A POSSIBLE LINK BETWEEN YELLOWSTONE AND GLACIER GRIZZLY BEAR POPULATIONS

HAROLD D. PICTON, Department of Biology, Montana State University, Bozeman, MT 59717

Abstract: Grizzly bears (*Ursus arctos horribilis*) have been observed in 5 of the 7 mountain areas that link the Northern Continental Divide (Glacier Park) and Yellowstone ecosystem grizzly bear populations in Montana. Thus these 2 populations, recognized by the Grizzly Bear Recovery Plan (U.S. Dep. Int. 1981) are possibly linked by a filter bridge. Portions of this bridge are not included in the Grizzly Bear Recovery Plan. Current data is analyzed to make specific estimates of the population potential of the bridge units. Each unit is evaluated with respect to extinction time, migration, and potential as a viable bridge link using methods based upon biogeographic theory. This analysis suggests that these scattered observations should not be routinely classed as accidental and ignored as is currently the case.

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Studies of the last 20 years of related Montana grizzly bear populations have justifiably centered upon 2 areas: the Northern Continental Divide population, including Glacier National Park, extending south through the Great Bear, Bob Marshall, and Scapegoat wilderness areas, and the southern population including Yellowstone National Park and a limited contiguous area (Fig. 1). This southern population has been regarded as isolated from the northern population; this theoretical view is expressed in the Grizzly Bear Recovery Plan (U.S. Dep. Int. 1981). The 2 areas, however, are linked by mountainous country in primitive or semiprimitive condition. The Recovery Plan does not encompass management of this intervening habitat and thus its possible role in future grizzly bear management has not been provided for. As interest in grizzly bears has grown, increasing numbers of reports of bears outside the 2 recognized population blocks have have come to me. Although many could not be verified, some are undeniable. These undeniable reports have sometimes been referred to as "accidental" observations in environmental impact statement documents (e.g., BPA 1981) and thus have not been incorporated into forest management plans or into the Grizzly Bear Recovery Plan. The number and pattern of the observations suggests several exploratory questions: does a biogeographic filter bridge (allowing intermittent travel) exist between the 2 populations? If potentially present, what are its properties? Can sufficient movement occur across the several hundred kilometers to be of genetic significance?

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DISCUSSION

Observational data (Table 1) verify tracks, photographs, hair samples, and dead bears. Direct observations made by trained individuals who have worked extensively with bears and who are well acquainted with species recognition are also included. The observation reporting rate has been about 0.04 verified observations/100 km^2/year compared to a rate of 0.07 verified observations/100 km^2/year in the area immediately adjacent to that used by radio-equipped Yellowstone grizzly bears in the Madison and Gallatin ranges as estimated from Basile (1981). A more organized effort has been made to collect information concerning the area adjacent to Yellowstone Park than in the areas being discussed here.

According to MacArthur and Wilson (1967) the number of species inhabiting mountain habitats (e.g., grizzly bears) is controlled by the area of their habitat unit. In a previous study (Picton 1979), I found that the occurrence of grizzly bears and other large mam-

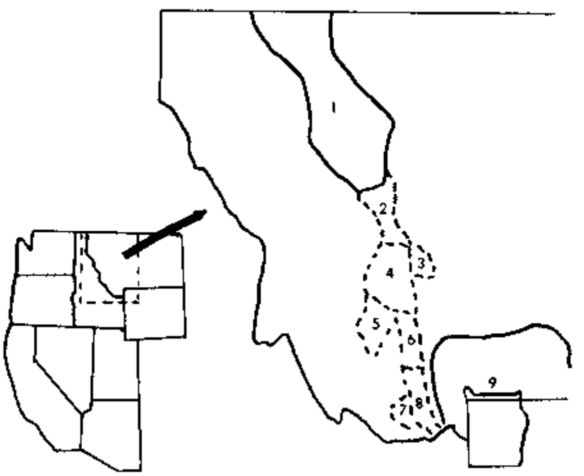

Fig. 1. Area proposed as a possible bridge linking the 2 officially recognized habitat areas. The areas shown are 1, Northern Continental occupied grizzly bear ecosystem; 2, McDonald-Rogers Pass; 3, Elkhorn Mountains; 4, Champion-Thunderbolt; 5, Highland Mountains; 6, Tobacco Root Mountains; 7, Snowcrest Mountains; 8, Gravelly Mountains; 9, Yellowstone occupied grizzly bear ecosystem.

Table 1. Verified observations and estimates of the grizzly bear population potential of mountain ranges in the Montana filter bridge zone as computed by precipitation-population density regression.[a]

Mountain Range	Area (km^2)	Verified observations[b]	Estimated potential population	Estimated time to extinction (yrs)[c]
Gravelly Range	1,580	1+RO	16	50–100
Tobacco Root	1,200	1P	15	50–100
Snowcrest	820	0	8	10
Total of unit	3,600	2+	39	100+
Highland	550	1D	6	5–10
Champion-Thunderbolt	1,900	2D	19	100
Elkhorn	800	0	8	10
Total of unit	3,250	3	33	100+
McDonald-Rodgers	1,600	1–O	16	50–100

[a] Estimated population density (km^2/bear) = 159 − 0.88x where x = the area integrated long-term average annual precipitation (cm) multiplied by land area.

