

GEOGRAPHIC VARIATION IN SIZE IN NORTH AMERICAN BROWN BEARS, *URSUS ARCTOS* L., AS INDICATED BY CONDYLOBASAL LENGTH

ROBERT L. RAUSCH

Arctic Health Research Center, Public Health Service, U.S. Department of Health, Education, and Welfare, Anchorage, Alaska

Received July 26, 1962

Abstract

Variation in size of brown bears, *Ursus arctos* Linnaeus, indicated by condylobasal length of the skull, has been studied in 357 specimens comprising series from 26 regions in North America. These were selected by criteria defined from a previous study of growth in black bears, *U. americanus* Pallas, since it was determined that the growth pattern is essentially the same for the two species. Variation in mean condylobasal length in the series studied is clinal; a well-defined gradient exists along the coastal zone from Bella Coola, British Columbia, to the end of the Alaska Peninsula, with mean condylobasal length increasing from south to northwest. A similar gradient was evident along the Arctic Coast, beginning in the region of Coronation Gulf. In the interior, small mean values were obtained for samples from the western Yukon Territory, with mean size increasing toward both the southeast and the northwest. It is concluded that formal recognition of segments of intergrading populations of brown bears at the subspecific level is not justified. Brown bears on Kodiak-Afognak-Shuyak Islands comprise a reproductively isolated population possessing distinctive cranial characteristics, and to them the name *U. arctos middendorffi* Merriam is applicable. It is proposed that *U. a. horribilis* Ord be used for brown bears over the greater part of the range of the species in North America. The number of subspecies of *U. arctos* recognized in Eurasia also may be reduced, with the study of comparable series of skulls.

Introduction

Morphological variation within an intrabreeding population of brown bears, *Ursus arctos* Linnaeus, is of three major types: differences between sexes, changes with age, and individual variation (Rausch 1953). Much of the past confusion obscuring the taxonomic status of this species has resulted from attempts to compare specimens without adequate consideration for these variables. Since growth changes take place in the skull of the individual bear over a period of several years, the selection of series of comparable skulls from different populations depends upon the ability to distinguish specimens of similar age.

Findings in Alaskan material have shown the pattern of cranial growth in the brown bear to be identical with that defined earlier (Rausch 1961) for the black bear, *U. americanus* Pallas. This conclusion was derived primarily from the study of a series of 65 brown bear skulls, representing animals of all ages, from the vicinity of Anaktuvuk Pass in northern Alaska (ca. lat. 68° N.), and from comparison of the latter with series from other regions (e.g., Kodiak Island). At the latitude of Anaktuvuk Pass, brown bears remain in the dens for about 6 months of each 12-month period, as do black bears in the region of southern Alaska from which the material used in the previous study originated. In the skulls of the northern brown bears was seen the same sequence of dental and other changes observed in the black bears, and for both species the same criteria could be used to distinguish 10 age classes.

As with the black bear, modification of the length of the denning time by climatic and other factors affects growth rate in the brown bear, but the recognition of fully grown individuals presents no difficulty. The skulls utilized in the present study represented age classes IX and X, as previously defined. Detailed observations on growth in the brown bear will be reported elsewhere.

It is the purpose of this paper to present observations on geographic variation in the size of North American brown bears as indicated by condylobasal length of the skull, and to discuss briefly the taxonomic significance of these findings.

Materials and Methods

The skulls upon which this study is based were selected from more than 2000 specimens in the following collections: United States National Museum (including Biological Survey collection); American Museum of Natural History; Museum of Comparative Zoology at Harvard College; Chicago Natural History Museum; Department of Zoology, Montana State University; National Museum of Canada; British Columbia Provincial Museum; Department of Zoology, University of British Columbia; University of Alaska; British Museum (Natural History). The specimens have not been listed by number and collection, but the series could be duplicated by the selection of skulls according to the criteria used here. Suitable specimens were also selected from 386 brown bear skulls that I obtained in Alaska during the period 1949-1962.

The sample utilized was comprised of male skulls in which the basioccipital-basisphenoid suture was obliterated, indicating that maximum length of the skull had been attained (Rausch 1961). Female skulls were excluded because too few were available to provide series of adequate size. Although 16 dimensions were measured on each skull, condylobasal length was found to be the best index of skull size and is the only dimension considered in the present paper. Zygomatic width is also a useful dimension, but the skull continues to increase in width long after maximum length has been attained; consequently, use of this dimension would have further reduced the size of the sample.

Condylobasal length (distance from prosthion to level of posterior surfaces of the occipital condyles) was measured to the nearest millimeter; there is little value in more accurate measurement, since shrinkage of as much as 2 mm was sometimes noted when skulls were remeasured after the lapse of a few years.

