AGGREGATION OF BEARS AT FOOD CONCENTRATIONS (ECOCENTERS)

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Abstract: Bears normally live widely separated from one another. But they sometimes aggregate at concentrations of natural foods or garbage -- "ecocenters". Because garbage dumps are the best known sites of aggregation, and because of elevated social strife at ecocenters, strife has sometimes been thought unnatural. This has had 2 consequences. First, protection of ecocenters has been lax. Second, validity of data from ecocenters has been challenged-- including the pioneering study of Yellowstone National Park grizzly bears by the Craighead team from 1959-70. However, this literature review demonstrates that aggregation is natural and relatively common in all 3 species of North American bears. At garbage dumps, the major unnatural feature is diet --which tends to be unusually rich. Data gathered at aggregation sites should be valid; but they may not be representative of dispersed bears, and vice versa. Comparison of data from aggregated vs. dispersed populations should take into account density of the bears; age-sex composition of the local population; and food supply locally vs. elsewhere in the habitat.

Key words: Aggregation, ecocenter, food concentration, *(Ursus sp).*

North America is home to black bear (*Ursus americanus),* grizzly bear (*Ursus. arctos*), and polar bear (*U. maritimus*). Bears in most populations are usually dispersed, at low densities, traveling over home ranges of several hectares to several thousand hectares (Stirling & Derocher 1990:Table 2). As adults, bears normally live with little social companionship. Exceptions are a dam with her cubs, suitors to a female in estrus, or occasionally loose associations of adult females. Juveniles may remain together for up to a few years after dissociation from their dam. (Grizzly: Craighead 1979, Ballard et al. 1982, Bledsoe 1987, LeFranc et al. 1987. Black: Rogers 1987. Polar: Schweinsburg et al. 1982, Lentfer 1983, Taylor et al. 1985).

At least occasionally, all species of North American bears gather at ecocenters (Stringham 1985; Table 1). The best known cases are with grizzly bears, involving over 30 individuals together at each of 2 sites used traditionally for decades: (a) McNeil Falls in Alaska, where grizzlies gather to fish for salmon (*Oncorhynchus spp.*) (Glenn et al. 1976, Bledsoe 1987), and (b) the garbage dumps that existed in or near Yellowstone National Park (YNP) from about 1900-72 (Craighead and Craighead 1967, Craighead 1972).

Social strife at both the YNP dumps and McNeil was high, --far higher than grizzly bears typically encounter where they are dispersed. (Hornocker 1962; J. Craighead, pers. comm.; Stonorov and Stokes 1972; Egbert and Stokes 1976).

These observations, and the fact that most commonly-known aggregations were at dumps, convinced some managers that aggregations are an unnatural or abnormal situation to which bears are ill-adapted (e.g., Stokes 1970). This opinion seems to have facilitated decisions to close garbage dumps to bears, and perhaps to permit "development" near natural ecocenters, for instance streams where bears fish, or groves of nut-reproducing trees such as oak (*Quercus*) and beech (*Fagus*). It has also led some biologists to question the validity of data gathered at aggregation sites, particularly dumps.

Having analyzed demography of YNP grizzly bears (Stringham 1983, 1985), it was critical that I test whether the aggregations were indeed unnatural. This was done mainly by reviewing literature on all North American bear species to find instances of natural aggregation. I also spent over 1000 hours observing black and grizzly bears at natural and artificial ecocenters.

Unpublished details about observations of bear behavior were provided by (a) C. Jonkel, Ursid Research Center, Missoula, MT; (b) D. Carney, Blackfeet Grizzly Management Team, Browning, MT; and D. Mattson, Interagency Grizzly Bear Study Team, Bozeman, MT. My work was supported by Wildwatch, the Blackfeet Indian Tribe, the Shikar-Safari Club, and the Society of the Sigma Xi; the Ecology Program, University of Tennessee, Knoxville; the State University of New York, College of Environmental Science and Forestry; A., J., J. and R. Stringham; C. and V. Nicolayeff; H. Strauss; L. and B. Lippincott.

