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Dear Steve:

This summer's predator management project results included the removal of 9 red fox (*Vulpes vulpes*), 6 grey fox (*Urocyon cinereoargenteus),* 18 raccoons (*Procyon lotor),* and 2 nutrias (*Myocastor coypus).* Animals removed were taken from both Hatteras and Bodie Islands during May 25-June 3 and July 20-30, 2004. Of the 15 fox, 8 were removed in May/June and 7 were removed in July. All 15 fox were removed from Bodie Island (see Table 1). Of the 18 raccoons, 16 were removed from Hatteras Island and 2 were removed from Bodie Island.

Table 1. Red and grey fox removed from Hatteras and Bodie Islands, May – July 2004.

	Species	Age/Sex	Location
1	Red Fox	Adult F	N 35.838940 W 75.560630
2	Red Fox	Adult F	N 35.791630 W 75.537510
3	Red Fox	Juvenile M	N 35.790680 W 75.537660
4	Red Fox	Juvenile F	N 35.791630 W 75.537550
5	Red Fox	Juvenile F	N 35.796410 W 75.541050
6	Red Fox	Juvenile F	N 35.796440 W 75.541130
7	Red Fox	Adult M	N 35.793090 W 75.541070
8	Red Fox	Adult F	N 35.791230 W 75.539357
9	Red Fox	Adult M	N 35.791500 W 75.539488
10	Grey Fox	Adult F	N 35.840170 W 75.561110
11	Grey Fox	Adult F	N 35.840550 W 75.561700
12	Grey Fox	Adult M	N 35.839070 W 75.561169
13	Grey Fox	Adult M	N 35.838800 W 75.561339
14	Grey Fox	Adult F	N 35.838950 W 75.561306
15	Grey Fox	Adult M	N 35.834960 W 75.560970

This year's data shows that the number of red fox removed decreased from the previous years; however, this was the first year that grey fox were removed in predator management efforts (see Table 2). This may indicate that additional predation could occur with the addition of another opportunistic predator. On the other hand, the presence of grey fox could also be an indicator that red fox numbers are declining because the two species are ecologically competitive, typically with the red fox being the more dominant species. In either circumstance, the presence of grey fox on the beach should be a concern due to the limited prey species available, which may result in increased predation of Threatened and Endangered (T&E) species as well as species of High Concern.

literature search two articles were found concerning the practicality of using wire cages. One article showed that wire cages can actually benefit the successful hatching of sea turtle young. This article, from the Marine Turtle Newsletter titled *Galvanized Wire Cages Can Prevent Nest Predation*, indicates that wire cages, although costly and labor intensive, are an effective means for excluding predators when properly constructed and installed. "Prior to the implementation of caging, the mean gross depredation (partial and total) rate of flat-screened nests was 26.2%. Caging has reduced this to 12.5%. Exclusive of the one year when 21% of caged nests were depredated (attributable to faulty cage installation and overwash by storm events), the mean drops to 3.5%. This also emphasizes the importance of proper cage installation. The reduction in partial nest depredation resulting from caging has probably contributed to an overall improvement in nest hatchling percentage," (Addison, 1997). The second research article we found is titled *Do Wire Cages Protect Sea Turtles From Foot Traffic And Mammalian Predators?* The findings of the study were as follows; "Predators (mostly raccoons) used the cages as landmarks to locate nests. Predators reduced the hatching productivity on the beach more during the year of our study (1996) than during the following years when cages were not used. We conclude that the cages used failed to protect the nests. We recommend that at this and at other sites where similar conditions exist, management efforts should shift away from efforts to discourage mammalian predators and toward efforts to reduce predator populations adjacent to the nesting beach." (Mzoriak, 2000). Copies of both articles are attached for your information.

There may be some validity in further evaluating the use of wire cages to protect T&E species from fox predation and the depredation resulting from other predator species. Further studies may assist to identify what effect these structures may have in regard to fox predation and the reproductive success of the shorebirds and sea turtles on NPS lands. The United States Department of Agriculture's Wildlife Services National Wildlife Research Center (NWRC) cooperates with other government agencies, universities, and the public to study and share scientific information on wildlife damage management. If the NPS finds that a research project is needed to address the above concerns, the NWRC might be available to assist the NPS.

Harassment techniques such as audio deterrents and visual deterrents are only briefly effective, if at all, because fox grow accustomed to the sounds and lights (Phillips, 1994). The widespread use of these techniques is not reasonable because of the associated costs and also the effects that the lights and noises would have on other wildlife species, such as the shorebirds and sea turtles we are trying to protect. Centralized use of frightening devices at nesting sites would most likely prove ineffective. The lights and noises could possibly exhibit the same suspected negative impact as that of the wire cages, in attracting predators, as well as disrupting the nesting of shorebirds and sea turtles.

The continued locating of den sites and monitoring of fox activity would be beneficial in managing fox populations on both Hatteras and Bodie Islands thus increasing available time for NC WS to spend trapping (see Table 3). In addition, this information will be useful to those conducting predator management activities by knowing where to concentrate their activities.

Table 3. Fox dens located by NC WS at Hatteras and Bodie Islands, May – June, 2004.

Site	Den Status	GPS Coordinates	Location
1	Inactive	N 35.235804 W 75.556165	Hatteras Island
2	Inactive	N 35.235761 W 75.555124	Hatteras Island
3	Inactive	N 35.235600 W 75.556648	Hatteras Island
4	Inactive	N 35.235793 W 75.555569	Hatteras Island
5	Inactive	N 35.796557 W 75.541026	Bodie Island
6	Active	N 35.840551 W 75.561840	Bodie Island
7	Active	N 35.791290 W 75.539280	Bodie Island
8	Active	N 35.791850 W 75.539490	Bodie Island
9	Active	N 35.793090 W 75.541080	Bodie Island
10	Active	N 35.792140 W 75.541510	Bodie Island
11	Active	N 35.791600 W 75.539990	Bodie Island

We suggest that an Environmental Assessment (EA) be completed to help the NPS determine the best future predator management practices. NC WS is available to complete an EA for the NPS which could also serve as

Literature Cited

Addison, D.S. 1997. Galvanized Wire Cages Can Prevent Nest Depredation. Marine Turtle Newsletter 76:8-11.

Mzoriak, Melissa L., Michael Salmon, Kirt Rusenko. 2000. Do Wire Cages Protect Sea Turtles from Foot Traffic and Mammalian Predators? Chelonian Conservation Biology 3 (4): 693-698.

Philips, Robert L., Robert H. Schmidt. 1994. Foxes. Prevention and Control of Wildlife Damage. pp. C-83-C-88.