In order to establish geographically the distribution of the available specimens, place of origin of each skull was plotted on detailed maps. This resulted in scattered concentrations which determined the composition of the final series. Of more than 400 skulls initially selected according to sex and age, 357 were finally utilized. The latter total was made up of 26 series representing as many regions. The remaining specimens were either widely scattered or had to be discarded because they were badly broken or lacked accurate data.

It was not practicable to examine all of the North American brown bear skulls extant. The majority of those not considered here represented populations from which large series had already been obtained (e.g., Kodiak

Island; Alaska Peninsula), but a few from other locations also were not included. However, it is believed that inclusion of this additional material would not have significantly changed the results of this study.

Results and Discussion

The brown bear had been nearly extirpated in North America south of about lat. 50° N. before much effort was made to preserve specimens for scientific study. As a result, the populations formerly occurring at lower latitudes are represented in scientific collections by only a few skulls from scattered localities. Excepting the region comprising northwestern Wyoming and western Montana, no series of adult skulls are available from the southern portions of the former range. Consequently, all but one of the 26 series considered in this study originated in western Canada and in Alaska.

The limits of the regions represented, as determined by the peripheral localities for the respective series of specimens, are defined briefly in Table I. The locations, numbered as in Table I, are shown on the map (Fig. 1). Numerical data for all of the series are summarized in Table II.

Variation in North America

From the data may be seen that there exists a rather well-defined size gradient extending approximately from south to north, with a clinal increase in mean condylobasal length from about lat. 50° N., at least, northward to about lat. 60° N., and thence westward. This is most evident in the bears inhabiting the coastal zone extending from the region of Bella Coola, in British Columbia, northward through southeastern Alaska and thence westward, encompassing the Kenai Peninsula, Kodiak, Afognak, and Shuyak Islands, and the lower Alaska Peninsula at least as far as long. 162° W. (see Fig. 2). A similar clinal increase toward the northwest is seen along the Arctic Coast, beginning with the sample from the region of Coronation Gulf. The situation appears to be different in the interior, where, as shown by the material studied, the population with the smallest mean condylobasal length occurs in the southern Yukon Territory, with mean size increasing both toward the southeast and the northwest. In Alaska and, at least to some extent, in northwestern Canada, there is a decrease in mean condylobasal length from south to north as well as from west to east.

The mean condylobasal length for the series from the region of Iliamna Lake - Kamishak Bay, at the base of the Alaska Peninsula, is low compared with mean values for series from the adjacent coastal regions. Identical mean values were obtained when the inland and coastal components of this series were compared, so this lower mean was not the result of combining smaller individuals from the inland with those from the coast. The condylobasal length of a single specimen from Kulik Lake was 392 mm, indicating that bears of comparatively large size occur also in the mountains north of Bristol Bay.

The largest skull known from north of the Alaska Range, from an animal killed at the junction of the Little Delta and Tanana Rivers, had a condylobasal length of 379 mm. Farther north, in the zone extending from about

