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Chesapeake Bay Nutria Eradication Project: Update 2009-2014

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ABSTRACT: Feral nutria were established near Blackwater National Wildlife Refuge (BNWR) in Dorchester County Maryland in 1943 after a failed attempt to create a fur industry. As the population expanded in number and distribution, natural resource managers began to notice an accelerating trend in wetland loss in the areas most heavily infested by nutria. By the late 1980s, an estimated 35,000 nutria occupied BNWR, which had seen approximately 5,000 acres of emergent marsh converted to shallow open water habitats and mudflats. Exclusion studies in the 1990s demonstrated a direct link between nutria and marsh loss, and by 2000 officials had procured funding to initiate an eradication feasibility study. This paper provides a historical overview of the eradication campaign that has been underway since 2002. The Chesapeake Bay Nutria Eradication Project (CBNEP) is a cooperative partnership between the U.S. Fish and Wildlife Service, USDA Wildlife Services program, and numerous state and non-governmental organizations. The CBNEP employs an adaptive management strategy utilizing systematic trapping carried out by salaried wildlife specialists to eliminate nutria from infested watersheds. We present a phased approach that allows us to continually expand the eradication zone and maintain nutria-free areas with a relatively small staff. Through an active research and development program, we have innovated new tools and techniques for trapping and detecting nutria including: floating trap sets, attractants, decoys, remote triggered cameras, detection platforms, hair snares, and Judas nutria. To date, we have reduced nutria populations to near-zero densities across 250,000 acres of emergent marsh. Based on extensive surveys, remaining populations should be removed by the end of 2014. Following a 2-year verification/biosecurity protocol, we hope to have nutria eradicated from the Delmarva Peninsula by 2017.

KEY WORDS: Chesapeake Bay, detection methods, eradication, invasive species, Judas animals, *Myocastor coypus*, nutria, trapping

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INTRODUCTION

Nutria (*Myocastor coypus*), a semi-aquatic rodent native to South America, were introduced to the Eastern Shore of the Chesapeake Bay near Blackwater National Wildlife Refuge (BNWR) in Cambridge Maryland in 1943. By the 1970s nutria were firmly established, and by the 1980s the population had grown to an estimated 35,000 nutria at BNWR and had spread into at least 5 neighboring counties in Maryland, Delaware, and possibly Virginia, occupying nearly a quarter-million acres of coastal wetlands on the Chesapeake. At BNWR, marsh erosion accelerated to nearly 500 acres annually and resulted in the loss of nearly 5,000 acres by 2002.

Research on the impacts of nutria herbivory on marshes at BNWR conducted in the mid-1990s demonstrated a causal effect on marsh erosion, resulting in the widespread conversion of emergent wetlands to shallow open-water habitats. Study sites protected from nutria herbivory by fencing showed rapid recovery of vegetation, while surrounding wetlands continued to erode (Haramis and Colona 1998). This pivotal study led to the formation of the Maryland Marsh Restoration and Nutria Control program, a partnership of federal, state, and non-governmental organizations whose goal was to develop methodologies for the eradication of nutria from the Chesapeake Bay region. The project was initiated in 2000 with a 2-year research study to develop baseline information on the life history, population dynamics, and reproductive characteristics of nutria in the Chesapeake Bay. In 2002, the project shifted focus to developing scalable methods and strategies for systematic removal of nutria from infested marshes, and testing the feasibility of eradication nutria at the landscape level. By 2006, with funding from the U.S. Fish and Wildlife Service, the USDA APHIS Wildlife Services eradication team had largely eliminated nutria from nearly 100,000 acres in southern Dorchester County, MD, which was the epicenter of the nutria invasion. In 2007, the project expanded outwards, tackling known high-density populations in adjacent watersheds. The results and accomplishments of the project from 2002 through 2009 have been reported previously by Kendrot (2011). The purpose of this paper is to provide an update on the progress, direction, and accomplishments of the project from 2010 to date.

