

RECREATION AND RISK: POTENTIAL EXPOSURE

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The Department of Energy and other federal facilities are reclaiming land through the process of remediation and restoration, and this land will eventually be turned over for future land uses that may involve recreation. Understanding the amount of recreation that is likely (and thus individual exposure) is an essential element in decisions about cleanup standards. In this article the number of days people engage in different recreational activities as a measure of potential exposure is examined. People attending a Mayfest celebration (n = 399) and the Palmetto Sportsmen's Classic (n = 285) in Columbia, SC, were interviewed regarding their recreational activities. In most cases reported in the literature, recreational activities are examined as the mean number of days people engage in each activity per year, but to determine risk it is essential to know the distribution of these activities. In descending order of frequency, people attending the Mayfest reported their activities as birdwatching, photographing, fishing, hiking, camping, and hunting. There were significant gender differences in the frequency of activities, with men spending more days in every activity except birdwatching and photography. There were ethnic differences in recreation, with whites engaging in higher levels of most recreational activities than blacks, but the percentage of black men who reported fishing more than 100 d per year was greater than for white men. Most people reported their participation in most activities less than 30 d per year; however, a higher percentage of people reported participating in photography, birdwatching, and fishing more than 30 d per year compared to the other activities. Further, individuals at the Sportsman's Classic reported far higher rates of hunting and fishing per year than the general public. These data can be used to examine potential exposure of recreationists on remediated and restored land. The data clearly indicate that over 25% of the people engage in at least one recreational activity over 20 d per year, and thus exceed the Department of Energy's 14-d recreation assumption in its future land use document.

Society and government agencies are continually faced with making decisions about public health and safety, as well as the health of the environment. Determining the risks to humans who use these ecosystems may be influenced by the nature of the activities to be performed there (Burger & Gochfeld, 1995). There is considerable pub-

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lic and governmental debate about cleaning up the Department of Energy (DOE) sites that are a legacy of the Cold War. Many of the DOE sites that were formerly involved in nuclear weapons production require cleanup before they can be used for recreational, industrial, or residential purposes. Cleaning up such sites is potentially very costly, and the degree of cleanup depends upon future land use (National Research Council, NRC, 1995; Wernick, 1995; DOE, 1996). In their future land use document, the DOE suggested that recreational use of these sites might be a maximum of 14 d per year (DOE, 1996). This was meant only as a suggestion, but such assumptions often become incorporated in future documents without critical review.

In this article recreational activities are examined for people from South Carolina, near the Savannah River Site (SRS) (Gibbons, 1993), one of the largest and most contaminated of the DOE sites. Two null hypotheses are tested: (1) There is no difference between the 14-d recreational limit mentioned by DOE (1996) and the actual recreational activities of people living near SRS, and (2) there are no gender or racial differences in potential exposure from recreational activities. Such data are critical for understanding potential exposure from recreational activities if the DOE sites (and other contaminated sites) are opened for recreation. Cleanup levels should reflect these potential exposures.

Risk assessment has come to the fore as an important component of public policy and decision making because it provides a framework for examining different hazards critically and comparatively (NRC, 1983, 1986, 1993). Initially, people evaluated hazards by separating the "science-based" process of risk assessment from risk management, but recently the importance of incorporating risk management into the process has been noted (NRC, 1994; Jenni et al., 1995). One important aspect of the blending of risk assessment and risk management has been the identification of the central role of stakeholders in the decision making process (Commission on Risk Assessment and Risk Management, 1996). Stakeholders are critical to the process of decision-making with respect to both the limits of acceptable risk, and the degree that contaminated lands will be cleaned up. Both risk and future cleanup decisions rest on future land uses (DOE, 1996). Moreover, future cleanup decisions will depend on potential future exposures, which will depend on the number of days people engage in recreational activities on the DOE sites if recreation becomes the major land use. This present research examines potential recreational exposure from a gender and racial perspective.

People in Columbia, SC, were interviewed because (1) it was close (90 km away) to the Savannah River Site (SRS), (2) hunting and fishing are already allowed on SRS for a limited number of days each year, and (3) there is a high potential at this site for increased exposure, either from opening up more lands to hunting or fishing, or

from extending the open periods. Columbia is close enough to SRS so that people are aware of SRS and for the economy to be influenced by SRS, but less than 3% of the people interviewed had ever worked for SRS. People attending a Mayfest celebration were interviewed because it is one of the largest events in the region and attracts a broad range of people, while people at a sportsmen's exhibit were included because hunters and fishermen are the only nonemployee group that at present is allowed access to SRS.

METHODS AND SUBJECTS

The overall research design was to interview people living near SRS for their recreational activities, and to examine these activities in terms of the 14-d recreational exposure assumption of DOE and in terms of gender and racial differences. The data for the study come from a survey of English-speaking people who were interviewed in person at the Palmetto Sportsmen's Classic ($n = 285$, 22–24 March 1996) and at a Mayfest celebration ($n = 399$, 3–5 May 1996) held in Columbia, SC. The Mayfest was attended by 30,000 people from throughout the state of South Carolina. Half of the people interviewed were women, and 78% were from Lexington and Richland counties, but our sample also included people from 38 of the 46 counties in South Carolina. Of the Mayfest sample, 75.4% were white, 23% were African-Americans, 1.3% were American Indian, and the rest were Asians (gender was nearly equal in each sample). The Sportsmen's Classic was attended by over 50,000 people, primarily men (83%), and only 9% were African-Americans. There were no ethnic differences in age or schooling within either males or females.