TABLE I

Limits of regions from which series of skulls originated

1. *Lower Alaska Peninsula*. From Cold Bay northeast to the level of Bear Lake and Stepovak Bay.
2. *Port Heiden - Becharof Lake Region*. Upper Alaska Peninsula from Port Heiden to the south shore of Becharof Lake.
3. *Kamishak Bay - Iliamna Lake Region*. From Tuxedni Bay west to Lake Clark, at the north, south to the level of Kamishak Bay and the south end of Iliamna Lake.
4. *Kodiak - Afognak Islands*.
5. *Kenai Peninsula*.
6. *Skwentna Region*. From Hayes Glacier and Beluga Lake at the south to Chelatna Lake and Kahiltna Glacier at the north, and from just west of the Susitna River to the upper Skwentna River on the west.
7. *Mt. McKinley Region*. From the junction of the East Fork of the Toklat with the main branch of the Toklat River at the north, to about the level of Mt. Hunter at the south, and from Colorado Station on the east to just beyond the head of Birch Creek on the west.
8. *Talkeetna Mountains Region*. From about the junction of the Maclaren and Susitna Rivers at the northeast, and Lake Louise on the east, to Nelchina on the southeast, to the headwaters of the Kashwitna at the south, and west about to the junction of Iron Creek with the Talkeetna River.
9. *Nabesna Region*. From the headwaters of the Chistochina and vicinity of Mentasta Village at the north, southeast to Nabesna, and west to Summit and Paxon Lakes.
10. *Lower Copper River Region*. The coastal zone extending from Thompson Pass and Valdez southeastward to about the point where Bering Glacier reaches the coast, and including Hinchinbrook Island.
11. *Yakutat Bay Region*. From about the level of Icy Bay and Mt. St. Elias on the west to the head of Yakutat Bay and to a point 15 miles south of Yakutat on the east.
12. *Chichagof Island*.
13. *Admiralty Island*.
14. *Baranof Island*.
15. *Bella Coola Region*. From Rivers Inlet on the south to Ocean Falls on the north, and from Atnarko on the east to the coast.
16. *Norton Sound Region*. From Golovin Bay and the upper Koyuk River on the west to Nulato, and thence down the Yukon River as far as the upper Anvik River in the south.
17. *Upper Noatak River Region*. A narrow area extending from the head of the Nimiuktuk River in the north to just below the Noatak River in the south.
18. *Anakturuk Pass Region*. From the level of Tulugak Lake, Siksikpuk Creek, and Okomini-laga Creek on the north, to Hunt Fork in the south, and from the Savioyuk River on the east to Chandler Lake, on the west.
19. *Mackenzie Delta Region*. The coastal area extending from the level of the east coast of Darnley Bay, at the east, to the west shore of Richards Island.
20. *Coronation Gulf Region*. The coastal area extending from the upper Dease River at the west to the east coast of Bathurst Inlet on the east, and to Contwoyto Lake at the south.
21. *Western Yukon Region*. From the head of the White River on the west eastward to Aishihik Lake, and from the Yukon River at the north to the head of the Donjek River and the south end of Kluane Lake on the south.
22. *Southern Yukon Region*. From the junction of the Haines and Alaska Highways on the west to Marsh Lake at the east, and south to include Dalton Post and Bennett Lake.
23. *Southeastern Yukon Region*. From just east of the junction of the Pelly and Macmillan Rivers east to the upper Ross River, and bordered approximately by the Pelly River on the south.
24. *Cassiar Mountains Region*. From Nahlin, at the west, to the upper Klappan River at the east, and from the junction of the Dease and Rapid Rivers in the north to the mouth of the Stikine River.
25. *Southeastern British Columbia*. From the upper Columbia River, at the level of the southern boundry of Jasper National Park south to Castlegar, and from Banff on the east to just beyond Lilloet, on the west.
26. *Montana-Wyoming Region*. A narrow area in the Rocky Mountains extending from Swan Lake, Montana, in the north, to a point about 16 miles northeast of Dubois, Wyoming, in the south.

TABLE II
Summary of numerical data on 26 series of skulls of North American brown bears

No.	Region	<i>N</i>	\bar{M}	Range	σ	<i>V</i>
1	Lower Alaska Peninsula	25	404	372-429	14.65	3.60
2	Port Heiden - Becharof Lake	10	402	379-432	15.10	3.75
3	Kamishak Bay - Iliamna Lake	26	377	351-405	14.11	3.74
4	Kodiak - Afognak Islands	37	397	372-433	13.46	3.39
5	Kenai Peninsula	18	385	368-409	11.9	3.09
6	Skwentna Region	10	366	353-382	8.93	2.43
7	Mt. McKinley Region	7	349	320-374	17.54	5.02
8	Talkeetna Mountains Region	16	366	343-394	13.13	3.58
9	Nabesna Region	7	343	326-353	8.78	2.55
10	Lower Copper River	5	386	374-400	—	—
11	Yakutat Bay Region	11	376	367-391	9.06	2.40
12	Chichagof Island	19	370	345-385	14.02	3.78
13	Admiralty Island	33	361	330-385	14.23	3.94
14	Baranof Island	14	363	342-400	15.09	4.15
15	Bella Coola Region	12	361	342-386	12.05	3.33
16	Norton Sound	9	353	321-374	17.92	5.07
17	Upper Noatak River	4	352	341-363	—	—
18	Anaktuvuk Pass Region	11	334	307-357	13.13	3.93
19	Mackenzie Delta	9	335	320-346	10.01	2.98
20	Coronation Gulf	8	324	306-344	10.01	3.08
21	Western Yukon Region	11	330	299-358	14.85	4.50
22	Southern Yukon Region	12	330	318-344	7.09	2.14
23	Southeastern Yukon Region	8	334	303-361	17.35	5.19
24	Cassiar Mountains Region	15	346	311-371	14.63	4.22
25	Southeastern British Columbia	10	337	318-356	12.31	3.65
26	Montana-Wyoming	10	347	323-368	13.07	3.76

lat. 68° N. to the Arctic Coast, the largest recorded specimen, from the Nimiuktuk River, a tributary of the Noatak, was 363 mm in condylobasal length; the next largest, from the vicinity of Arctic Village, far to the east, measured 359 mm in this dimension. No material was available from the northern half of the Yukon Territory excepting two skulls from the vicinity of Old Crow, in the north; the larger had a condylobasal length of 349 mm. In the sample representing the "barren-ground bear," from the region of Coronation Gulf, was seen the smallest mean value of any of the 26 series studied. Little material was available from lower Canada east of British Columbia. Specimens from western Alberta fell within the size range of the sample from southeastern British Columbia, as would those from farther east in Alberta according to data published by Merriam (1918).

