Bear-Human Conflict Risk Assessment at Glacier Bay National Park and Preserve

Tom Smith[1,4], Terry D. Debruyn[2], Tania Lewis[3], Rusty Yerxa[3], and Steven T. Partridge[1]

Abstract. We used historical data, extensive site surveys, and artificial neural network models to estimate the relative probability of bear (*Ursus arctos, U. americanus*) use of habitats and bear-human conflict at kayaker campsites within Glacier Bay National Park and Preserve, Alaska. We created a database for the input, organization and analysis of 70 years of bear sightings and conflicts data. Geographic information system (GIS) was used to analyze temporal-spatial patterns of both bear and camper use of the area. We visited 162 campsites throughout the bay and recorded a suite of variables deemed relevant to bear habitat quality and bear-human conflict potential. Artificial neural network models are being used to predict bear use and bear-human conflict. Results from this work will assist park managers in minimizing bear-human conflict and bear displacement from important habitats by camper activity.

Introduction

Sea kayaking is the predominant recreational activity in Glacier Bay's extensive marine backcountry. Kayakers frequently camp several nights, camping within the narrow strip of land between the ocean and steep-walled mountains. Both brown and American black bears seasonally occupy these same coastal areas. Beaches not only provide bears with unrestricted movement corridors, but also important foraging opportunities. Seaside habitats are among the earliest to provide bears with new plant growth as well as access to intertidal areas that host a variety of marine forage items. Consequently, the potential for bear-human interaction at Glacier Bay's campsites is higher than for other areas of the backcountry. It is also more likely that human activity in these areas will displace bears from important forage resources, or interfere with their movements.

Study Area

Glacier Bay National Park and Preserve (GLBA) is located in southeast Alaska at the northernmost end of the Alexander Archipelago. Glacier Bay extends northward from Icy Strait more than 96 km (60 mi). Plant communities reflect its history of glacial recession, with boreal rain forests giving way to scrublands which, in turn, fade until only bare rock meets the glacial interface. GLBA is a vast maritime wilderness encompassing 1.3 million hectares of tidewater glaciers, timbered islands, winding fjords and a unique assemblage of marine and terrestrial life. Mountains in the park rise from the ocean to >4,600 m (15,000 ft), with rock, ice and barren terrain comprising the largest component of the terrestrial ecosystem. Consequently, some of the most productive terrestrial habitat lies within the narrow belt of terrain alongside beaches. This research estimated the potential risk of bear conflict and bear displacement at campsites within Glacier Bay proper. Bear-human interactions also occur in the park's interior, along the Outer Coast, and at Dry Bay, but these areas are not discussed here.

Methods

Initially we constructed an accurate history of bear activity and conflict at Glacier Bay before attempting to devise research that would provide insight regarding bear-human conflict. Glacier Bay National Park staff have carefully documented instances of bear-human conflict (approximately 300 incidents from 1960-2004), bear sightings (>3,700 sightings from 1932 to 2004), and backcountry campsite use (>8,000 records from 1996 to 2004). We then created a computer database into which these records were entered.

This database of 'bear sightings and incidents' guides the process of data entry (fig. 1), visually presents the distribution of sightings and incidents that have occurred in the bay, and enables users to query for specific information by providing key words. We also used geographic information system (GIS) software to perform spatial analyses of camper and bear use of the bay. This information, in turn, was used to create a temporal-spatial profile of bear and human activity and conflict in the back country.

To assess the potential for bear-human interaction at campsites, this research built upon the work of Herrero and others (1986) and MacHutchon and Wellwood (2002). The assumption underlying these previous research efforts was that bears are not randomly distributed across the terrain; but rather that the temporal-spatial pattern of bear activity is largely a

[1] U.S. Geological Survey, Alaska Science Center, 1011 E. Tudor, Anchorage, AK 99503

[2] National Park Service, Alaska Support Office, 240 West 5th Avenue, Anchorage, AK 99501

[3] National Park Service, Glacier Bay National Park and Preserve, P.O. Box 140, Gustavus, AK 99826

[4] Corresponding author: tom_smith@byu.edu

function of seasonal forage characteristics. If this assumption is correct, an assessment of bear habitat quality at campsites should provide a relative index of the amount of seasonal bear activity at those sites. It follows then that if campers avoid areas seasonally important to bears, the number of bear-human encounters will decline.

