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Source: *Wildlife Society Bulletin*, Vol. 16, No. 1 (Spring, 1988), pp. 58-62

Published by: [Allen Press](#)

Stable URL: <http://www.jstor.org/stable/3782354>

Accessed: 03/11/2010 15:00

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## ASSESSING IMPACT OF RECREATION ON WILDLIFE: A CLASSIFICATION SCHEME

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Meeting public demand for wildlife recreation opportunities while avoiding undesirable impacts on wildlife and its habitat is a constant challenge for wildlife managers. The situation is complicated because recreational uses of wildlands may have multiple impacts. A recent survey of wildlife refuge managers and review of literature regarding impacts of consumptive and nonconsumptive recreationists on wildlife (Weeden 1976; Wilkes 1977; Kirkpatrick 1978; Ittner et al. 1979; Boyle and Sampson 1983, 1985; Lee et al. 1984) indicate that a dichotomous classification of recreationists as consumptive or nonconsumptive does not address the types of impacts resulting from various uses of wildlife and implies that 1 class of activities has impacts on the resource and the other does not. Furthermore, this activity-based classification does not sufficiently aid managers' decisions about acceptable recreational uses of wildlands. Consequently, we developed a classification of impacts that recreational activities can have on wildlife that we believe provides a useful alternative framework for making decisions regarding permissibility of various recreational uses of wildlands.

We have classified the negative impacts to wildlife that result from recreational activities on wildlands into 6 categories (Table 1). The impacts are generic and 1 type does not necessarily exclude another. For instance, a bird-watcher hiking through prime nesting habitat of the piping plover (*Charadrius melodus*) may cause stress to the bird, reducing use of pre-

ferred habitat, which ultimately results in lowered productivity. As another example, the obvious impact of hunting is direct mortality, but the activity might also result in reduced use of the hunted area by wildlife, an indirect impact. Alternatively, different recreational activities may produce the same impact. At issue is not whether the intended outcome of an activity is considered to be consumptive or nonconsumptive of wildlife, or even that wildlife is considered the focus of the activity, but whether the impact on wildlife is acceptable.

### RECREATION ON REFUGES

The impact classification scheme (Table 1) was developed as part of a study of recreational-use impacts on U.S. Fish and Wildlife Service (USFWS) national wildlife refuges (NWR's) in Region 5 (Region 5 includes the eastern seaboard states from Me. to Va. and as far west as W. Va.). Many of these NWR's are near metropolitan areas and receive heavy public use, which is expected to increase in the future (R. Kirby, U.S. Fish and Wildl. Serv., pers. commun.). Decisions about the acceptability of various recreational uses of refuges are made in consideration of the charge to the USFWS to "provide the federal leadership to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of people" (U.S. Fish and Wildl. Serv. Manage. Plan, 1982:4). The study provided us with an opportunity to apply and assess the useful-

ness of our classification of recreational-use impacts in helping managers determine the limitations on recreation use necessary to minimize negative impacts on wildlife.

We conducted a telephone survey of Region 5 refuge managers in November 1985 to obtain a preliminary listing of wildlife species that refuge managers believed were negatively impacted by recreational activities; a description of the nature and importance of the recreational-use impact; and descriptions of the types of visitor publics. Data from the telephone interviews were used to develop the classification of recreational-use impacts. We then sent a questionnaire to refuge managers in July 1986 and asked them to use the classification system to describe impact situations on their refuges. Any recreational activity that resulted in adverse impact to wildlife was considered an impact situation. One hundred forty-eight impact situations involving 20 wildlife species were reported by 16 refuge managers. Of the impacts described by managers, lowered productivity was cited in 61 of the 148 situations (41%) as the impact on the species of interest. Impact situations involving aberrant behavior of wildlife (16%), reduced use of habitat (14%), reduced use of refuge (13%), and direct mortality (12%) were reported with similar frequency. Indirect mortality was the least frequent (5%) impact reported.

Managers identified 12 visitor activities that had negative impacts on species of special concern on their refuges. Two activities, exploring on foot and driving on beaches, accounted for >60% of the impact situations. These same activities had the greatest variety of impacts on wildlife as well, resulting in everything from direct mortality to aberrant behavior. Activities involving use of land vehicles were commonly associated with direct mortality. Ten of the 12 visitor activities were believed to impact species of concern by lowering productivity. Hunting accounted for about 30% of all impact situations described in which direct mortality was a result, whereas exploring on foot with

Table 1. Classification of recreational-use impact on wildlife derived from interviews with refuge managers in the Northeast.