The lack of material makes it impossible to form an accurate concept of geographical variation in size in the populations of brown bears that once inhabited North America south of about lat. 50° N. The mean condylobasal length for the small series from the Rocky Mountains of Montana and Wyoming was 347—that is, about 10 mm greater than that obtained for the sample from southeastern British Columbia. Three skulls from eastern Montana, not included with the Rocky Mountain series, fell within the range of the latter. The largest, a topotype of *U. horribilis* Ord (U. S. N. M. 202739; see Merriam 1918, p. 18) was 364 ± mm in condylobasal length. A specimen from Fort Steele, Wyoming, also not included in the series, measured 356 mm in condylobasal length.

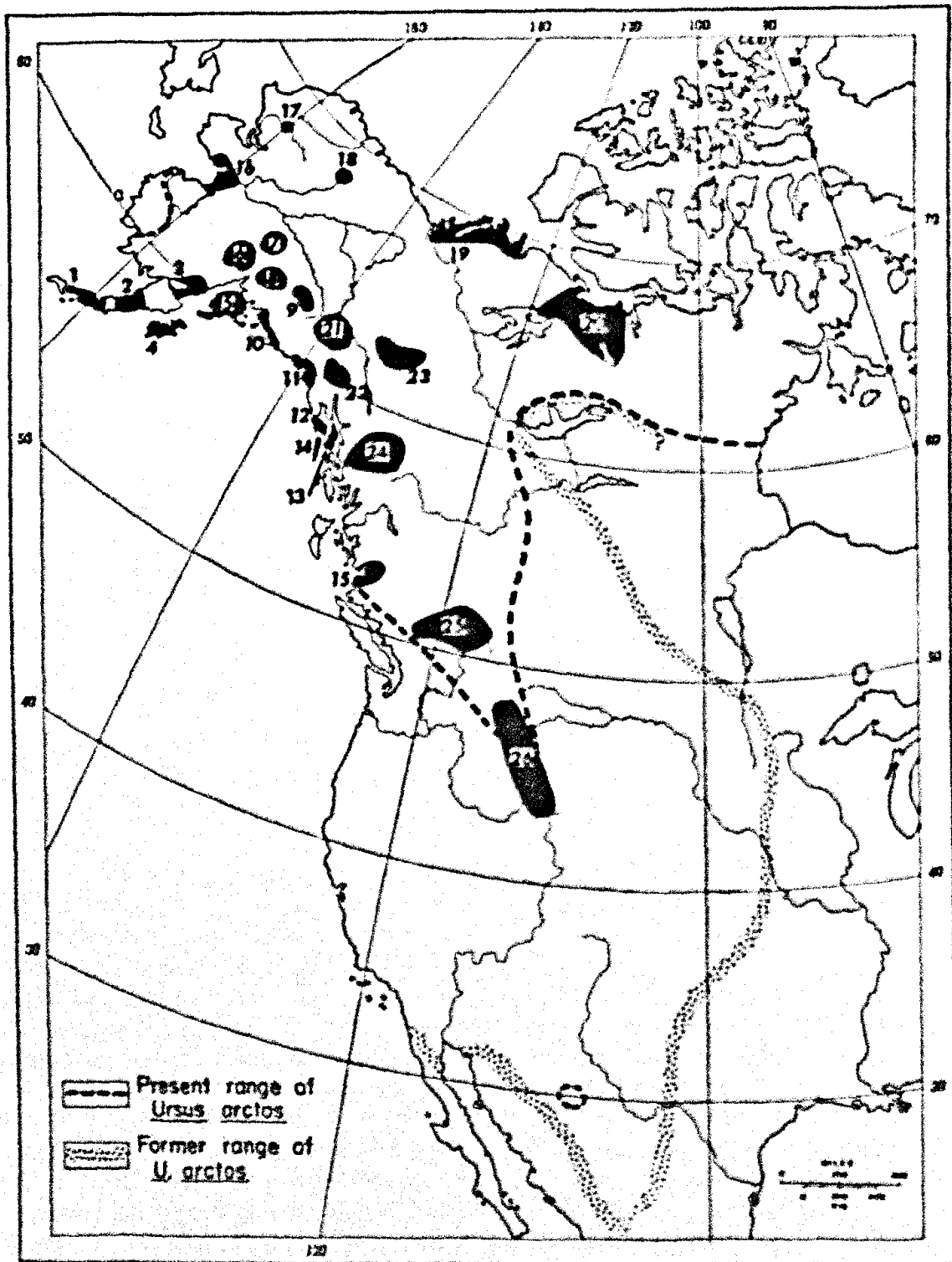


FIG. 1. Location and extent of 26 regions, numbered as in Table I, from which series of skulls originated. Limits of geographic distribution of *U. arctos* are based upon data compiled from the literature.

