

MONITORING THE IMPACTS OF VISITORS TO SHOREBIRD POPULATIONS IN THE NPS COASTAL AND BARRIER ISLAND NETWORK AREAS

Christopher A. Monz
Environmental Studies Department
St. Lawrence University
Canton, NY 13617
cmonz@stlawu.edu

Erica A. Young
Sterling College
Craftsbury Common, VT 05827

Yu-Fai Leung
Department of Parks, Recreation and Tourism
Management
North Carolina State University
Raleigh, NC 27695

Abstract

The impacts of recreationists on wildlife are a growing concern in protected natural areas around the world. In the NE Coastal and Barrier Island Network areas managed by the National Park Service (NPS), the effect of ever increasing visitor numbers on beach nesting shorebirds such as the piping plover is an ongoing management concern. Currently, these NPS areas conduct counts of shorebird species and numbers, but do not monitor other important trends such as visitor-wildlife interactions. The purpose of this study was to evaluate established procedures for the assessing the type and frequency of human disturbance to shorebirds and to determine the applicability of these procedures to monitoring trends of impact in the Coastal Network. Based on a literature review of disturbance studies, and a preliminary field assessment, the monitoring variables of pre and post disturbance behavior, visitor activity type and number of visitors are suggested for future field testing.

1.0 Introduction

Parks and protected areas are often seen as refuges of naturalness, where visitors can have opportunities to experience the many aspects of the natural world first hand. Such opportunities are becoming increasingly rare in an ever more urbanized world. Protecting the resources so vital to these experiences is arguably more challenging than ever before in an age of increasing visitation, urban area expansion and demand for natural resource extraction.

Progressively more visitors are drawn to parks and protected areas for opportunities to view wildlife.

Approximately 12% of the U.S. population over 16 years of age cite a range of wildlife-dependent activities as a primary reason traveling to a park or protected area. Nearly 63 million visitors to public lands in the US enjoyed various activities dependent on wildlife (USFWS 1996). Despite the value of wildlife to visitors, there remain many situations where wildlife needs and recreation activities conflict. Although significant knowledge gaps remain, recent reviews of the impact of recreation on wildlife (Knight and Gutzwiller 1995; Hammitt and Cole 1998) suggest several overall conclusions. First, recreational impacts may be direct or indirect, the former from interactions with humans, the latter from habitat or environmental alterations. Second, different species have different tolerances to human disturbance. Third, the major impact to wildlife by recreationists is unintentional harassment by visitors who unknowingly produce stressful situations for wildlife. Finally, the frequent presence of visitors in and near wildlife habitats can alter the behavior of animals significantly.

Perhaps a quintessential example of a situation where these conflicts arise is coastal beaches, where millions are drawn annually to enjoy the recreational opportunities these areas provide. The very locations sought by the beach visitors—sandy areas near the ocean—are also exclusive habitat to various shorebird species. Although shorebird protection programs exist, many coastal managers have little information on their efficacy in terms of visitor compliance and the ongoing frequency and type of direct disturbances by recreationists.

The purpose of this research was to examine the current state of knowledge on the assessment and monitoring of direct human disturbance to shorebirds to determine if a viable program of monitoring these impacts could be developed. Specifically the context for this work is the Vital Signs Monitoring Program of National Park Service with a focus on the Northeast Coastal and Barrier Island Network parks. This study is part of a larger project charged with the development of monitoring protocols for visitor impacts to resources across the Coastal Network, a group of eight eastern NPS managed areas extending from Cape Cod National Seashore in the north to Colonial National Historic Park in the south. In

this context, this research sought to examine the directly relevant literature to determine the extent of current shorebird monitoring methods, determine specifically which variables and methodologies might be adaptable to the Vital Signs Monitoring Program and finally, through a preliminary field exercise, determine which methodologies showed the most promise for future field testing.

2.0 Monitoring Visitor Impacts to Wildlife

Monitoring recreation impacts to wildlife is inherently more complex than the assessment of soil and plant disturbance. Wildlife are mobile, exhibit learned behavioral responses and are more complex biologically than other ecosystem components (Cahill and Marion 2004). As such, the majority of recreation impact monitoring efforts to date have not involved detailed wildlife assessments (Marion et al. 1993; Cahill and Marion 2004). Given the aforementioned recent advances in our understanding of wildlife impacts due to recreation activities (e.g., Knight and Gutzwiller 1995; Hammitt and Cole 1998), accurate and reliable monitoring methods are of clear importance for managers of protected areas. The development of meaningful assessment methods is complicated by the staff and funding limitations that managers often face, making full physiological assessment of responses impractical. Cahill and Marion (2004) reviewed the range of possible methods for monitoring given these limitations and concluded that monitoring a limited number of observational indicators that assess direct human wildlife disturbance events may be the most effective for managers. Although they acknowledge that more extensive, long-term, experimental studies are needed to determine cause and effect, observations of a limited number of indicators may be all that is needed for managers to take precautionary interventions to limit undesirable human disturbance to wildlife (Cahill and Marion 2004). The goal of this project is to suggest a suite of practical observation-based indicators that could be field tested in the future to monitor human disturbance on shorebird species.