We stratified our interviews at the Mayfest to reflect the racial composition in attendance, which generally matches the overall population of Georgia and South Carolina (28% black; Greenberg & Simon, 1995). Further, there was no significant difference in educational level attained as a function of gender or race (Kruskal–Wallis χ^2 tests).

People were interviewed while they waited in line for food or tickets, were sitting or standing about waiting to get into a sports exhibit, or were listening to music. Some were just talking. Most people agreed to answer the questions; exceptions were parents with small children and people too engrossed in conversations to be interrupted. The people interviewed were not necessarily people who lived immediately adjacent to the site or who worked at the site.

The survey instrument used included questions about demography (age, gender, occupation, where they lived) and recreational activities. People were also asked how they thought land at Savannah River Site (SRS) should be used in the future, but this is not addressed here

(see Burger et al., 1997). Recreational questions dealt with days spent in different activities, how many cameras, guns, and fishing rods they possessed, whether they ever hunted or fished at SRS, whether they would recreate on SRS, whether they would pay to do so, and whether they believed that the deer and fish from SRS were safe to eat. Subjects at the Mayfest were asked about a variety of recreational activities, while those at the Sportsmen's Classic were asked only about hunting and fishing.

Unless otherwise noted, means plus one standard error are given in the text. Most recreational data of this nature are presented only as means, and authors do not give the potential range of exposure. Although means are useful for management of visitors, it may well be that the range of potential exposures is of most interest in computing risk—that is, the percentage of the population that would exceed the 14 d recreational exposure assumption in DOE's future land use document (DOE, 1996). Therefore, frequency data for various recreational activities are presented in this article.

Data from the Mayfest are presented first because they represent the general population, as opposed to the targeted hunters and fishermen at the Sportsmen's Classic. The mean age of respondents was 34 yr (range 14–75). About 10% of the sample had less than a high-school education, 41% graduated from high school, 37% graduated from college, and the rest had postbaccalaureate training.

RESULTS

Recreational Level and the 14-Day Assumption

The most popular activity was birdwatching, and in order of popularity, people reported recreational rates as follows: birdwatching ($\bar{X} = 21.5$ d/yr), photography ($\bar{X} = 19.5$), fishing ($\bar{X} = 11.2$), hiking ($\bar{X} = 4.8$), camping ($\bar{X} = 4.3$), and hunting ($\bar{X} = 2.6$). People canoed on average less than 1 d per year. On average, people birdwatched and photographed more than the 14 d per year, and fished more than 10 d per year. These data lead to a rejection of the null hypothesis that there is no difference in recreational use and the 14-d assumption.

The percentages of people reporting different recreational activities for different time periods are shown in Figure 1. Between 4 and 24% of those interviewed said they would engage in each activity 1–10 d per year; the percentage of people who did not engage in each activity varied between 62 (photography) and 89% (hunting). More importantly in terms of the 14-d assumption of the DOE, the percent of people that reported participation in each activity over 14 d per year was as follows: birdwatching (11.9%), photography (19.4%), fishing (14.8%), hiking (8.1%), camping (7.1%), and hunting (5.2%). This is