The chance of an encounter escalating to conflict is modified by campsite characteristics that reduce the ability of bears and people to detect each other early enough to avoid conflicts, and by terrain features that reduce options for bears and people to avoid each other. Because Glacier Bay is comprised largely of steep-walled fjords, level areas that produce the high quality bear forage are relatively rare and are important to bears. The presence of camping activity may displace bears from these areas; hence a rating of displacement potential was deemed an important aspect of this work. We incorporated this information into a research approach that enabled us to estimate bear habitat quality and bear encounter and conflict probabilities at the most frequently used campsites within the bay by both qualitative (subjective assignment) and quantitative means (correlational analyses and artificial neural networks). Figure 2 presents the campsite risk assessment process.

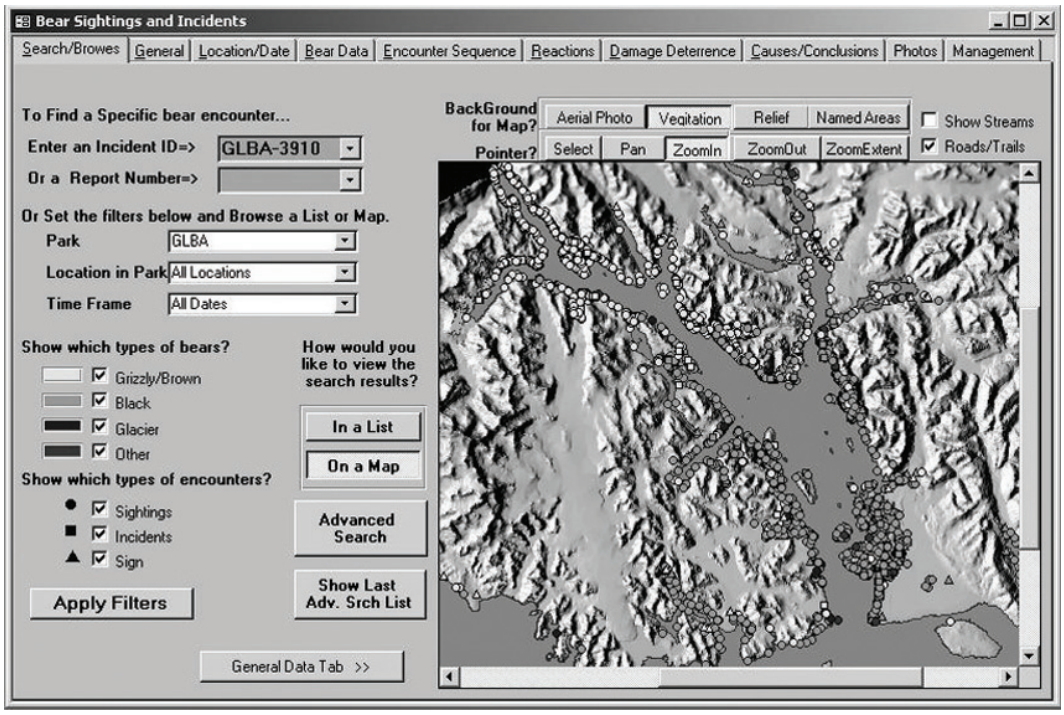

Figure 1. Database that contains Glacier Bay's bear sightings and incidents information.

Results and Discussion

During the summers of 2001-02, we evaluated 162 campsites, recording a suite of variables considered relevant to bear habitat quality, bear encounter potential, and bear displacement potential. Analysis of these data is ongoing using a variety of techniques, including multivariate statistical analysis. In analyzing the park's bear-human conflicts, we found that in more that 98 percent of all reported encounters, bears did not injure people. We also found that trends (fig. 3) in incidents were strongly affected by management actions, such as the implementation of bear resistant food containers in the early 1990's.