FIG. 2. Mean condylobasal lengths designated for the regions shown in Fig. 1. Gradients in size are suggested by the broken lines.

Excepting the latter from Montana and Wyoming, all suitable specimens examined from the western United States and northern Mexico are listed in Table III. Although the sample is small, the observed range in condylobasal length falls within limits narrow enough to suggest that brown bears were relatively uniform in size over much of the portion of the continent under consideration. In fact, if two specimens, the largest and the smallest, were excluded, all from north of Mexico would be similar enough in condylobasal length to have been drawn from the same population. A very large skull,

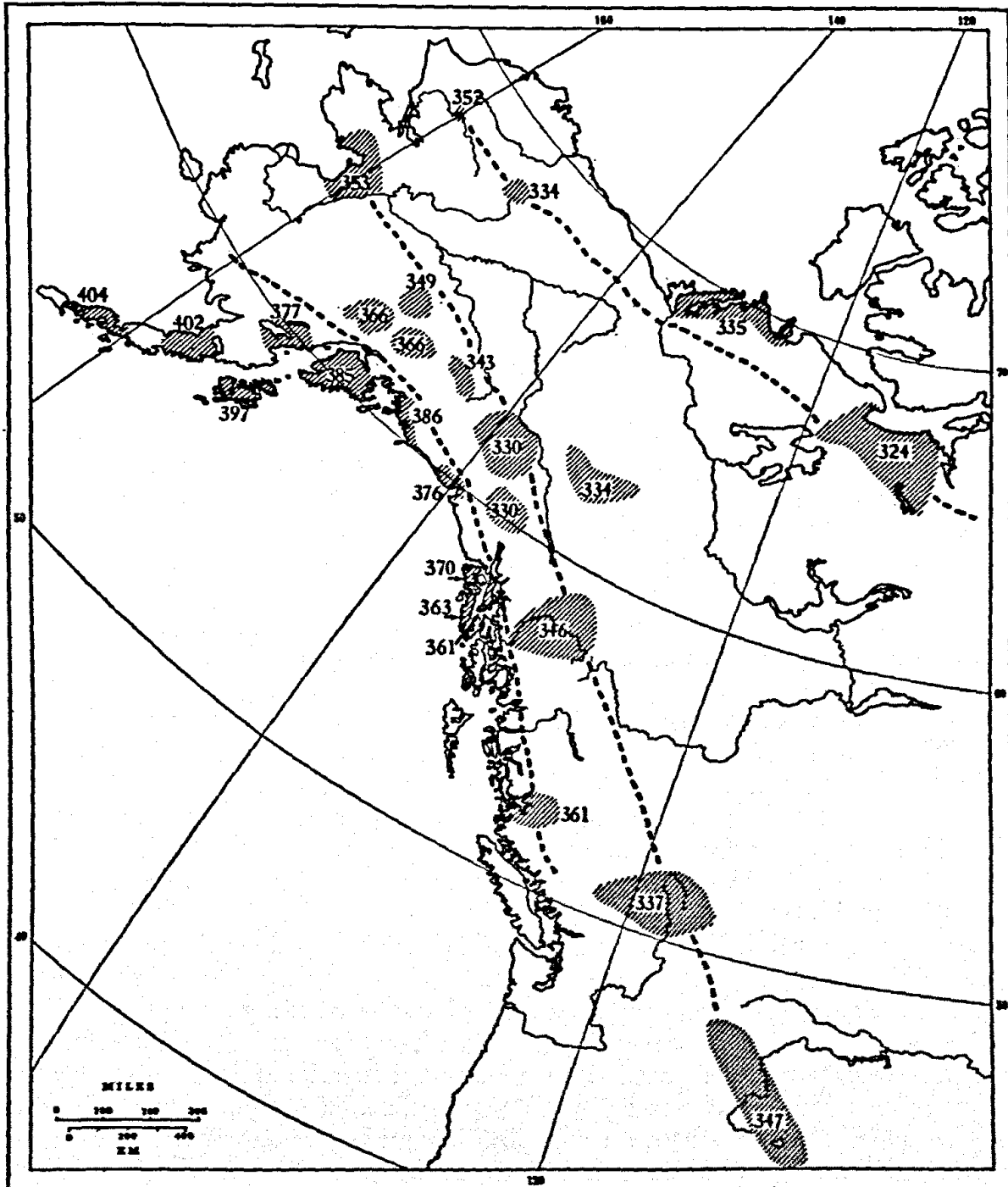


FIG. 2.