SOUTH CAROLINA MAYFEST RECREATIONAL ACTIVITIES

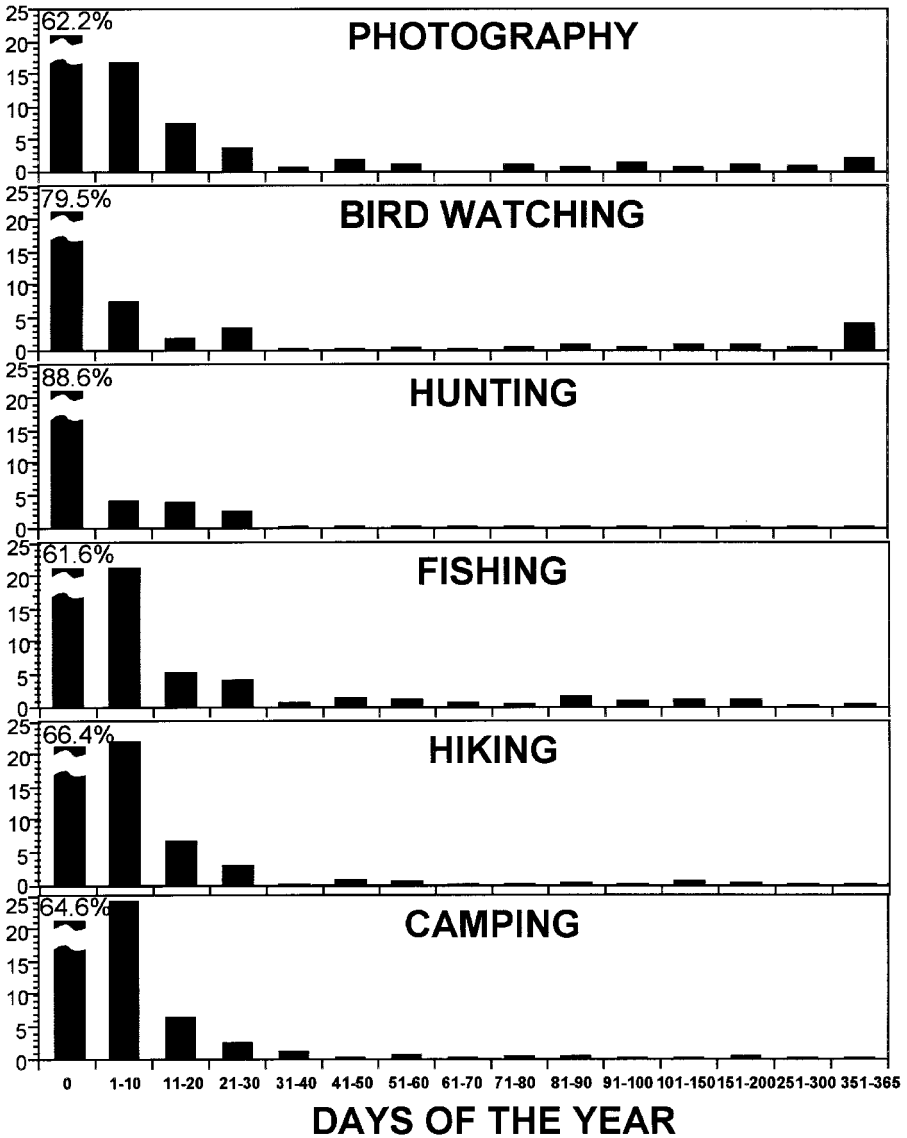


FIGURE 1. Percentage of respondents reporting different recreational activities from the Mayfest sample in Columbia, SC.

fairly typical of South Carolina, since in the early 1990s, 6% of the population bought hunting licenses, and 13% bought fishing licenses (South Carolina Division of Wildlife and Freshwater Fisheries, personal communication). These data also lead to a rejection of the null hypothesis that there is no difference in recreational activity and the 14-d maximum exposure assumption of DOE.

Overall Recreational Level and Gender Differences

There were gender-related differences in the frequency of activities for the sample from the Mayfest. Men reported higher rates of fishing (Kruskal–Wallis $\chi^2 = 37.7$, $p < .001$), camping ($\chi^2 = 5.0$, $p < .001$), and hunting ($\chi^2 = 26.5$, $p < .001$), while women reported more photography ($\chi^2 = 4.1$, $p < .04$). There were no differences in the other activities. Thus, the null hypothesis of no gender differences in recreational rates is rejected.

As well as means, it is important to examine the frequency distribution of each activity, since this presents a picture of different exposure rates. For both hunting (7%) and fishing (20%), a significant percentage of men attending the Mayfest reported participating in these activities over 20 d per year (Figures 2 and 3). Since hunting and fishing rates were correlated ($r = .42$, $p < .0001$), the potential days of exposure are even greater. Over 15% of women, and 12% of men, reported photographing more than 20 d per year (Figure 4). As might be expected, hiking and camping were also highly correlated ($r = .39$, $p < .0001$), but hiking and fishing were not. Women reported frequent birdwatching (Figure 5), and women who birdwatched frequently reported high rates of photography ($r = .11$, $p < .01$).

People attending the Palmetto Sportsmen's Classic were asked only about hunting and fishing (Figures 6 and 7). Of men, over 60% reported hunting more than 20 d per year, and over 60% reported fishing more than 20 d per year (Figures 6 and 7). Although the percentages were considerably lower, about 30% of women reported fishing over 20 d per year (Figure 6). For people attending the Sportsmen's Classic, hunting and fishing rates also were correlated ($r = .32$, $p < .001$).

Ethnicity

There were ethnic differences in rates of recreational activities, with white men generally engaging in significantly more activities than the other three groups (Figures 2–7). Fewer African-Americans reported birdwatching than did whites of either gender ($\chi^2 = 4.6$, $p < .03$), although 6% of black men said they birdwatched more than 100 d per year (Figure 5). For white Americans, over 15% of men and 15% of women birdwatched over 20 d per year. What is interesting about birdwatching is a number of respondents reported birdwatching over