Category of impact	Description of impact
Direct mortality	Immediate, on-site death of an animal.
Indirect mortality	Eventual, untimely death of an animal caused by an event or agent that predisposed animal to death.
Lowered productivity	Reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site.
Reduced use of refuge	Wildlife not using refuge as frequently or in the manner they normally would in the absence of visitor activity.
Reduced use of preferred habitat on refuge	Wildlife use is relegated to less suitable habitat on the refuge due to visitor activity.
Aberrant behavior or stress	Wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

pets and driving on beaches accounted for 18 and 47%, respectively, of such situations. Exploring on foot impacted nearly all groups of species identified. Some activities had several impacts on a specific group of species (e.g., the impacts to waterfowl as a result of boating included indirect mortality, lowered productivity, reduced use of preferred habitat, and aberrant behavior and stress). Other activities were associated with fewer impacts but affected numerous kinds of wildlife (e.g., wildlife observation on foot was associated with lowered productivity and aberrant behavior for shorebirds, waterfowl, and birds of prey).

## DISCUSSION

### *Classification of Wildlife Recreation Impacts*

An assessment of wildlife impacts should consider types of visitors to an area, their activities, their interaction with wildlife and wildlife habitat, and the resulting impact(s).

As a simple example, a cursory evaluation of a wildlife impact problem on a NWR might associate surf fishermen with nest disturbance of piping plovers. This could suggest a need to restrict surf fishing in the nesting area. However, a detailed examination of a manager's depiction of the problem, such as that used in the questionnaire for Region 5 NWR managers, would reveal more completely that nest disturbance is caused by surf fishermen driving to and from the beach; pets and non-fishing companions of the fishermen exploring the beach; and fishermen picnicking on the beach. Thus, the offending publics are off-road tourers, beachcombers, pets, and picknickers; the impacting activities are driving on beaches, exploring on foot, unrestrained pets, and picnicking, respectively. Analyzing the problem in this way indicates that potential solutions might be to restrict fishermen to routes that avoid driving through nesting areas; to restrict visitor and pet activities; and to provide alternative areas away from the beach for picnicking. It would therefore be concluded that fishing itself is not a cause of negative impacts on wildlife of special concern and may be continued, with certain restrictions, as a compatible public use of the refuge.

### ***Public Use Policy***

It is our opinion that wildlife managers can make the difficult decisions about recreational uses of wildlands and maintain their credibility amid controversy if their decisions are based on defensible criteria. We believe the important criteria managers need to consider to determine recreational-use of wildlands are the kinds of impacts on wildlife or habitat that are of special concern on a particular site and the kinds of recreational activities that are most or least likely to cause such impacts. Decisions about permissibility of recreational-use of wildlands could then be made based on estimated levels of impact expected from the rec-

reational-use activities under consideration, at various levels of participation, and with various levels of mitigation effort. The establishment of acceptable levels of impact for each category of impact in the classification scheme presented earlier seems to be the key element in the rational and defensible regulation of recreational-use of wildlands.

As wildlife managers attempt to be sensitive both to the needs of resources and to the public desiring to use those resources, they need to be working under a policy that provides considerable individual flexibility consistent with the philosophy of the resource management agency. The dilemma that many managers face is meeting the multiple goals of the resource management agency. The goals of the NWR system are a case in point. They include the promotion of multiple uses of refuge lands for public benefits and the resolution of resource allocation for wildlife. Providing resources for wildlife often requires the stringent preservation of critical habitat, which limits the use of the land for other public benefits.

According to the 1966 NWRS Administration Act (P.L. 89-669), uses such as recreation are permissible on a refuge if the use is "compatible" with the basic purposes for which the refuge was established (Drabelle 1985). The decision to allow recreational activities is made by a regional director of the USFWS with advice from the refuge manager, in consideration of the "compatibility test." However, at the time of the 1966 NWRS Administration Act, no criteria were given for this test, nor was a process for developing such criteria suggested. Consequently, refuges handled decisions on compatibility individually. The public challenges of USFWS decisions to extend the boating season at Nevada's Ruby Lake NWR (Drabelle 1985) and to permit hunting on the Buenos Aires NWR in Arizona (Lee 1986) illustrate the controversy that often results from management decisions that try to accommodate multiple interests.

