; Red Willow Creek, 1 U. Alberta. Saskatchewan. Found in Crane Lake when it dried up, pick up in May of 1937, 1 Old Timers Museum at Maple Creek; Dollard, 1 NMC. Minnesota. Sandhill River in southern Polk Co. (Hall, 1981:953). North Dakota. Ft. Clark, 1; near Middle Butte, now generally Bullion Butte, 1. Wyoming. Bearlodge of Sundance Natl. Forest, 1; Fort Laramie, 1; Lone Tree Canyon, between Hawk Springs and Chugwater, 1 Scotts Bluff Nat. Monument Museum. Kansas. Trego Co. (Hall, 1981:953). Colorado. type locality of Ursus planiceps, 1; 12 mi. NE Saguache, 1. New Mexico. 25 mi. NE Taos Saw Mill Park, 1; Taos, 20 mi. SE on Rio Chiquito, 1; Magdalena Baldy, 1. Texas. Davis Mts., 1. Coahuila. vic. Cuatro Ciénegas (Hall, 1981:953). Durango. Southern Durango (ibid.). Chihuahua. Arroyo del Nido, 600 ft., 25 mi. SW Gallego, 1 MVZ; Colonia Garcia, 6. Sonora. Los Nogales, 1. Arizona. SW slope of Baldy Peak, 10,000 ft., near head Hurricane Creek, Apache Co., 1 MVZ; 8 mi. N Payson, near Green Valley, 1; 30 mi. S William, 1; San Francisco Mts., 1. Utah. Pine Valley Mts., 1; N Fork Salina Creek, about 10 mi. SE Mayfield, 2; Logan Canon, 1. Idaho. Minidoka, 1. Oregon. From dry bed of Malheur Lake, 1; South Ice Cave, 40 mi. S Bend, 1. British Columbia. Rossland, 1 MVZ; near Vernon, 1; Okanagan, 1; Shuswap, 4; Canim Lake, 1; Slough Creek Mts., above timber, Barkerville District, 1 MVZ; Omineca River, 1 ANSP; Gundahoo Pass, 5000 ft., 1 MCZ. Yukon. Upper Liard River, near B. C. Boundary, 1; 50 mi. S Whitehorse, 2 ANSP. British Columbia. Rainey Hollow, 2. Yukon. Dalton House, 5; hd. Alsek River, 1; Duke River, Kluane, 4; Caldern Cr., 30 mi. E Mt. Natazat, hd. White River, 1; headwaters, White River, 1; Divide, White, Glacier and Tanana, Yukon side, 1; Ogilvie Range, Klondyke headwater, 1. Mackenzie. Foothills W of McKenzie River Delta, 1 NMC; Richards Island, Mackenzie Delta, 1 NMC.

Ursus arctos middendorffi Merriam
Kodiak Brown Bear


Zygomatic breadth and depth of skull (Fig. 5) in both sexes from Kodiak Island average larger than in any other subspecies.
U. a. middendorffi specimens from Afognak average smaller in both sexes (two adults of each sex) than those from Kodiak Island in the three cranial measurements except for condylobasal length which averages more.

The M2 averages longer and narrower in middendorffi (Kodiak and Afognak islands) than in gyas in both sexes.

MARGINAL RECORDS.—Alaska. Afognak Island, 7 (specimens of all ages including 3 KU); Kodiak Island, 116 (specimens of all ages including 44 AMNH, 4 ANSP, 3 Boone and Crockett specimens at Carnegie Mus., 7 CAS, 4 KU, 4 MCZ, 12 MVZ).

**Ursus arctos sitkensis** Merriam

Big Brown Bear


Compared with males of **U. a. stikeenensis** from immediately east in northwestern British Columbia, males of **sitkensis** average larger in condylobasal length, zygomatic breadth and depth of skull; M2 is shorter but broader.

Females of **sitkensis** likewise average larger in condylobasal length, zygomatic breadth and depth of skull; M2 is both shorter and narrower.

Compared with males of **stikeenensis** from the area to the south (bounded by Bella Coola, Lagoon Lake, Kleena Kleene, and Ashlum Creek), males of **sitkensis** average larger in condylobasal length, zygomatic breadth and depth of skull, but M2 averages shorter and narrower. Females of **sitkensis** are larger in all measurements except condylobasal length.

**U. a. sitkensis**, when compared with all specimens referred to **stikeenensis**, averages larger in all measurements of the males, and in females averages larger in the three cranial measurements but smaller in length and breadth of M2.

Comparison with **U. a. dalli** has been made in the account of that subspecies.

MARGINAL RECORDS.—Alaska. Headwaters Bear Creek, 40 mi. from Haynes, 1 CAS; *head of Chilkoot Lake*, 1; Berner’s Bay, 5; Taku Inlet, mainland, 1; Sumdum, mainland, 1; Admiralty Island (allegedly), 261 (including 3 AMNH, 5 ANSP, 1 CAS, 1 CM, 6 MCZ, 25 MVZ); Baranof Island, 78 (including 7 MVZ); Kruzof Island, 9; Chichagof Island, 170 (including 1 AMNH, 1 ANSP, 4 CM, 1 MCZ, 3 MVZ); NW side Lituya Bay, 2; Fairweather Glacier, about 15 mi. NW Lituya, 1; *Porcupine, Chilkat*, 1.