SOUTH CAROLINA MAYFEST FISHING

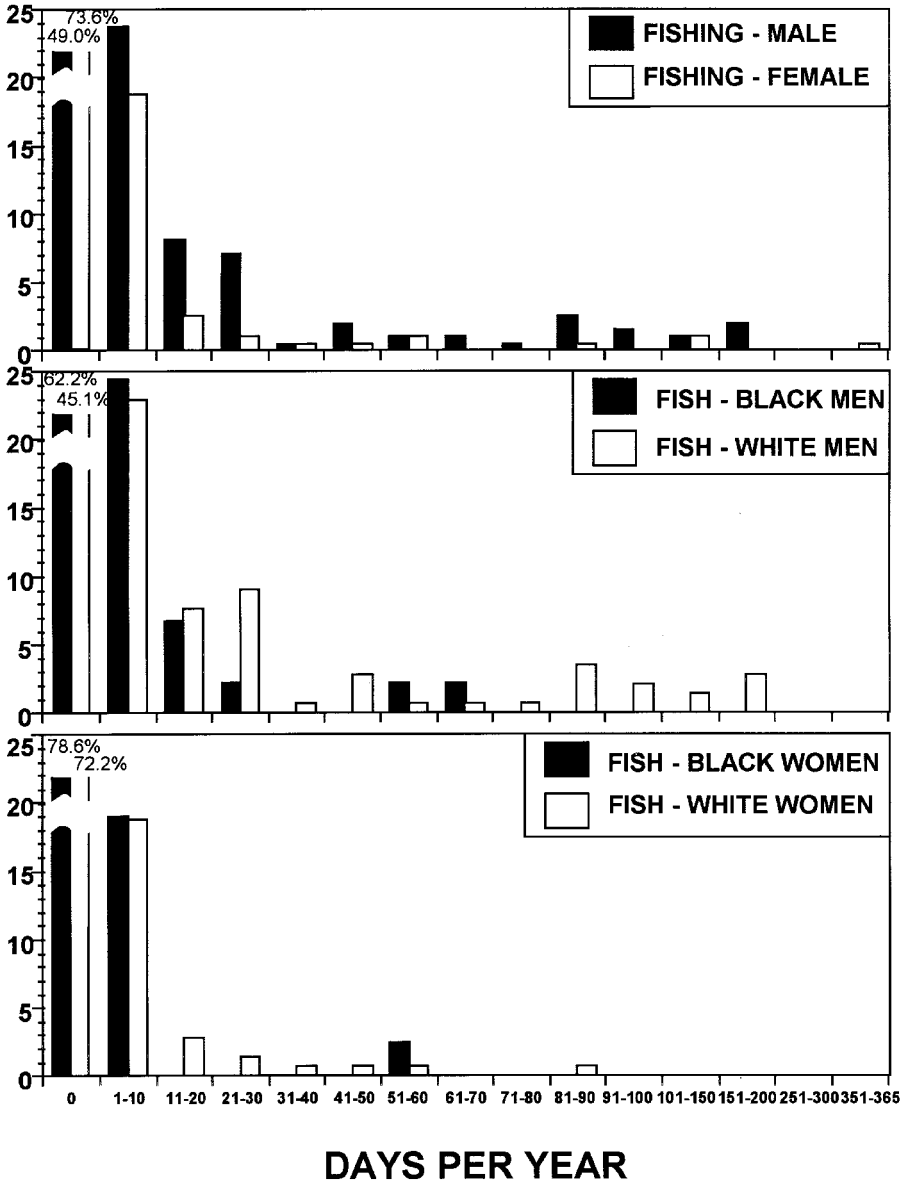


FIGURE 2. Percentage of men and women reporting fishing (Mayfest), and ethnic relationships.

