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ANALYSIS

An economic analysis of predator removal approaches for protecting marine turtle nests at Hobe Sound National Wildlife Refuge

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Abstract

Hobe Sound National Wildlife Refuge (HSNWR) on Florida's east coast provides undisturbed nesting habitat for three species of threatened or endangered marine turtles. Predation by raccoons and armadillos poses the greatest risk to turtle nests, and predator control has been identified as the most important management tool for enhancing nesting productivity. Recently, estimates of the number of nests that would have been lost in the 2000 nesting and incubation season were made using the results from four control approaches. These approaches were, in order of descending complexity: (1) refuge control enhanced by a one person-month contract with federal control specialists, with that control optimized using a passive tracking methodology for monitoring predators; (2) refuge control enhanced by a one person-month contract with federal control specialists, without predator monitoring; (3) refuge control, but no contract with specialists; (4) no control. In that analysis, approach 1 resulted in the fewest turtles lost to predation. In this paper, we perform a benefit–cost analysis to determine if operational efficacy translates into economic efficiency. Approach 1 had by far the best benefit–cost ratio for loggerhead turtles, but approach 2 was best for Atlantic green and leatherback turtles. However, almost 90% of the turtles nesting at HSNWR are loggerhead, and this area is vital to loggerhead survival. Thus, approach 1 also had by far the best benefit–cost ratio over all turtle species, saving approximately $1.7 million over approach 2, $2.6 million over approach 3 and $8.4 million over approach 4. Given these results, one must ask how can we afford not to control predators, and furthermore, how can we not afford to take the minimal extra steps to maximize control efficacy. © 2002 Published by Elsevier Science B.V.

Keywords: Endangered species; Benefit–cost analysis; Marine turtles; Economics

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1. Introduction

The fundamental focus of the Hobe Sound National Wildlife Refuge (HSNWR) on the east coast of Florida is to offer undeveloped and protected beach habitat for nesting by loggerhead (*Caretta caretta*), leatherback (*Dermochelys coricea*), and green (*Chelonia mydas*) marine turtles (U.S. Fish and Wildlife Service, 1996), each of which is threatened or endangered (U.S. Fish and Wildlife Service, 1994). Prior to controlling raccoons (*Procyon lotor*) on the refuge, as many as 95% of turtle nests were destroyed annually (Bain et al., 1997). Beginning in 1988, armadillos (*Dasypus novemcinctus*) became noticeable as another primary predator of turtle nests at HSNWR (Drennen et al., 1989). Their level of predation has since risen to a similar level as that from raccoons (Bain et al., 1997). Predator removal has been carried out by refuge personnel since 1972 and has been identified as the most important management approach at the refuge (Bain et al., 1997).

The refuge in recent years has sought to improve efficacy of predator control by contracting with specialists to provide additional control of turtle nest predators. Beginning in 1999, the refuge has contracted with USDA Wildlife Services to carry out approximately one person-month of control. In 2000, the efficiency of this one person-month control budget was improved by using a passive tracking index to: (1) optimize the timing and strategy for application of control; (2) minimize labor by identifying areas where control would have maximal effect; (3) examine beach invasion patterns of predators; (4) assess control efficacy; (5) provide anticipatory information for future turtle nesting seasons; and (6) serve as a detection method for invasion by additional species known to depredate turtle nests (Engeman et al., 2001, in review). In a recent evaluation of control strategies at the refuge, this approach of concomitant predator monitoring in support of a contract with control specialists produced the highest efficacy in terms of reduced predation rates and estimated numbers of hatchlings produced (Engeman et al., 2001, accepted). However, operational efficacy does not guarantee economic efficiency. Therefore, we carried out an economic analysis of four control approaches that have been applied at the refuge.

2. Methods

2.1. Economic analysis

For the analysis we applied a benefit–cost model, which attempts to determine the net benefit to the HSNWR in monetary terms, based on the gross benefits and costs given certain management techniques. Decision tree analysis, based on the four different approaches to predator management, was used to determine the optimal control technique from the standpoint of benefits versus costs from the refuge's perspective. The benefit–cost analysis (BCA) follows the framework outlined in Loomis and Walsh (1997, pp. 369–410), Boardman et al. (1996, pp. 187–205), Nas (1996, pp. 57–66), Zerbe and Dively (1994, pp. 369–394) and Loomis (1993, pp. 116–170).

The BCA of the predator approach involves estimating the monetary value of the benefits measured in turtles saved by reduced nest predation versus the costs measured in turtles lost. Determination of monetary values for threatened or endangered species is often not a straightforward or precise process. As an illustration, consider that values of endangered or threatened species have been deemed 'incalculable' in U.S. Supreme Court case law (Tennessee Valley Authority vs. Hill, 1978). Even so, conservative monetary values for rare species can be estimated through such means as costs of captive breeding projects divided by the number of healthy individuals produced (Bodenchuk et al., in press), or by minimal statutory financial penalties assessed as mitigation for illegal kills (Bodenchuk et al., in press). Captive breeding costs were not available, but in Florida, minimum monetary values (penalties) are clearly specified by statute and administrative code (Florida Statutes 370.021(5) d–f; Florida Administrative Code 39-27.002 and 39-27.011). The statutes specify minimum monetary replacement costs for marine turtles at $100 apiece, while the administrative code places the