From my (E. Raymond Hall’s) Diary for August 1, 1962, written at the Division of Mammals, U.S. National Museum, Washington, D.C., I quote: “At Museum E. P. Walker (Phone W06-5358) phoned having heard from his sister Winifred Deering of U. S. Fish and Wildlife Service, that I was in Washington D. C. He hoped I could nominate someone to get vol. 1 of his 4 vol. work on genera of Mammals ready for the printer. When I told him that I was here examining
skulls of bears with the aim of arriving at a better classification than the current one, Walker said let me tell you something that will help you ‘Ignore all specimens obtained by Merriam from fur dealers and persons who sold skulls to Merriam. Dr. Merriam sent word, for example, to Mr. X in Alaska that skulls were wanted from Admiralty Island. Mr. X told the Indians that bear skulls were wanted from Admiralty Island. The Indian hunters brought the skulls to Mr. X and told him that the skulls were from Admiralty Island. No wonder that four kinds of bears were recorded from Admiralty Island that had close relatives on the mainland. After skulls from Admiralty Island had been obtained, Dr. Merriam sent out word that skulls were wanted from the mainland. The fur dealers told the Indians and hunters and the skulls that came in were all from the mainland, according to the hunters, regardless of where the bears were shot.’”

Ursus arctos stikeenensis Merriam
Big Brown Bear


1918. Ursus atnarko Merriam, N. Amer. Fauna, 41:22, February 9, type from Lonesome Lake, Atnarko River, one of upper forks of Bella Coola, British Columbia.

1918. Ursus crassodon Merriam, N. Amer. Fauna, 41:90, February 9, type from Klappan Creek (Third South Fork Stikine River), British Columbia.

Comparison of stikeenensis has been made with three geographically adjoining subspecies, californicus, horribilis, and sitkensis in the accounts of those three subspecies.

MARGINAL RECORDS.—British Columbia. Dease River, Cassiar Range, 2; Tatletuey Lake, near head Skeena River, 1; Bear River, Bear Lake, 1 ANSP; Tako Lake, 6; “Big Creek, B.C.” but printed on front of label is “Williams Lake, Cariboo BC,” 1 NMC; Kamloops, 1. Washington. Holman Pass, Hd. Holman Creek, trib. of W fk. Pasayton River, 1; Twp. 30N, range 16E, WM, Chelan Co., 1. Presumably to coast of Oregon and presumably up coast of Washington to British Columbia. Nass River, 1 U. Alberta. Alaska. Burroughs Bay, Unuk River, 1; Bradfield Canal, 1; Groundhog Basin, 8 mi. S mouth Stikine River, 3. British Columbia. Stikine River, 1 mi. above boundary, 1; Stikine River, 50 mi. N boundary, 1; Shesley River, 45 mi. N Telegraph Creek, 4; 12 mi. NE Tulsequah on Taku River at entrance to Zohini Creek, 1 Boone and Crockett specimen at Carnegie Mus.; Ben My Chree, Tagish Lake, 1 CAS; Atlin, 1; 60 mi. E Atlin, 1.
Table 1. Average, minimum, and maximum cranial and dental measurements of *Ursus arctos*.

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<th>No. of specimens examined</th>
<th>Condylobasal Length</th>
<th>Zygomatic Breadth</th>
<th>Depth of Skull*</th>
<th>Length M2</th>
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* Measured from sphenoidal floor of braincase above posterior margin of palate to highest point on braincase.

** Remaining specimens are from USNM
LITERATURE CITED

AND SOME OTHER PERTINENT LITERATURE
NOT IN THE PRECEDING SYNONYMIES


11
Ursus maritimus
Polar Bear

Ursus arctos-group
Big Brown and Grizzly Bear

Ursus americanus
Black Bear

Figure 1. The Holarctic and Nearctic bears (genus Ursus).
Figure 2. Subspecies of *Ursus arctos* in North America.
Figure 3. Geographic range of *Ursus arctos* in Eurasia at about 1400 B.C.
Figure 4. Geographic range of *Ursus arctos* in North America and adjoining part of Asia at about 1400 B.C.
Figure 5. *Ursus arctos middendorffi* Merriam, C. H., 1896:69. Collected by Ross Beach. δ ad. No. 5355 Fort Hays Kansas State College Collection of Vertebrates. From Upper Spiridon Lake, Kodiak Island, Alaska. ×½ natural size (condylobasal length of skull is 395 mm).

Figure 6. *Ursus arctos gys* Merriam, C. H., 1902:78. Collected by Colonel Colby. δ ad. No. 135502 Amer. Mus. Natural Hist. From Canoe Bay, Alaska Peninsula. ×½ natural size (condylobasal length of skull is 398 mm).
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