3.0 Approach

A comprehensive scoping process on visitor impacts in the Coastal Network (Monz et al. 2004) found that the impacts of visitors to nesting piping plovers (*Charadrius melodus*), an endangered shorebird, was an overriding concern of managers at several areas in

the Coastal Network. As such, we focused this study on one of the NPS Network areas, the Sandy Hook unit of Gateway National Recreation Area in New Jersey where both historically and presently many plovers reside during nesting season. Prime plover habitat—sandy beaches—are also the primary areas of concentrated visitor use at Sandy Hook. This spatial overlap necessitates that managers employ the use of exclusions directly surrounding the nests, and signage and fencing to prohibit visitors from disturbing the birds. The Sandy Hook area provided an opportunity to view current plover management strategies first hand, observe the interaction of visitors and nesting birds and conduct some preliminary investigations as to the feasibility of established impact assessment methodologies. Although this project focused on Sandy Hook, the issues and concerns of visitor impacts and the management thereof are similar in many areas in the northeast and mid-Atlantic coast.

After an initial site visit to Sandy Hook, an extensive literature review of the existing methodologies for observing visitor impacts to piping plovers and other similar shorebirds was conducted. Based on this literature review, we designed a preliminary monitoring protocol and informally field tested these procedures in a second visit to Sandy Hook. The efficacy of monitoring protocols were evaluated on the basis of a) ease of measurement; b) time required to obtain measurement; c) ability to determine a disturbance response; and d) consistency among several observers. This preliminary selection of monitoring indicators and protocols is the first step in the process of developing appropriate and feasible monitoring strategies in the context of the Vital Signs Program (Fancy 2002) and the suggestions provided in this work will be subject to further refinement in future phases of this project.

4.0 Findings and Discussion

A significant body of information exists on the effects of various recreation activities to the piping plover, the majority of this work having been conducted in coastal areas of New Jersey (e.g., Burger 1995). Plovers are solitary nesting species and therefore have a limited ability to defend against intruders than colonially nesting birds. The consequences of visitors on plovers reported in the literature (Table 1) include: 1) direct nest disturbances such as stepping on eggs and chicks and scaring adults from nests; 2) alteration of habits as

Table 1.—A Summary of Visitor Impacts to Piping Plovers and Other Beach-Nesting Shorebirds

Study	Impacts Assessed	Salient Findings
Burger and Gochfeld (1998)	Visitor impacts on foraging behavior of five species	Presence if visitors influenced foraging behavior; time of day was a significant factor
Burger (1995)	Beach recreation effects on nesting birds	Stepping on eggs/ chicks, scaring incubating parents from chicks/ nests, forcing birds to alter habits, impeding foraging
Burger (1994)	Effects of human disturbance of foraging behavior and habitat use	Time spend foraging inversely related to number of visitors. Habitat use depends upon tidal conditions and numbers of visitors
Burger (1991)	Disruption of foraging time due to visitor activities	Loss of foraging time due to visitors, foraging at night observed. Direct relationship between number of visitors within 100 m and alert behavior

a consequence of the close proximity of beach visitors; and 3) swimmers moving in and out of waves causing a disruption of normal foraging activities in intertidal areas (Burger 1995). Foraging behavior was found to be disrupted considerably by heavy daytime beach activity and foraging at night to obtain enough food was observed (Burger 1991). Adults were found to be distracted from normal foraging activities as disturbance forced them to be alert and to defend the nest. Direct disturbance events (such as a jogger passing in close proximity) caused chicks to scatter. Repeated disturbance resulted in fewer and fewer chicks remaining and when only one or two chicks were left could the adults then devote sufficient time to feeding. As such, overall reproductive success may have been reduced (Burger 1995). A direct relationship was found between the number of seconds a foraging plover devoted to alert behavior and the number of people within 100 m (Burger 1991).

The above research findings and the general aspects of monitoring visitor impacts to wildlife (Cahill and Marion 2004) suggest four important variables for assessing visitor impacts to plovers (Table 2). Two of these variables focus on the behavioral response of the plovers and are thus direct assessments of disturbance while the others are observations of visitor behavior. First, a primary concern is whether any clear disturbance response

behaviors can be observed including interrupted foraging, flushing and nest defense. Habituation to humans is included in this category as “no response”. The change in plover behavior is captured in the comparison of pre- and post-disturbance observations. A second concern is the assessment of visitor behaviors that are the sources of potential disturbance. Although indirect in terms of wildlife species, these measurements are relatively easy to conduct, are related to impact and may be useful to managers in determining the efficacy of visitor management programs (Cahill and Marion 2004). In this case, monitoring potentially disruptive behavior and the number of visitors near nests and exclosures is suggested (Table 2).

Various elements of sampling must be addressed in order to develop feasible and accurate monitoring protocols (Table 3). The literature and some common sense conclusions suggest that the distance of the observer to the nest, length of sampling time per observation, time of day and time of year are important considerations. Preliminary field trials suggest that a distance of 75 m and a sampling time of 2 min are optimal for observations given the limitations of potential disturbance by the observers and the practical considerations of allowing a reasonable opportunity to observe plover behavior.