In an attempt to make decisions on public use more consistent, the USFWS has recently established a set of guidelines for determining compatibility (U.S. Fish and Wildl. Serv. Man. 5 RM 20.8 A-F, 1985). The guidelines advise managers to identify the purposes of the refuge; describe the proposed use including information on the location, timing, duration, nature, and reasons for the activity; and assess the impact of use on the refuge purposes giving consideration to the temporal and spatial requirements of the activity, the direct impacts to refuge resources (e.g., disturbance of wildlife, habitat destruction), and long- and short-term impacts of the use. After completing the above steps a manager should be able to determine if a use is compatible or not and list any stipulations required to ensure compatibility. The compatibility decision must be supported by adequate justification.

We believe that application of the recreational-use impact classification system will help refuge managers comply with the compatibility test criteria because it provides a systematic means to assess the relative impacts of proposed uses. Standard application of such a procedure might increase consistency in wildlife managers' decisions without sacrificing considerations of the individual characteristics of the particular management area and the proposed uses. It should also provide a more defensible position for wildlife managers when recreational-use conflicts arise.

### CONCLUSIONS

The consequences of recreational impacts presented in reference to wildlife refuges have similar application to policy decisions regarding all lands managed for multiple benefits. The U.S. Forest Service with its multiple-use mission must constantly balance timber, wildlife, and recreational interests. The primary goal of the National Park Service is the preservation of the natural environment for future

generations. Yet, the Park Service must accommodate millions of visitors each year that often threaten the very environment they are mandated to protect. Thus, the problems faced on national parks and forests parallel those of NWR's.

Ultimately, decisions about the compatibility of recreational uses with wildland management objectives cannot be determined without an evaluation of recreational-use impacts on wildlife. After activities are classified by their anticipated impacts, it will be easier to justify their inclusion or exclusion from a particular site. Using the classification system described herein should enable wildlife managers to select activities that will benefit the public while minimizing impacts on wildlife.

*Acknowledgments.*—Funding for the study of NWR managers in Region 5 was provided by the U.S. Fish and Wildlife Service through a Unit Cooperative Agreement (No. 14-16-0009-1553). We acknowledge with appreciation the help of L. Y. Mattei and N. A. Connelly and the cooperation of M. E. Richmond, D. G. Young, G. H. Haas, R. E. Kirby, and 22 NWR managers in the northeastern U.S.

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Received 4 March 1987.

Accepted 3 October 1987.



*Wildl. Soc. Bull.* 16:62-64, 1988

## NAPHTHALENE SHOWS NO REPELLENCY FOR STARLINGS

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Birds nesting or roosting in urban areas can cause a variety of health, nuisance, aesthetic, and structural problems. This is particularly true for starlings (*Sturnus vulgaris*), which perch or nest on ledges or support beams, and in various nooks and crannies in urban structures (Davis 1959, Thompson and Coutlee 1963, Miller 1975, Weber 1979, Martin and Martin 1982).

One chemical registered by the U.S. Environmental Protection Agency (EPA) for repelling birds from structures is naphthalene (Eschen and Schafer 1986), a crystalline aromatic hydrocarbon used widely in homes as a fumigant for moths and other insects. Our office occasionally is contacted by persons wanting information on the use and effectiveness of this chemical for resolving bird problems; however, we can find no experimental results and only 2 anecdotal reports (Wright 1963) on naphthalene as a bird repellent. Therefore, we conducted an experiment to evaluate the ef-

fectiveness of naphthalene as a repellent for starlings.

### METHODS

In 1984, 51 wooden nest boxes (28 × 13 × 17 cm) were placed 2.5-3.0 m from the ground on utility poles throughout the 2,400-ha NASA Plum Brook Station in Erie County, Ohio. Boxes were at least 120 m apart. Each box had a 5.1-cm-diameter entrance hole; most boxes had slight (<5 mm) openings where the detachable roof met the box sides.

Between 30 April and 2 May 1985 all nesting material was removed from the boxes, and on 3 May 1 of 3 treatments (0, 0.6, or 8.0 g of naphthalene) was assigned randomly to each box with the restriction that 17 boxes received each treatment. The proper weight of naphthalene was placed in a clear plastic vial (7 cm long, 3-cm diameter) containing 9 6-mm-diameter ventilation holes, and the vial was secured with wire to the inside back wall of the nest box. Vials with pebbles similar in size and color to the naphthalene crystals were placed in the control nest boxes. Each box was examined for nesting activity 3-4 times weekly, from 6 May to 15 July, by removing the roof and noting contents of the box (i.e., nesting material, number of eggs and nestlings, and evidence of predation). In addition, a survey of starling activity at nest boxes was