SOUTH CAROLINA MAYFEST HUNTING

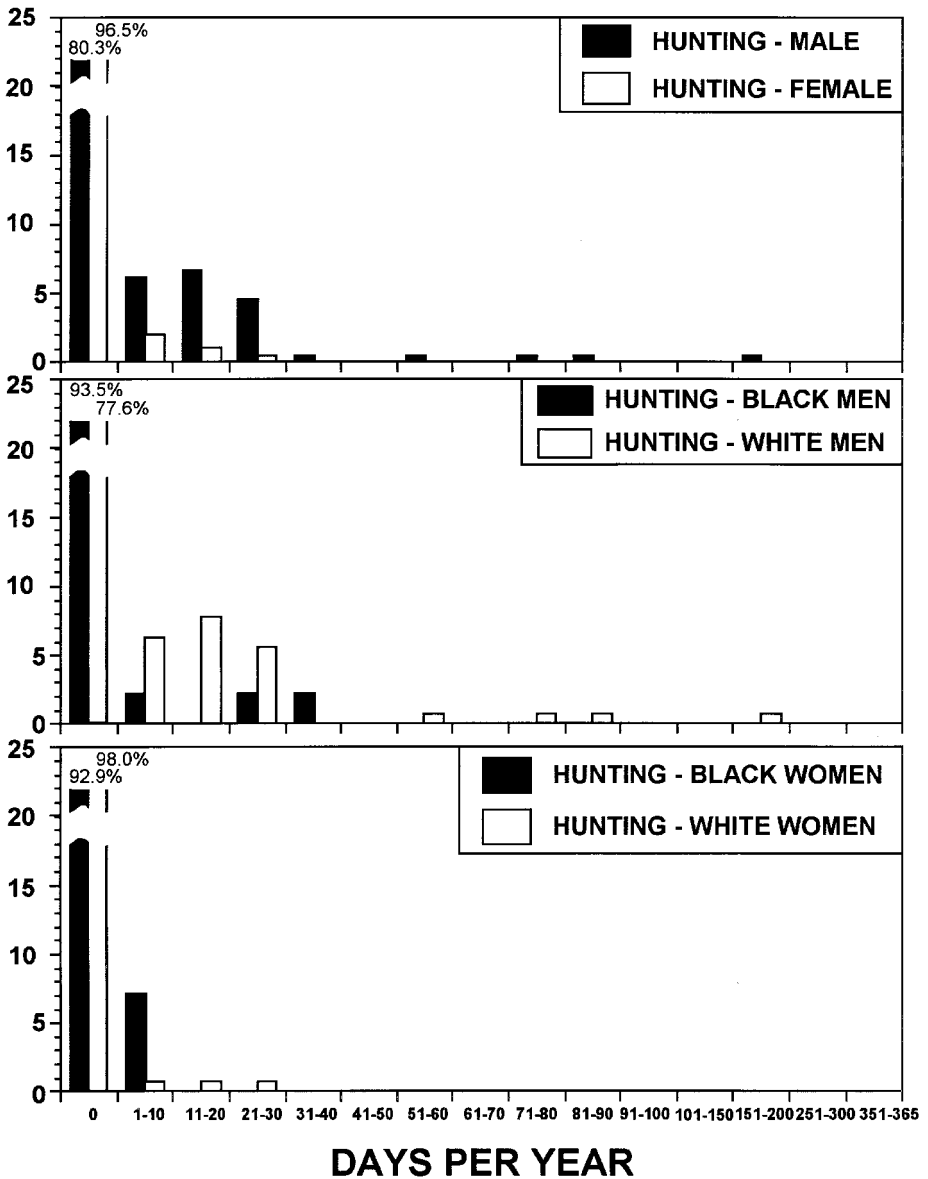


FIGURE 3. Percentage of men and women reporting hunting activities (Mayfest), and ethnic relationships.

SOUTH CAROLINA MAYFEST PHOTOGRAPHY

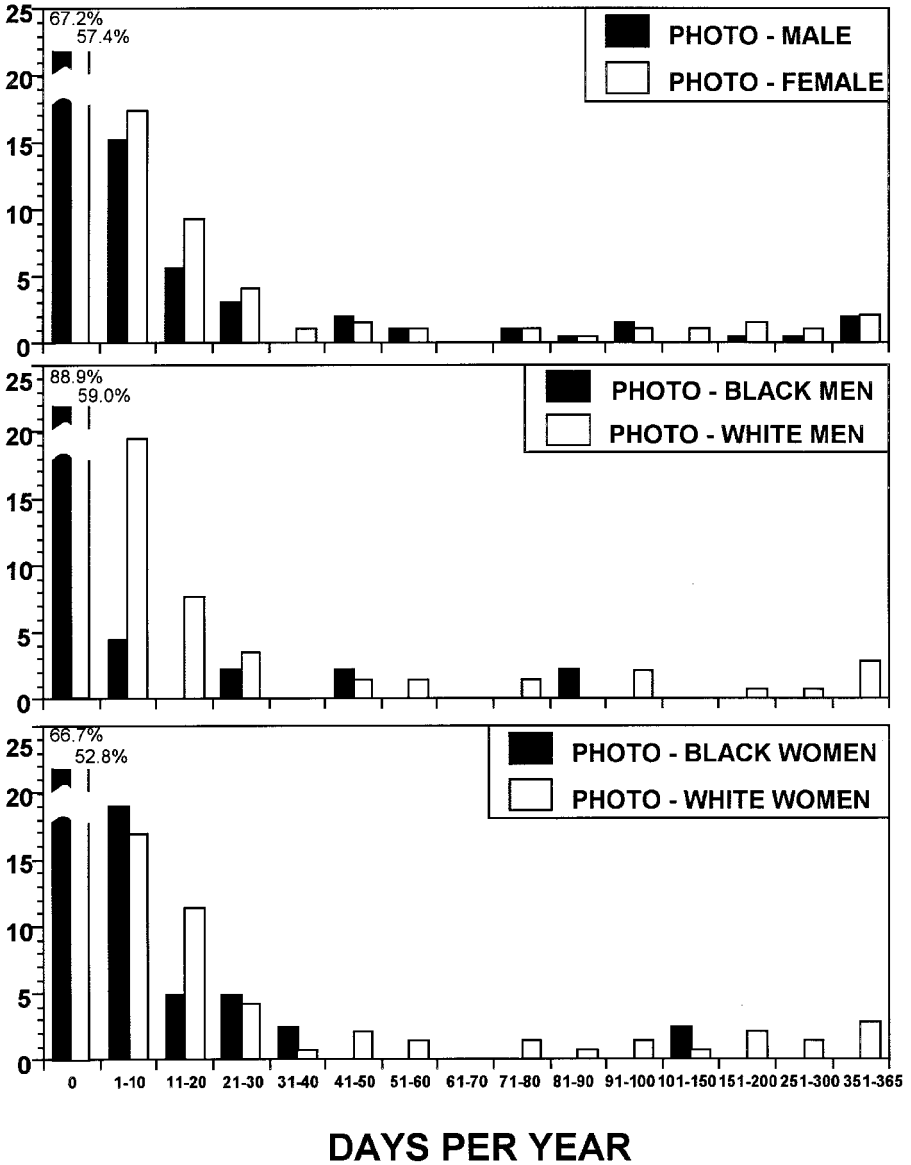


FIGURE 4. Percentage of men and women reporting photography (Mayfest), and ethnic relationships.