EXTERNAL REVIEW

In October 2009, The U.S. Fish and Wildlife Service contracted with Invasive Species International (ISI), a division of the New Zealand-based Landcare Research, to conduct an external review of the CBNEP. Led by a 3-person team comprised of 2 eradication ecologists from ISI and a nutria expert from Louisiana, the team spent a week in the field interviewing administrative, managerial, and field staff and reviewing practices, methods, and goals of the project. In January 2010, the review team presented a 38-page report to the CBNEP management team. The report contained 18 recommendations to ensure continued success in the latter stages of the eradication campaign, where detection of rare individuals would require different strategies, techniques, and resources than the removal of populations.

Based on these recommendations, the CBNEP instituted a number of changes in the ensuing years to address the biggest obstacles to the project's success. One of the first and most significant changes was to the staffing and structure of the work force, including the creation of an assistant supervisory position, a research coordinator, and eventually a GIS specialist. The 15-member field team was split into 2 operational groups, and 2 team leaders were elected to serve as a liaison between management and field staff. This stratification of the work force allowed the redistribution of roles and responsibilities and decreased reliance on the single project leader in place at the time of the review. In addition, planning committees were established to incorporate and blend strategic and tactical planning considerations between management and field staff.

OPERATIONAL ACTIVITIES

Delimiting Surveys

One of the key knowledge gaps identified by the external review team was a lack of reliable information about the geographic distribution of nutria throughout the Delmarva Peninsula. The feasibility study was initiated in the center of a population that had expanded outward. Once the Dorchester County population had been eliminated, expansion of removal efforts was targeted at areas of known infestation in an effort to maximize removal rates. This "inside-out" strategy left us chasing an ever-expanding invasion front. Following recommendations by the external review team, we devised a strategy that prioritized delimiting the extent of the remaining population and protecting areas already cleared of nutria. The Delmarva Peninsula was divided into 2 zones. The first zone consisted of any river basin currently or historically occupied by nutria. In this zone, staff conducted on the ground habitat evaluations and sign searches. The second zone was comprised of all river basins that had never had confirmed populations. In this zone we surveyed natural resource managers, outdoor recreationalists, and fur buyers, as well as conducted site inspections where members of the public reported possible sightings. An "outside-in" removal strategy was developed once the geographic distribution of nutria was known.

During removal trapping, staff observed that nutria had a strong affinity for certain habitat types, particularly those dominated by brackish and freshwater plants like Olney's three-square bulrush (*Schoenoplectus americanus*) and broadleaf cattail (*Typha latifolia*). Although nutria certainly occupied less preferred habitat types, rarely were marginal habitats occupied when optimal habitats were not. Occupancy at the watershed level could be most effectively and expediently determined by prioritizing searches in optimal cover types. Although three-square and cattail occurs widely throughout the project area, they are clumped in distribution. Because GIS overlays defining habitat by vegetation type were not available, staff developed a Rapid Habitat Assessment survey (RHA) to identify priority areas for intensive sign searches within watersheds. Staff estimated percentage cover type from key vantage points along navigable waterways by observing vegetation from an elevated platform in the boat. Staff estimated the distance observed and the species composition of visible cover types. This information was cataloged using GPS waypoints and later used to identify areas with a high percentage of preferred vegetation for more intensive sign searches.

Between 2010 and 2012, staff alternated between surveying previously trapped areas, removing remnant individuals where detected, and conducting RHAs and delimiting surveys along nearly 7,000 kilometers of navigable waterways in Maryland, Virginia, and Delaware. Ultimately, nutria were detected in 4 watersheds in addition to the ones that had already been depopulated. From north to south they were the Wicomico, Manokin, and Annamessex Rivers, where established populations were confirmed, and the Pocomoke River, where sign was detected but no populations were confirmed.