RESULTS

Grizzly And Black Bears

Reports of aggregating bears (Table l) date back at least to the 1804-06 journals of Lewis and Clark; they saw aggregations of grizzlies along the Missouri River, for instance at fords where bison had drowned as their herds crossed. Schorger (1949) reviewed reports from the 1800's of Wisconsin black bears aggregating at food concentrations and of apparently following bison herds. California grizzly bears once migrated to seasonal concentrations of nuts, berries, and other foods, forming aggregations of up to 40 bears (Storer and Tevis 1955). Along the Pacific coast, from Alaska at least as far South as tributaries to San Francisco Bay, salmon were once common and were fed on by both grizzly and black bears--as still occurs in parts of British Columbia and much of Alaska (Table 1). Each summer, up to 100 grizzlies feed on salmon at McNeil Falls; over 30 bears have been seen there simultaneously (Rausch 1958, Stonorov and Stokes 1972, Bledsoe 1975, 1987). Up to 20 grizzlies were seen eating sedge in a 16-hectare tidal flat near McNeil River; several were seen feeding on a beached whale carcass (Egbert and Luque 1975, Egbert and Stokes 1976). Observers have seldom reported how many bears aggregated at carrion or how they were spaced; but one case was documented by the photograph appearing on pp. 28-29 of the March 1980 edition of the Alaska Magazine.

Species Location	Food Source	N° of Bears	Reference
GRIZZLY			
Missouri River	Bison drowned at fiords		Lewis and Clark 1804-1806
California	Nuts, berries, etc...	≤ /*40[a]	Storer and Tevis 1955
Southern Yukon	Berries		Pearson 1975
Glacier Nat. Park U.S.A. (GNP)	Spring: lowland meadows ; snow slides. Summer: subalpine areas. Fall: spawning red salmon.		Martinka 1974 Singer 1978 Chadwick 1983
N. Montana near GNP	>100 boxcar loads of corn spilled from trains--eaten fresh or fermented.	≥ 13G ≥ 5B	Jonkel 1989 Carney pers. comm. Stringham, this study
Yellowstone Nat. Park (YNP)	Berry patches, clover fields, sedge, seepages, fish spawning streams, whitebark pinenut stands, and carrion	≤ 25	F. Craighead 1976, 1979 Judd and Knight 1980
	Garbage dumps	≤ 135	
Pacific coast: AK-Ca[b]	Spawning salmon, etc...		Trautmann 1963
Kodiak Island, AK	Spawning salmon in drainages of Karluk Lake	Many	Troyer 1962 Troyer and Hensel 1964 Burns and Hensel 1972
	Alpine areas		Atwell et al. 1980
Admiralty Island	Marine carrion; coastal vegetation; salmon		Wood 1976
Mid-lower AK Peninsula (AK Pen.)	Spawning salmon; marine mammal carrion and mollusks. Coastal sedge		Glenn 1973 Glenn and Miller 1980 Bledsoe 1987
Lake Becharof on AK Pen.	Spawning salmon		Stonorov pers. comm.
Katmai Nat. Monument on AK Pen.	Spawning salmon	≤ 8	Dean 1967 Stringham, this study
McNeil River on AK Pen.	Spawning salmon	≤ 30	Stonorov & Stokes 1972 Egbert & Stokes 1976 Glenn et al. 1976 Bledsoe 1987 Aumiller 19_
Montana	Fish in pools left as a canal and lakes dried up; apple orchards		Stringham, this study

a ≤ 40 means aggregations ranging in size up to 40 grizzlies.
b AK-CA means Alaska to California, on the Pacific coast

Species Location	Food Source	N° of Bears	Reference
BLACK BEAR			
Wisconsin	Plants		Schorger 1949
	Following bison herds (1800's)		
North Am.	Nuts		Harlow 1961
GSMNP[c]	Acorns		Garshelis and Pelton 1981
TN and NC			
Pacific Coast AK-CA	Spawning salmon.		Wright 1909
			Frame 1974
			Stringham, this study
Oregon	Tidelands.		Lindzey and Meslow 1977
Arkansas	Fish in pools left as a river dried up.		Smith 1985
Montana	Fish in pools left as a canal and lakes dried up; apple orchards; cherry orchards.		Stringham, this study
North America	Garbage dumps		Rogers et al. 1976
			Herrero 1983
			Rogers 1987
			Stringham, this study
POLAR BEAR			
Barents Sea	Whale carcasses		Flyger and Townsend 1968
	Whale carcasses	56	Anderson (cited by Taylor et al. 1985)
	Whale or walrus carcasses 1800's and 1900's	≤ 100	Perry 1966
	Garbage dumps		Breummer 1984
			Taylor et al. 1985

Table 1. ***Bear aggregations at concentrate food sources (ecocenters).***

F. Craighead (1976, 1979) provides many examples of Yellowstone grizzlies aggregating at berry patches, clover fields, sedge seepages, streams where fish were spawning, carrion, and whitebark pine stands where bears found nuts. As many as 25 grizzlies were seen together feeding at a single ungulate carcass. Up to 13 were found bedded within a single hectare of timber near a feeding area. They also aggregated at garbage dumps; 135 were seen at a single dump on one exceptional night, and 88 on another, although the average was far lower. On high altitude talus slopes, huge concentrations of army cutworm moths (*Euxoa auxiliaris*) also attract numerous grizzlies in YNP, the Mission Mountains of Montana, and Glacier National Park (French & French, in press; Mattson pers. comm., Carney pers. comm.). Black bears are commonly observed at garbage dumps, raiding garbage cans in campgrounds, or begging for food on roadsides (Rogers 1976, Rogers et al. 1976, Herrero 1983; Stringham unpubl.); such close contact with people is rarer for grizzly bears.