SOUTH CAROLINA MAYFEST BIRDWATCHING

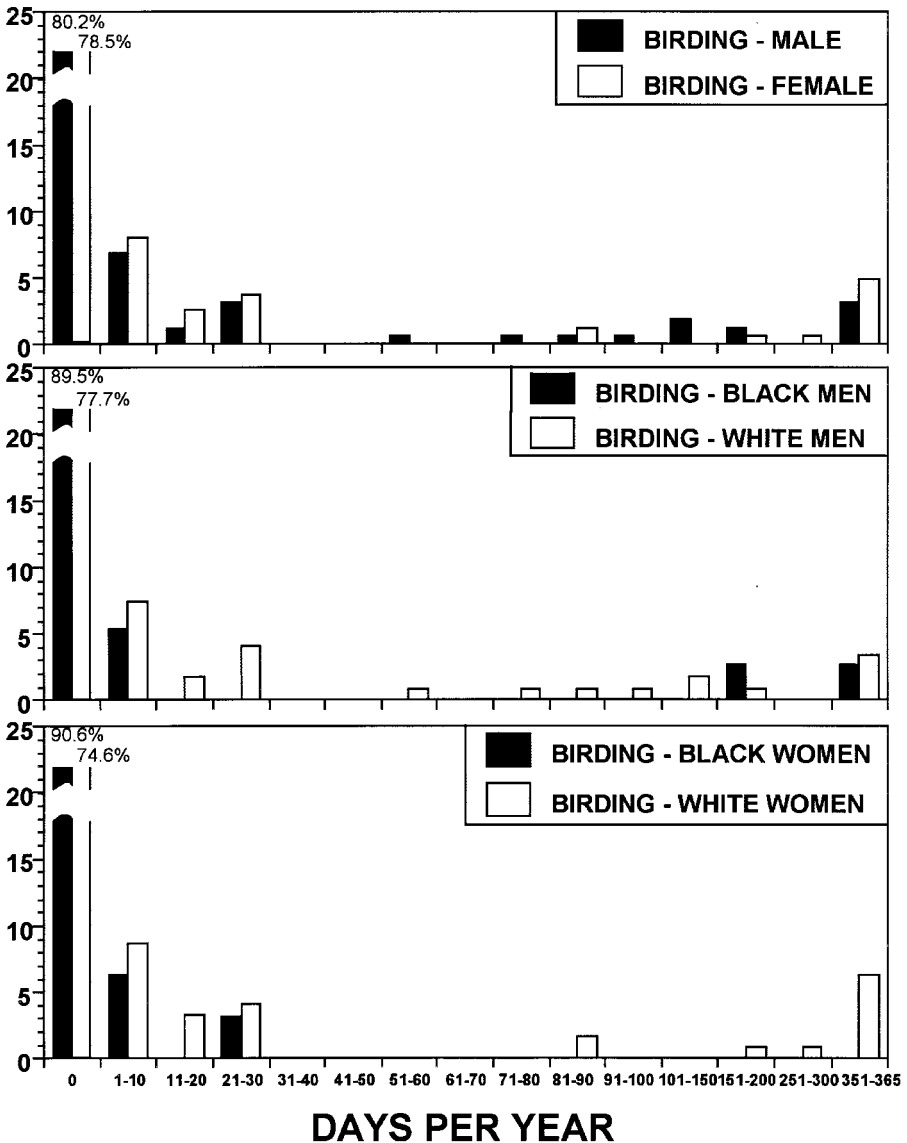


FIGURE 5. Percentage of men and women reporting birdwatching (Mayfest), and ethnic relationships.