Geospatial Data Management

At the time of the external review, field data on trapping and sign searches were collected on paper forms and later entered into a relational database. Spatial data, including survey tracks and sign or capture locations, were recorded using a consumer-grade GPS unit (Garmin GPS 76CSX, Garmin International Inc., Olathe, KS) and downloaded into shapefiles. The instability of the shapefile format required creation of new shapefiles monthly to store the extensive spatial data collected by the field crew. A lag time between data collection and entry, lack of connectivity between spatial and associated non-spatial data (i.e., trap location and trap history), and data entry errors requiring correction and validation diminished the utility of our data for reporting, real-time decision making, and planning of field work. In 2012 we redesigned our data collection system into a Geodatabase format using ArcGIS, and we implemented electronic data collection on ruggedized handheld GPS computers using customized forms developed for ArcPad. With the new system, data was validated at the time of collection, downloaded into a centralized geodatabase daily, and instantly available for review, reporting, and analysis once downloaded. Although time required for data collection in the field increased slightly, the need to re-enter data into a database was eliminated and allowed staff to spend more time in the field. The cost savings associated with a reduction in data handling and processing more than offset the costs of acquiring GPS devices. Search effort is measured through the collection of GPS tracks (vector data), which are categorized by survey type (ground search, shoreline survey, trap line, etc.). Point data (trap/capture locations, platform locations, sign observations) are associated with the corresponding survey track on which they were collected. Non-spatial data such as survey conditions, trap and detection device checks, biometric information of captures, sign type, etc. are associated with their corresponding spatial data (survey tracks and points).

DEVELOPMENT AND TESTING OF NEW DETECTION TECHNIQUES

Judas Nutria

From 2009-2010, with funding from the National Fish and Wildlife Foundation, and assistance from the U.S. Geological Survey's Patuxent Wildlife Research Center, CBNEP staff tested the feasibility of using radio-tagged

“Judas” nutria to locate and facilitate the removal of residual nutria that escaped prior trapping efforts. Over the course of 2 summers, 20 adult nutria of both sexes were surgically sterilized and implanted with abdominal RF telemetry radios. A subset of study animals were additionally outfitted with a micro-GPS collar previously described by Haramis and White (2011). These GPS collars were programmed to acquire and store position data every 90 minutes until the rechargeable battery died. Collars were recovered via trapping or homing to the RF transmitter component of the collar in the event that the animal died or slipped the collar.

We released Judas nutria into previously-trapped areas in order to test their ability to discover free-ranging nutria that may have escaped detection with other methods. Dense vegetation and semi-aquatic behaviors of nutria dramatically reduced the effective range of the RF transmitters. Relocating nutria was difficult, particularly when study animals moved long distances between relocation attempts. Several animals moved more than 10 miles from their original point of release and in some cases covered up to 3 miles overnight. Relocating these animals took days or weeks, and aircraft were required to locate 2 animals months after their disappearance. Animals that exhibited localized movements or sedentary behavior were assumed to have established contact with other nutria. In some cases this was confirmed by the co-location of multiple Judas nutria, but in other cases efforts to recapture Judas nutria with expired GPS collars resulted in the capture of additional unmarked nutria from areas where they were thought to have been eradicated.

Movement data downloaded from GPS collars provided much more clarity on spatial and temporal movement patterns of Judas nutria. Some animals that appeared to be very sedentary based on diurnal locations obtained via radio-telemetry actually moved distances up to 2 miles in multiple directions overnight, only to return to their daytime resting sights by morning. This casting behavior is exactly what we hoped would enable Judas nutria to locate conspecifics. Other interesting observations derived from GPS data related to the influence of landscape features on nutria movements, which helped to inform effective placement of detection devices. Extensive long-range movements up to 16 km by some individuals demonstrated the risk that small refugia of untrapped populations presented to reinvasion of previously trapped areas.