Table 2.—Important variables and their attributes for piping plover disturbance assessment

Variable	Attributes
Post-disturbance behavior	• Alert • Interrupted foraging • Flushing • Defending nest • No response
Visitor activity type in proximity of the nest	• Running • Walking • Sedentary activity • Throwing objects • Kite flying • Fishing
Pre-disturbance behavior	• Foraging • Resting • Preening • Attending to chicks
Visitors in proximity of nests	Number of people within 50 meters of nest/exclosure
Plover age classes	• Adults • Chicks

Table 3.—Important sampling considerations for plover human disturbance assessment

Sampling Consideration	Research findings and options	Suggested protocol for field testing and rational for tentative selection
Observation Distance	• 25, 40,75,100,120 meters from nest/exclosure (Burger 1994)	• 75 meters • Ease of identification of species. Closer observations distances resulted in disturbance of species
Sampling Time per Observation	• 30s, 2min, 4min. (Burger 1994)	• 2 min. • Longer time intervals impractical for continuous observation, shorter intervals lack opportunity to observe behavior
Time of Day	• Low tide and peak visitor use times (Burger 1991)	• Hours of plover foraging and high potential visitor disturbance
Time of year	• During breeding season until chicks fledge (April-July)	• Regular periodic assessments during times of high visitor use (May-July)

It should be stressed that the suggestions for monitoring presented here have not been thoroughly field tested and additional work is needed to refine these ideas into a well developed protocol. Nonetheless, the research findings examining human-wildlife interactions and the literature specific to plover disturbance suggest that several observation based variables of plover and human behavior can be measured to provide an index of the frequency

and extent of visitor disturbance. The informal field trials conducted at Sandy Hook demonstrated the importance of standardization of certain procedures such as the distances at which to observe the plovers, amount of observation time and the need to train multiple observers for consistency and accuracy. Future phases of this project will seek to refine and test the suggestions provided here in an effort to develop specific monitoring protocols for

visitor disturbance to plovers and to potentially adapt these methods to other beach nesting species across the Coastal Network.

5.0 Conclusions

This project examined the possibility of utilizing basic observational indicators as a surrogate to more extensive population or physiologically based studies of human disturbance to piping plovers. A preliminary suite of indicators (Tables 2 and 3) and protocols (Table 3) are suggested for field testing in future phases of this project. Further research is needed to examine the validity of using human-wildlife interaction measures as a surrogate for more traditional wildlife disturbance assessments. However, the observation-based assessments suggested here are more feasible for managers in need of gathering some useful data to manage undesirable visitor wildlife disturbance. Future phases of this project will refine the suggested indicators into a suite of specific protocols for monitoring and seek to collaborate with the current NPS assessments of plover populations to determine the validity of these assessments.

6.0 Citations

- Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). *Journal of Coastal Research*. 7(1): 39-52.
- Burger, J. 1994. The effect of human disturbance on foraging behavior and habitat use in piping plover (*Charadrius melodus*). *Estuaries*. 17(3): 695-701.
- Burger, J. 1995. Beach recreation and nesting birds. Knight and Gutzwiller., eds. 1995. *Wildlife and Recreationists*. Washington D.C.: Island Press: Chapter 17, 281-296.
- Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. *Environmental Conservation*. 25(1): 13-21.
- Cahill, K.L. and J.L. Marion. 2004. Monitoring recreation impacts to wildlife: A classification of methods. *Wildlife Society Bulletin*. Accepted and in Revision.
- Fancy, S. Monitoring natural resources in our national parks. On-line at: <http://www.nature.nps.gov/im/monitor/>. [Last Visited: May 25, 2004]
- Hammitt, W.E. and D.N. Cole. 1998. *Wildland recreation: ecology and management*, John Wiley and Sons, New York, USA.
- Knight, R.L. and Gutzwiller K.J. 1995. *Wildlife and Recreationists*. Washington D.C.: Island Press.
- Marion, J.L., J.W. Roggenbuck, and R.E. Manning. 1993. Problems and practices in backcountry recreation management: a survey of national park service managers. United States Department of the Interior, National Park Service, Natural Resources Publication Office, Denver, CO. Natural Resources Report NPS/NRVT/NRR-93/12.
- Monz, C.A., Y. Leung, C. Ingle and H. Bauman. (2004) Visitor impact monitoring in the coastal and barrier island network. In: D. Harmon, B. Kilgore and G. Vietzke, (eds) *Protecting our diverse heritage: The role of parks, protected areas and cultural sites*. Proceedings of the George Wright Society/ National Park Service Joint Conference April 14-18, 2003. p. 135-139.
- U.S. Fish and Wildlife Service. 1996. National survey of fishing, hunting, and wildlife-associated recreation. U.S. Department of the Interior, Fish and Wildlife Service, U.S. Department of Commerce, and Bureau of the Census, Washington, D.C., USA.