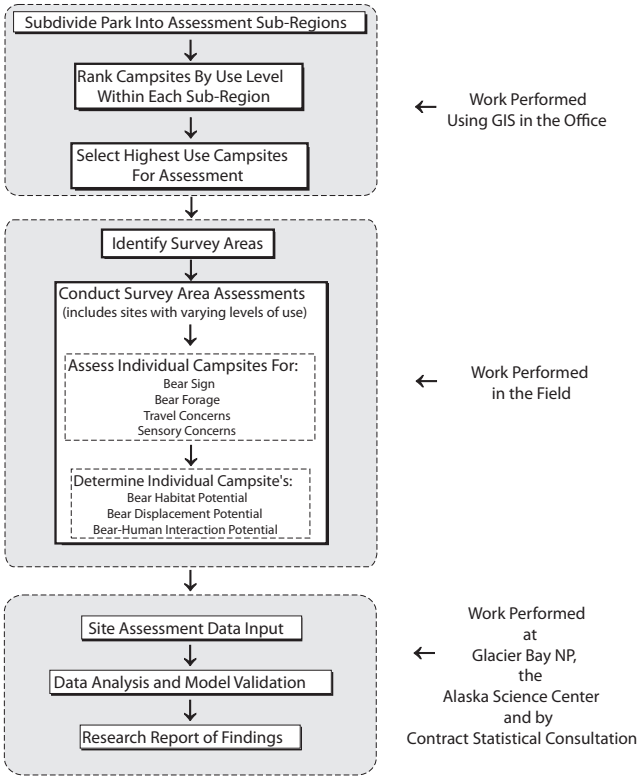

Figure 2. Progression of steps in the campsite risk assessment process.

Although black bear sightings (2,100) outnumbered brown bear sightings (1,300) nearly 2 to 1, black and brown bears were nearly equally involved in conflicts with people (56 percent vs. 44 percent). Eighty-five percent of bear conflicts occurred between 6 a.m. and 6 p.m. and human foods were a factor in bear conflict nearly half the time (42 percent). We also found that single campers were disproportionately more involved in bear conflicts than camps with 2 or more people. Our assessment of information supplied by persons involved in bear conflicts suggests that people were responsible for precipitating conflicts twice as often as were the bears.

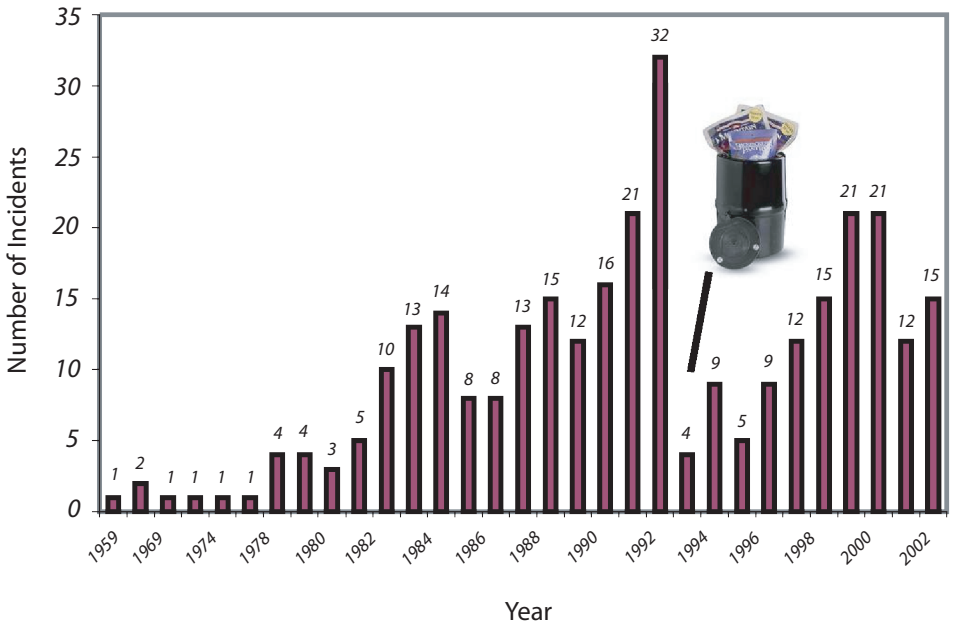

Figure 3. Trends in bear-human conflict at Glacier Bay National Park and Preserve, 1959-2002. Bear proof containers were introduced in 1994.

Park policies and practices must be based on the best possible information to effectively manage people and bears. This project provides managers with a bear sightings and encounter database which will not only provide a historical perspective regarding bear activity and bear-human conflict, but also a framework for future data collection, input, and analysis. Campsite risk assessment determines which site variables most influence bear-human encounter and conflict rates, and provides input for bear management policy. Statistical analysis is providing insight regarding the roles both biotic and abiotic factors play in bear-human encounter rates and conflicts.

Management Implications

Although analysis is ongoing, results from this work will be valuable for park managers to better understand the seasonal importance of various habitats to bears within Glacier Bay. Additionally, an understanding of the relative roles played by specific site characteristics in determining both habitat quality and bear-conflict potential is important for managing human activity.

Acknowledgments

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