Although Judas nutria were apparently successful in locating conspecifics, the limitations of standard RF telemetry in wetland ecosystems presented significant challenges and compromised the effectiveness of the Judas technique as a management tool. While GPS collars provided valuable movement data, the time lag incurred in retrieving the store-on-board devices limited our ability to make timely management decisions. In order for the Judas concept to be a cost-effective management tool, real-time GPS that can be downloaded routinely or on demand would be required. This would enable eradication specialists to respond quickly when animal behavior indicated the possible detection of wild nutria. Unfortunately, at the time this study was conducted, remote downloadable GPS receivers were not available in a package that could be deployed on small mammals. As GPS and additional technologies advance, such as the use of unmanned aerial vehicles that could be used to aid in the relocation of study animals, the Judas technique may become more cost-effective in finding the last remaining individuals or confirming successful eradication.

Nutria Detection Platforms

At the time of the review, staff used visual searches for nutria spoor as a primary detection technique. These surveys were conducted from slow-moving boats along waterways or by foot in areas where boats could not access the marsh. Staff looked for tracks on muddy shorelines, scat on the ground or floating on the water’s surface, and evidence of feeding and bedding in the marsh. While a skilled observer can quickly determine the presence of nutria under the right conditions, the ephemeral nature of animal spoor in the tidally-influenced coastal marshes of the Chesapeake leaves observer-based detection methods vulnerable to false negative conclusions about the presence of nutria. Furthermore, bias, fatigue, and variability between observers make it difficult to interpret survey results. As a result, observer-based surveys are a snapshot in time with a degree of uncertainty that requires repeated surveys without detection to indicate absence.

A common trapping technique employed by the specialists was to create a mat of vegetation along a shoreline that mimicked a nutria bed. These false beds were visually attractive to nutria, which would inspect the sites and often defecate on the beds. Traps were set to capture the visiting nutria, but in areas where presence was uncertain, some staff began to use false beds without traps to informally monitor for the presence of nutria. High tides would often wash the sign and even the beds themselves away, so staff began to experiment with different methods of creating more persistent false bed sites that would preserve evidence of visitation. In 2010, a standardized floating platform was developed that could be placed along the shoreline or in the water (Figure 1). Platforms were constructed of a 24 × 24-inch square piece of waterproof oriented strand board attached to a 2-ft-thick piece of closed cell ethafoam to provide floatation. The platform is rimmed on 3 sides by 2 × 4-inch lumber stood on edge to contain bedding material and scat. A trap stabilizer placed in a 9-inch opening on the fourth side of the platform allows a 7-inch body-gripping trap to be set on the platform. Camera traps placed to record nutria response to these platforms indicated that a significant number of nutria visited platforms without defecating, thus leaving no sign of their presence. In order to increase detectability, staff experimented with alternate methods to actively solicit evidence of visitation, eventually settling on a novel hair snare design utilizing aircraft cable (Kerr and Dawson 2013). Initial trials showed that the cable hair snare provided an 80% detection rate compared to 6% using scat alone as proof of visitation (unpubl. data). The nutria detection platform and hair snare combination has become a cornerstone of our monitoring program. Although not a substitute for observer-based surveys, the accumulation of sign over time and the broad geographic area that can be covered

Figure 1. A standardized floating platform proved useful in determining nutria presence as well as for control. Here, a platform is equipped with a Sleepy Creek #700 Body Gripping Trap. The trigger configuration reduces non-target captures by allowing smaller animals (rails, muskrats) to walk through with less risk of activation.

by platforms offer distinct advantages as an early detection system.

In 2012, we evaluated the effectiveness of monitoring platforms and 3 associated detection methods: hair snares, presence of scat, and trail cameras. The research objectives were to 1) determine if nutria visitation rates to platforms (actually boarding platforms) varied depending on whether they were placed on land or water, 2) determine if visitation rates varied between platforms with or without hair snares, and 3) if nutria boarded a platform, determine if the detection probabilities varied among the 3 detection methods. Platforms were placed in pairs (one on land, and the other in the water) in creeks off of the Wicomico River where nutria were previously detected. The findings suggest that platforms placed on land were up to 3.0 times more likely to be visited than those placed in water, and that platforms without snares were an estimated 1.7 - 3.7 times more likely to be visited than those with snares. Since snares were placed later in the study, more research is needed to find the cause of lower visitation rates when snares were present. Relying on scat as an indication of nutria presence proved the least effective. CBNEP recommends the continued use of hair snares on monitoring platforms as they are the most cost-effective and reliable detection method available at this time. Future research should focus on the cause for the observed decrease in nutria visits over and time and after snares were applied.