[b] All observations were from the 1976–84 period. RO = radio-collared bear, see also Greater Yellowstone Coalition 1986; P = photographs, hair samples and tracks of bears; D = dead bears; O = visual observations. Sources: D. Graham, personal communication with personal examination of the material; personal interviews and newspaper reports cross-checked with the Mont. Fish, Wildl. and Parks Dep.

[c] Estimated, following MacArthur and Wilson (1967) using estimates of propagule lifetime calculated from Craighead et al. (1974).

mals correlated with the area of mountain ranges (r^2 = 0.49; $P < 0.01$). I also showed that the number of vegetation habitat types was a slightly better predictor of species occurrence than area (r^2 = 0.51; $P < 0.01$). Mueggler and Stewart (1980) and Patten (1963) have pointed out the importance of precipitation in controlling the vegetational patterns of this area of the Rocky Mountains. It is likely that the distribution and abundance of grizzly bears will reflect land area and precipitation.

A potential grizzly bear population estimator is needed if the possible roles of the areas between the Northern Continental and the Yellowstone populations are to be assessed. Existing estimates of grizzly bear density were obtained for 6 populations located between 44–52° North latitude and 110–115° West longitude (Martinka 1971, Blanchard and Knight 1980, U.S. Dep. Int. 1981). Long-term precipitation data for these individual mountain area precipitation zones (Farnes 1968, B.C. Nat. Res. Conf. 1956) were integrated to give an overall precipitation average. A regression describing the relation of this long-term precipitation average and the estimates of grizzly bear population density was calculated ($Y = 159 - 0.88x$; $r^2 = 0.81$; $P < 0.05$) with the wettest areas having the highest density of grizzly bears. Although the 6 density estimates represent the best data available they must be regarded as somewhat suspect. Based upon my familiarity with the 6 areas, I believe that the relative ratios between the data points are unlikely to change significantly and the relation showing increasing grizzly bear density with increasing precipitation is valid. This precipitation-density relationship is consistent with that noted for deer (Picton 1984, Hammond and Humphries 1985) and is consistent with the relationship of climate to grizzly bear home range size (Picton et al. 1986). Habitat in the 6 areas resembles wilderness or near wilderness in that it retains over 80% of the historical mammalian species. Thus, this described precipitation-density relationship applies specifically to the wilderness energy coupling between the habitat and the bears.

The precipitation-population estimator regression was used to calculate an estimate of the grizzly bear population potential for each of the 7 mountain ranges of the filter bridge (Table 1) area from integrated long-term precipitation data. The subsequent analysis suggests that the bridge mountain ranges have the properties necessary to support grizzly bears for periods long enough to allow some resident reproduction and movement to the adjacent unit. Periodic recolonization would be necessary for some subunits. Following MacArthur and Wilson (1967), I estimated time to extinction using propagule lifetime estimates calculated from Craighead et al. (1974).

The movements along the several hundred kilometers of the bridge are those of genetic flow through interchange between groups of animals rather than those of an individual animal moving the entire distance. Following Frankel and Soule' (1981), I estimated that the exchange of 2–4 bears/generation, that are effective breeders, between populations would be adequate to maintain genetic continuity.

The bridge area is separated into blocks by highway corridors and intermountain valleys. These probably do not permit entirely free movement, but they probably do not represent absolute barriers. Interstate highways I-90 and I-15 are the most substantial of the highway barriers. Both have substantial contiguous cover in some areas, which could facilitate crossing. The daily movements observed for grizzly bears are adequate to cross any of the valley areas (Craighead 1980). A radio-equipped grizzly bear is known to have crossed the several kilometers of sagebrush-grassland habitat and well-traveled U.S. highway 287 in the Madison River valley when moving back and forth between Yellowstone Park and the Gravelly Range.

CONCLUSIONS

The exploratory hypothesis presented here differs from the views expressed in the Grizzly Bear Recovery Plan (U.S. Dep. Int. 1981). The recovery plan absolves the Helena, Deer Lodge, and Beaverhead national forests and industry from considering the grizzly bear in their management plans and impact statements involving these bridge units. I suggest that the grizzly bear observations from these areas should not be dismissed as "accidental" and that the potential for a filter bridge connecting the 2 populations exists. Failure to consider it will result in unnecessary degradation of a biologically important block of habitat. The bridge appears to be adequate for genetic continuity without the liabilities associated with "dumbbell" shaped reserve areas (Frankel and Soule' 1981). Maintenance of such a bridge would substantially improve the long-term survival probability of the grizzly bear. It would also enhance the survival of the Yellowstone population. A system to gather and verify reports on grizzly bear activity should be established for these areas. Management consideration should encompass the maintenance of bear habitat continuity through these mountain ranges. Future studies should determine the degree of genetic isolation of the Yellowstone grizzly bear population.

The hypothesis presented here is based upon the best data available, data that are only marginally adequate. It is the pattern outlined by the data that is of prime importance. It is unlikely that the data set will improve unless an organized effort is made to test the hypothesis. The 1986 bear hunting map and regulations of the Montana Fish, Wildlife and Parks Department depicts the Gravelly and Tobacco Root mountain ranges as occupied grizzly bear habitat, however hunters have killed grizzly bears in other bridge units, which accounts for several of the observations listed in Table 1. This suggests that the potential bridge link is of sufficient biological importance to be monitored and to have management regulations developed for it.

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