[c] Great Smoky Mountains National Park

Polar Bears

Especially during the 1800's, when harvest of whales, walrusses, and other marine mammals in the arctic peaked, carcasses of human-killed or naturally-dying marine mammals drew large numbers of polar bears, in some cases up to about 100 bears (Perry 1966, Breummer 1984). Anderson saw 56 polar bears at a single whale carcass in the Barents Sea (cited by Taylor et al. 1985; see photo by Anderson in Cousteau 1981:786-787). Perry saw up to 29 polar bears adrift on a single ice floe. Breummer (1984) reports that during October and November of each year, as polar bears await freezing of the sea ice, up to 600 bears have been counted along 100 miles of coast on Hudson's Bay, with up to 60 bears--mostly adult males--at or near Cape Churchill. DeRocher and Stirling (1990) also report on aggregations of males during the ice-free period (August-October), when there is negligible competition for food or mates. These males were on land around Hudson's Bay, usually on coastal promatories or nearshore islands. Over half the males captured were in close association with 1-13 others; the mean group size was 4. Polar bears of both sexes often concentrate in "restricted feeding areas such as ice-bound fiords and floe edges, and in denning areas and areas of summer sanctuary when the sea ice melts" (Jonkel 1982:234).

DISCUSSION

Available data demonstrate that aggregation is natural and normal in all 3 North American species. It is mainly the food sources that are appropriately dichotomized as either natural or unnatural; garbage tends to be richer than most natural diets (see Stringham 1989). The YNP and McNeil aggregations are extreme cases in terms of the number of grizzly bears gathered and the small areas in which they concentrated on a regular basis over many decades. Aggregations of polar bears on marine mammal carrion can be as large and dense, but last only a matter of days. It isn't known whether black bears ever formed comparably large aggregations, but aggregation may be reduced in this species by the greater tendency towards territoriality among females (cf. Jonkel and Cowan 1971; Rogers 1976, 1987). Data from the whole range of aggregation/dispersion is valuable for understanding bear ecology, life history strategies, and vulnerabilities to humanity.

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ENERGY, DIET SELECTION AND RESTORATION OF BROWN BEAR POPULATIONS

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Abstract: Brown bears (*Ursus arctos*) and black bears (*Ursus americanus*) in North America prefer food items with high energy density. Contrary to the conventional views of diet selection for plants and protein, our analysis shows a preference for lipid-rich foods (pine seeds, insects, fish, berries) and animal parts (eggs, brains) which are highly digestible but relatively undetectable in analyses of feces. Bear populations with access to spawning fish exhibit densities 20 times those populations without this diet. Access to rich food sources that is blocked by human-induced insecurity has resulted in population depensation. The behavior of relictual and cryptic populations of brown and black bears in the Rocky Mountains is compared with behavior of the densest populations of brown bears in Alaska's Katmai National Park. Implications are presented for restoration of mountain habitats, genetic heterogeneity and recovery of relict populations of European brown bears.

Key words: brown bear, energy, food habits, grizzly bear, *Ursus arctos*.

Resource defense theory predicts that animals will defend the smallest area that includes all the resources needed for survival and reproduction over an annual period.

The density of the carnivores, particularly ursids, should therefore be a direct function of the food density (seasonal abundance of high caloric foods per unit area). Worldwide areas available to small, relict populations of bears are constrained by surrounding land uses, human disturbances or attraction to agricultural crops. Without increases in the size of these populations on a constant land base, recovery in the long run is unlikely because of genetic homogeneity, declines in availability of major foods, human-induced mortality or other chance events which could push the population across the threshold of survival.

Since this conference seeks to formulate specific recommendations on the management of small populations of bears, one avenue for fundamental ecological changes toward recovery would be to increase the abundance and predictability of the seasonal food base (habitat enhancement). Theory predicts that a significant increase in high-caloric foods will result in a more dense and therefore more genetically diverse bear population on the same land area. Based on our North American experience, we can also predict other benefits to bear populations that concentrate their foraging on rich foods in more remote areas.