Lures and Attractants

CBNEP staff used nutria urine and gland based lures in prior trapping and monitoring efforts. Although used frequently, the effectiveness of nutria lures had never been evaluated, nor had there been a systematic approach to developing lures specific to nutria. Under the guidance of the CBNEP staff biologist and a consultant furbearer expert, CBNEP staff tested a number of olfactory and visual attractants to produce a consistent and predictable response from nutria to increase the efficiency of trapping and detection devices.

Lures were tested in wetlands with known nutria populations in Somerset County, MD, in 2011-2012. CBNEP staff developed lures based on past field experience, literature, and other trappers' input. In areas likely to be visited by free-ranging nutria, liquid or paste formulations were presented on a pipe cleaner suspended approximately 3 ft from the ground on a support wire or bamboo pole. For visual lures, the object was used in place of the pole. A remote-triggered "Trail" camera (Bushnell Trophy Camera, Overland Park, KS) was placed approximately 10 ft from the attractant and set to record 1 minute of video following a triggering event. The camera reset 1 second after a video ended, providing a series of near continuous video recordings during a prolonged visit by nutria.

Videos of nutria reacting to olfactory and visual attractants were evaluated; response behaviors were described and categorized, and the intensity of the apparent reaction was quantified. CBNEP staff tested 44 lures in 2011-2012. Four lures were visual, 7 were a combination visual/olfactory, and the remaining 33 were olfactory. When all lure types were combined (visual and olfactory), the 2 top lures were both a visual/olfactory combination. When only considering olfactory lures, a gland-based and a curiosity lure ranked the highest. A nutria decoy was also tested and showed promise as a possible attractant, but it needs more observations (nutria interactions) for a comprehensive assessment. Although some lure formulations seemed to elicit strong behavioral responses, no clear patterns of attraction or avoidance emerged. Efforts to evaluate lure effectiveness were confounded by small populations with limited ability to replicate experiments, repeat exposures, and changing weather and seasonal patterns.

CURRENT STATUS AND FUTURE PLANS

In the spring of 2014, CBNEP initiated trapping on the Wicomico River – the last known infested watershed on the Delmarva Peninsula. Although 2 large wildlife management areas at the mouth of the river were initially trapped in 2007, the main stem of the Wicomico had not been trapped. By August 2014 the crew removed 193 nutria and captures dwindled. This accomplishment marked the official transition of all watersheds into the verification stage of the eradication campaign. Though additional nutria will likely be captured during mop-up trapping, the focus of the program will now be on conducting population surveys in previously trapped watersheds. The team will continue to employ proven techniques for detecting nutria at low densities, and continues to develop new methods. Staff have used personally-owned trained dogs to locate and remove nutria since 2004; however, with aging dogs and dwindling nutria populations, the highly effective dog program has suffered and lost its effectiveness. Through collaboration with the USDA APHIS National Detector Dog Training Center, staff began a new initiative to train agency-owned detector dogs that are specifically trained to cue on nutria sign, rather than to hunt actual nutria. These dogs will enhance the ability of specialists to detect nutria sign and play a key role in verifying that eradication has been successful.

CONCLUSIONS

Using trapping and hunting as the primary removal techniques, a relatively small team of 10-15 eradication specialists have virtually eliminated nutria from nearly a quarter-million acres of coastal wetlands on the Chesapeake Bay over a 12-year period. Although declaration of eradication is premature, there is strong evidence that eradication is an achievable goal on the Delmarva Peninsula. With an evolving suite of detection methodologies, over the next 2-4 years staff should be able to eradicate and verify that eradication has been successful.

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