TABLE III

Condylobasal length of some old male brown bears from various locations south of lat. 50° N. in North America

Location	Cbl	Remarks
Targhee Creek, Idaho	336	
Mayfield, Utah	370	Type of <i>U. utahensis</i> Merriam
Logan County, Utah	358	
Sevier National Forest, Utah	358	
Lone Cone, Colorado	371	
Pagosa Springs, Colorado	368	
Hillsboro Peak, New Mexico	350	
Near Mt. Taylor, New Mexico	360	
Santa Ana Mountains, California	390	Type of <i>U. magister</i> Merriam
Near Beswick, California	355	Type of <i>U. klamathensis</i> Merriam
Mt. Hamilton, Isabel Valley, California	366	Probably has not attained maximum length
Dubbins Creek Canyon, Arizona	377	
30 miles south of William, Arizona	362 ±	
Davis Mountains, Texas	327	Type of <i>U. t. texensis</i> Merriam
Casas Grandes, Chihuahua	298	Topotype of <i>U. nelsoni</i> (see Merriam, 1918, p. 35)
Colonia Garcia, Chihuahua	304	Probably has not attained maximum length

having a condylobasal length of 390 mm, originated in the Santa Ana Mountains of California (U. S. N. M. 160155; the type of *U. magister* Merriam). There evidently are no reliable data on size distribution of bears in California (see Storer and Tevis 1955). The smallest form of brown bear in North America evidently occurred in the mountains of northern Mexico, where a remnant of the population still survives (Leopold 1959).

Excluding from consideration any animals from south of lat. 50° N., it is evident that the largest bears occur in the coastal zone from the region of Bella Coola, in southern British Columbia, northward and westward to the end of the Alaska Peninsula and, presumably, Unimak Island. The environmental factor or factors responsible for the relatively large size attained by these animals are unknown, but there appears to be a correlation with the distribution of salmon, *Oncorhynchus* spp. This was pointed out earlier (Rausch 1953) but it was not made clear that large size in these bears was considered to be the result of selection, and not the effect of diet upon the growth of the individual. Since brown bears are essentially herbivorous, the luxuriance of the coastal vegetation may also be an important environmental factor in connection with the attainment of large size.

Growth in captive black bears was found to be accelerated by feeding a high-calorie diet, and the length of time required for individual animals to attain maximum size was much reduced when the denning period was eliminated (Rausch 1961). However, it was evident that genetically predetermined size, as indicated by the condylobasal length of the skull, was not affected either by the rate of growth or by quality of diet. Although I have not been able to make observations on a comparable number of captive brown bears, the limited data indicate, as would be expected, that the same is true for the latter species. A male brown bear cub from Kodiak Island, captured in May at a weight of 30 lb, was maintained in Anchorage under the same

conditions as the aforementioned black bears. When killed 2 years later, in May, at an approximate age of 28 months (assuming a birth date of February 1), this animal weighed 606 lb, and the condylobasal length was 352 mm. It had not denned during the period of captivity and, as a result of continual growth, had reached the size of a wild individual of more than twice its chronological age. A second male cub weighed about 50 lb when it was captured in November near Hurricane, east of Mt. McKinley in the Alaska Range. Four years later, in August, at an approximate age of 4 years, 7 months, this animal weighed 500 lb. Although this bear was not killed, making it impossible to determine condylobasal length, it could be considered equivalent to that of a wild bear of more than twice its age. In view of the variation in size observed in bears in the region from which the latter animal originated, maximum skeletal size probably had been attained. Both animals had received the same diet and had been kept under otherwise identical conditions.

Variation in Eurasia

This paper does not purport to examine the status of Eurasian brown bears, but the study of limited material indicates that these animals also vary widely in size. The bears at higher latitudes are comparatively large, with size increasing toward the east. In the west, the largest specimen of *U. a. arctos* seen, from Sweden, had a condylobasal length of 348 mm. Farther east, a single specimen from the northern Ural measured 343 mm. Maximum size is attained in eastern Siberia, by *U. a. beringianus* von Middendorff; the range in condylobasal length for 10 old males from Kamchatka was 338 to 384 mm (mean: 364 ± 16 mm). Farther south in this region, a skull from Manchuria, not yet fully grown, measured 373 mm, and the maximum recorded for *U. a. lasiotus* Gray (Hokkaido Island) was 356 mm. Farther west, a specimen of *U. a. pruinosus* Blyth, from the vicinity of Lhasa, Tibet, possibly not fully grown, measured 346 mm. Skulls of six specimens of *U. a. isabellinus* Horsfield, from Kashmir, ranged from 275 to 317 mm (mean: 298 mm). *U. a. syriacus* Hemprich and Ehrenberg, in Asia Minor, appears also to be quite small, although I have not been able to examine skulls of old males.*