PALMETTO FISHING

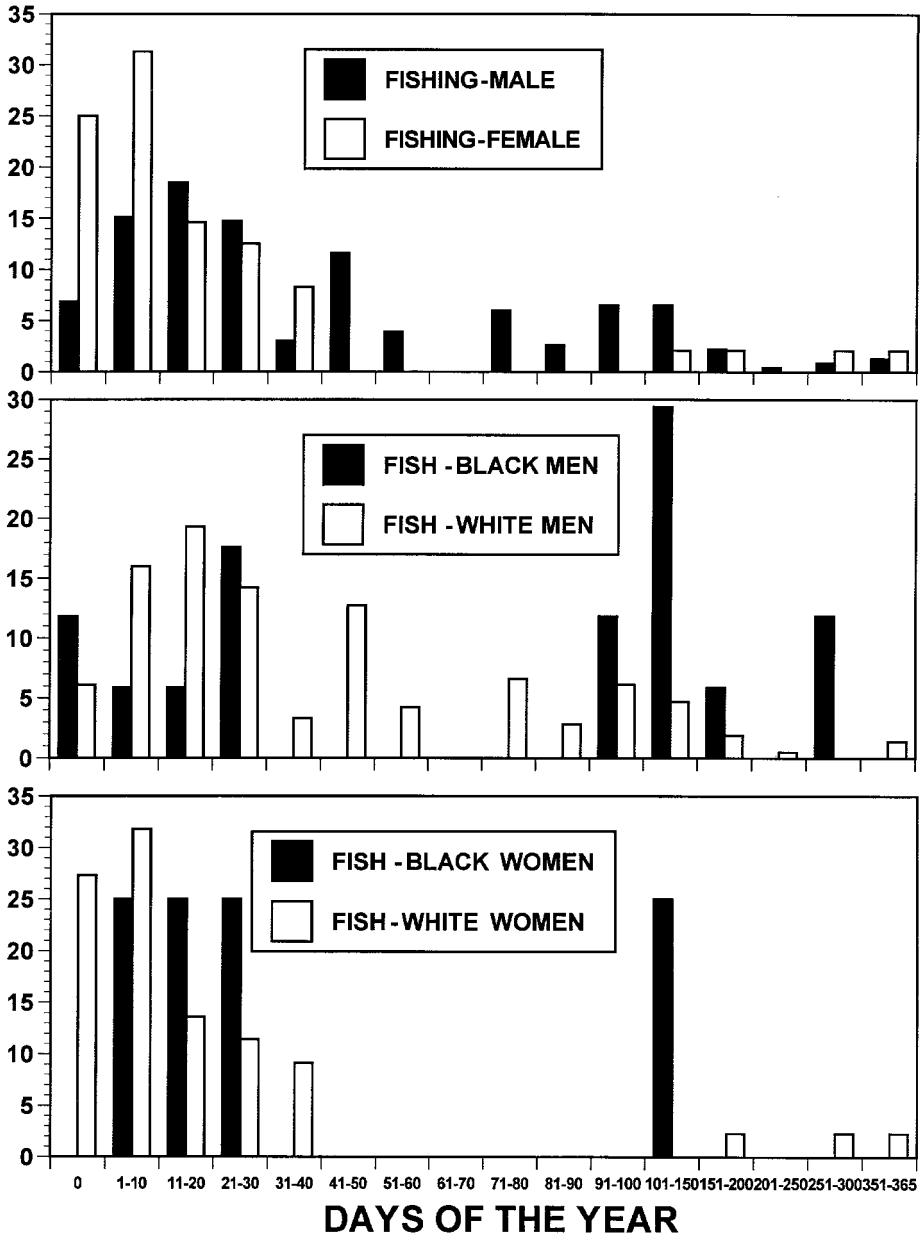


FIGURE 6. Percentage of men and women reporting fishing, and ethnic relationships (Palmetto).

PALMETTO HUNTING

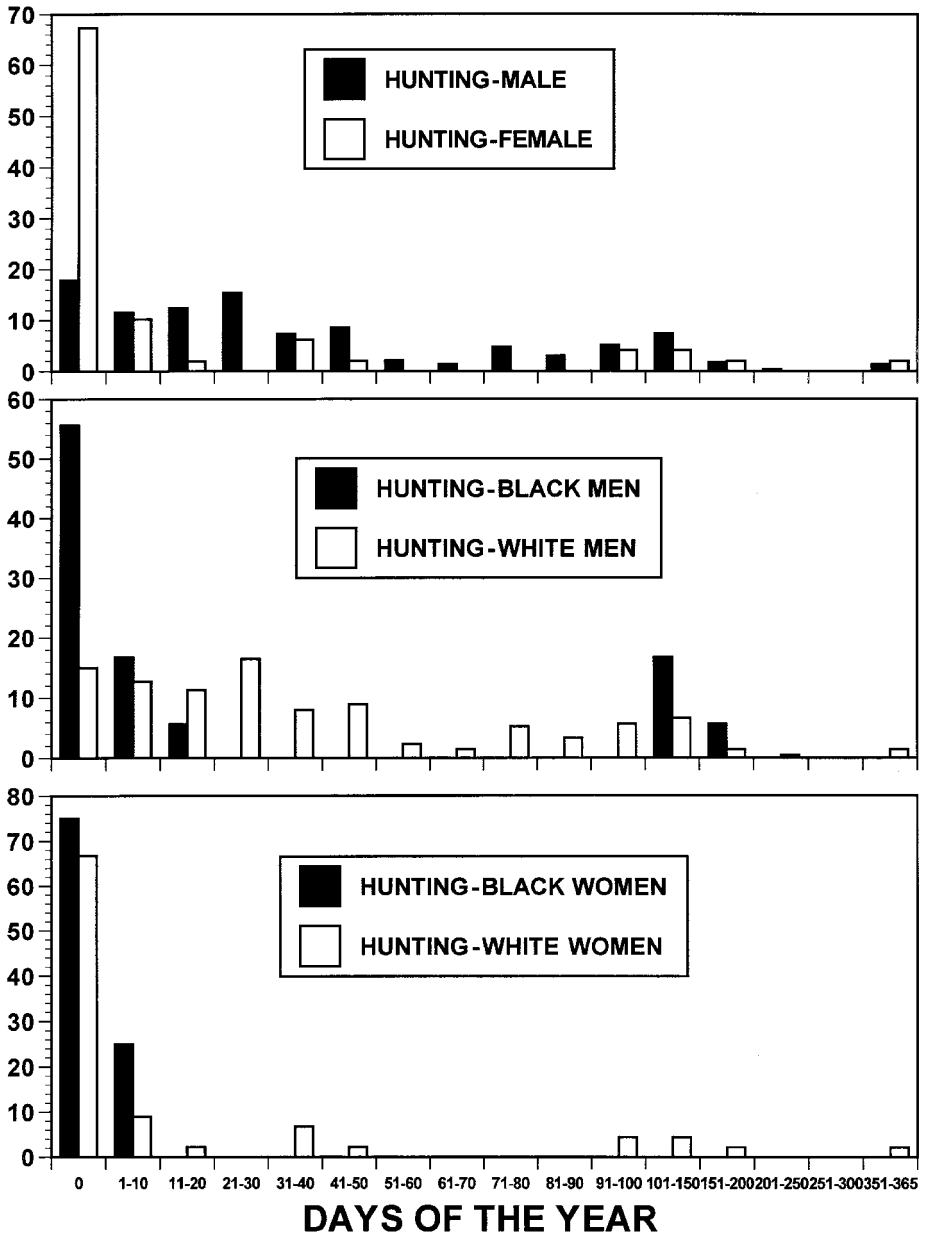


FIGURE 7. Percentage of men and women reporting hunting, and ethnic relationships (Palmetto).