Taxonomy

The brown bear was recognized as an holarctic species as early as 1851 by von Middendorff (p. 72): "Dieser *Urs. arctos* L. hat innerhalb der nördlichen gemässigten Zone eine sehr weitläufige, sogar zirkumpolare geographische Verbreitung, in dem er sich über alle drei Welttheile dieser Zone erstreckt." He possessed a remarkably complete understanding of the nature of variation in this animal, as demonstrated in a later publication (von Middendorff 1853). Schäff (1889) likewise perceived the extent of cranial variation in *U. arctos*. Lydekker (1897) listed 10 subspecies of *U. arctus* (= *U. arctos*), including the North American bears that Merriam (1896) had considered distinct species. Because adequate material was lacking, Lydekker retained *U. pruinosus* Blyth, from the Tibetan region, as a species. Ognev (1931) recognized several species and subspecies of Eurasian brown bears, but at the same time was critical of Merriam's (1918) treatment of the North American bears (see p. 15). The review of Eurasian brown bears by Pocock (1932)

*See addendum.

was nearly definitive; he asserted (p. 780), in agreement with Lydekker, that "... I regard all the bears, generally described as 'browns' and 'grizzlies', inhabiting Europe, Asia and North America, as members of this species, some of the technically described forms representing subspecies or local races." Excepting one subspecies, *U. a. shanorum* Thomas, whose status they considered doubtful, Pocock's revision was accepted by Ellerman and Morrison-Scott (1951).

Seven subspecies of *U. arctos* were recognized in Eurasia by Ellerman and Morrison-Scott (1951): *U. a. arctos* Linnaeus; *U. a. collaris* Cuvier and Geoffroy; *U. a. isabellinus* Horsfield; *U. a. syriacus* Hemprich and Ehrenberg; *U. a. beringianus* von Middendorff; *U. a. pruinosus* Blyth; *U. a. lasiotus* Gray. In addition to these, Bobrinskii *et al.* (1944) would recognize *U. a. leuconyx* Severtzov and *U. a. caucasicus* Smirnov; they suggested also that *U. a. mandchuricus* Heude should be considered valid. The latter three were listed as synonyms of *U. a. isabellinus*, *U. a. syriacus*, and *U. a. beringianus*, respectively, by Pocock and by Ellerman and Morrison-Scott. In a more recent review of the carnivora of the Soviet Union, Novikov (1956) followed Bobrinskii *et al.* in the treatment of the brown bears.

In a monograph on fossil and Recent bears, Erdbrink (1953) denied that subspecies are distinguishable among living brown bears (p. 345): "... I hope that it has been made quite clear that, in my opinion, all names of genera, subgenera, species, subspecies, varieties or races, enumerated in the list published here, are *nomina delenda* and synonymia for *Ursus arctos* L." A similar opinion was expressed by Couturier (1954, p. 329): "Je conclurai donc définitivement en disant qu'il y a de par l'hémisphère boréal de nombreuses populations d'Ours brun dont la structure est éminemment variable et dont l'ensemble constitue une seule espèce: *Ursus arctos* L. 1758."

Five North American subspecies (*U. a. horribilis* Ord; *U. a. middendorffi* Merriam; *U. a. gyas* Merriam; *U. a. richardsoni* Swainson; *U. a. californicus* Merriam) have been recognized by recent workers (Rausch 1953; Storer and Tevis 1955; Banfield 1958; Murie 1959; Cowan and Guiguet 1960). The older classification of Merriam (1918) was retained by Miller and Kellogg (1955), whose review of the literature extended only through 1952. Hall and Kelson (1959) also followed Merriam, although they remarked prefatorily (p. 869) that "It seems almost certain that the majority of these [North American brown bears] are at most subspecifically distinct."

Geographic variation in condylobasal length of North American brown bears has been shown to be essentially clinal, and the examination of any given series of fully grown males discloses a wide range of individual variation that seems to prevent characterization of local populations. Of the material considered in the present study, only the series from certain islands could represent populations isolated by geographical barriers. Among the latter, bears inhabiting Kodiak, Afognak, and Shuyak Islands together comprise a reproductively isolated population; these animals possess distinctive cranial characteristics and appear to be the most stable genetically of any considered in the present study. Consequently, application of the name *U. arctos middendorffi* Merriam seems justified. The bears on Chichagof and Admiralty Islands differ in average size, having mean condylobasal lengths of 370 and 361 mm,

respectively. Comparison of the two series disclosed that this difference is significant ($P = 0.04$). However, the extent of cranial variation observed makes it doubtful that the two populations can be distinguished on grounds other than that of mean size.