100 d per year (Figure 5). The data for photography indicate that 15% of white men and 20% of white women photographed over 20 d per year, but the percentages for blacks were much less ($\chi^2 = 11.0$, $p < .001$, Figure 6). These data lead to a rejection of the null hypothesis of no ethnic differences in recreational activities.

There were far fewer African-Americans in the Sportsmen's Classic (9%, $n = 22$) sample than in the Mayfest (23%) sample; however it is instructive to examine ethnic differences for this group of potentially high recreational users because there might be ethnic differences with respect to consumptive recreational activities. The pattern of potential exposure, as measured by days reported for these activities, is of interest because the percentage participating in hunting and fishing over 20 d per year was much higher (Figures 6 and 7). Ethnic differences in fishing were particularly pronounced, with 83% of black men reporting that they fished more than 20 d per year; 44% fished more than 100 d per year (compared to 10% for white men, Figure 6). Fewer black men hunted over 20 d per year (only 21%) compared to white men (67%, Figure 7).

DISCUSSION

Most scientists in the United States who examine recreational activities are either interested in the effects that people have on wildlife or habitats (Knight & Cole 1995), are interested in knowing recreational needs so they can manage people in these habitats or at least minimize conflicts (Manfredo & Larson, 1993), or are interested in tourism generally (Inskeep, 1987; Roehl & Fesenmaier, 1987; Raitz & Dakhil, 1988). For the most part, recreation in North America is limited to public lands. Many European countries, however, have a tradition of "all-man-right" access, which gives anyone common access to wildland areas for hiking, camping, and other activities, except for restrictions on cropfields and gardens (Hammit et al., 1992). These two different perspectives on recreation and the use of wilderness have important implications for management because in the latter case it is difficult to either know the extent of human use or manage for natural resources. One of the aspects that has not been recognized with this dichotomy is the difficulty of determining risk to people who enter contaminated lands, or of determining the level of cleanup that might be required under the common access tradition. Cleanup standards assume some level of exposure, which for recreationists would usually refer to the number of days (or hours) an individual would be on the land each year.

The main objective of this study was to examine the efficacy of using 14 d per year as a reasonable maximum days of exposure for recreationists who might use DOE sites (DOE, 1996), and to deter-

mine whether there were gender or ethnic differences in recreation rates. We did not determine where they recreated, particularly since SRS is only open for hunting and fishing 30 d per year. Nonetheless, it is reasonable to assume that people who live close to SRS, and have limited access to other sites or limited time for travel and recreation, might use the SRS site for a significant percentage of their activities if attractive habitats were open to them. In the late 1980s, Flather and Hoelstra (1989) noted that the number of big game hunters has generally increased, while the number of small game and migratory bird hunters has declined. The declines were attributed to lower game populations, reduced access, and crowded conditions—all factors that might lead to increased use of SRS for hunting if more hunting land were available for hunting and fishing, or access periods were extended.

To some extent, since the DOE (1996) assumed that recreationists would not be on site for more than 14 d, it concluded that the level of cleanup required if land were to be used for recreation was much less than for other types of exposure (such as industrial or residential). It is not clear where the 14-d assumption came from, although it may partially come from information on hunting uses of some of the DOE sites where hunting is allowed on a limited-access basis. This, however, misses the point that people might well engage in many different recreational activities if the land were open and available all year.

Most of the recreational activities examined in this article were positively correlated; that is, respondents who reported a given activity were likely to report other similar activities. The most highly correlated activities were hunting and fishing, and hiking and camping; these were also popular activities. This suggested that the exposure limits (number of days reported for each activity per year) determined from only one activity are underestimates, or are conservative estimates at the very least. The data presented earlier suggest that it is not reasonable to assume that recreationists would be on site a maximum of 14 d per year. It is proposed that this is true because (1) both men and women averaged over 14 d per year for at least one activity, (2) at least 25% or more of men and women reported at least one recreational activity more than 14 d per year, and (3) there are ethnic differences in frequency of recreational activities that should be taken into account. This latter finding is particularly important given that exposure both via presence on a site and through consumption of food would be different whether people consumed fish or deer. The racial differences in recreational activities should be studied further with respect to potential exposures.

It can be argued that people would not conduct all of their recreational activities at one site, and that exposure would thus be less

than the maximum identified in this study. However, some people who live close by may use a site for a significant proportion of their activities, and this aspect should be studied in people living near SRS. Further, hunters who actually use SRS claim that they would like to hunt there more often (Burger et al., in press), suggesting that at least this group would use the site more frequently than 14 d.

These data also suggest that cleanup standards for recreational activities must take into account the range of days people engage in these activities, and not just the mean values. The mean days reported for any recreational activity does not adequately describe the proportion of the population at risk, or the potential rate of exposure (as measured by days reported for particular activities) for those most at risk. It is usual in human health risk assessment to examine the health risk for the population that is potentially most at risk (NRC, 1983). Thus, the actual number of days people engage in recreation should be considered in the cleanup decisions for contaminated sites.

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