Most of the taxa recognized by Merriam represented segments of populations which intergrade, or formerly intergraded, with surrounding populations, and formal recognition of such local demes, even at the subspecific level, does not seem justified. The name *U. a. horribilis* has priority and probably can be applied to the brown bears occurring over most of the continent. Excepting *U. a. middendorffi*, there is little evidence for the existence of reproductively isolated populations, although for some regions at lower latitudes this can never be certainly determined. Contrary to an earlier conclusion (Rausch 1953), the extent of individual variability exhibited by bears on the Alaska Peninsula is such that the status of *U. a. gyas* is doubtful. Banfield (1958) determined that brown bears are extending their range eastward across the districts of Mackenzie and Keewatin in northern Canada. These animals, designated *U. a. richardsoni*, occupy a position at the end of a size gradient extending toward the northwest, and it seems doubtful that they can be accorded taxonomic recognition. The status of *U. a. californicus* is uncertain, although, judging from the type of *U. magister* Merriam, bears possessing rather distinctive cranial characters formerly existed in what is now California. Insofar as material permits, comparative morphological data will be presented in a separate publication.

The problem of defining subspecies of brown bears appears to be much the same in Eurasia as it is in North America. A study of series of comparable skulls may reveal that the number of subspecies currently recognized in Eurasia is likewise too large.

Acknowledgments

The generous cooperation of many persons has made the present study possible. Dr. David H. Johnson, Division of Mammals, United States National Museum, provided working space and otherwise assisted on several occasions. Miss Viola S. Schantz and Dr. Richard H. Manville permitted the use of the Biological Survey collections. The late Dr. Rudolph M. Anderson in 1950 kindly joined me in the examination of the specimens of bears in the collections of the National Museum of Canada. Study of bear skulls in the collections of the British Museum (Natural History) and use of library facilities were permitted by Dr. Peter Crowcroft; I am also indebted to Messrs. R. W. Hayman and G. W. C. Holt, of the Mammal Room, for assistance. Specimens were made available on loan by: Dr. Richard G. Van Gelder, American Museum of Natural History; Dr. Barbara Lawrence, Museum of Comparative Zoology; Dr. Robert S. Hoffmann, Montana State University; Dr. Phillip M. Youngman, National Museum of Canada; Mr. Charles J. Guignet, Provincial Museum of British Columbia; Dr. Ian McT. Cowan, University of British Columbia; Dr. Frederick C. Dean and Mr. Ludwig J. Rowinski, University of Alaska. Eurasian material was provided by Professor V. G. Heptner, Zoological Museum, University of Moscow, and by Dr. S. S. Schwarz,

Biological Institute, Ural Branch of the Soviet Academy of Sciences, Sverdlovsk. A large collection from Alaska was assembled only through the diligence of many guides, hunters, and biologists. Unfortunately, each cannot be listed; many of the specimens were provided by the following: Messrs. Peter Bading, Jerry Brunner†, Ward Carroll†, Webster K. Clark, Bud Conkle, Richard G. Drew, Ward Gay, Lee Hancock, Kristjan Helgason, Russell R. Hoffman, Frenchy Lamoureux, Alf Madsen, Joe Maxwell, Bill Pinnell, Jack Randall, Max Shellabarger†, John Swiss, Bradley Temple, L. H. Temple, Averill Thayer, Tommy Thompson, Roy Van Dusen, Oscar Vogel, and Hal Waugh. A valuable series of specimens from northern Alaska was secured through the cooperation of the Eskimo residents of Anaktuvuk Pass. Dr. Francis H. Fay, Mrs. R. V. Rausch, and Mr. Francis S. L. Williamson have provided much assistance during the course of this study.

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Addendum

In August, 1962, through the courtesy of Prof. emerit. Tetsuo Inukai and Prof. Kyojiro Shimakura, I was able to examine a large series of skulls from Manchuria, Sakhalin, the Kurile Islands (mainly Etorofu), and Hokkaido, in the collections of the Faculty of Agriculture, Hokkaido University. Most of these were subadult, but additional information was obtained on the size of brown bears on Hokkaido. The condylobasal lengths of five old males ranged from 335 to 370 mm (mean: 347). Among Eurasian brown bears, it appears that *U. a. lasiotus* is second only to *U. a. beringianus* in size.