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# Nutria Control in Louisiana

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**Abstract:** The nutria (*Myocastor coypus*) is a large semi-aquatic rodent that was introduced throughout much of the world as a means of increasing the fur market in the first half of the 20<sup>th</sup> Century. Although not considered a pest in their native range of South America, nutria presence elsewhere has often met with greater detriment than benefit. Nutria have damaged crops, marsh vegetation, and water control structures. Nutria damage has been described for decades, yet science is now better defining values provided by marshes that are prime habitat for many mammalian, avian, reptilian, and amphibian species as well as flora. The uniqueness of the marsh and coastal habitats is in jeopardy of being so damaged as to make the cost of repair astronomical. Nutria foraging often causes current re-vegetation projects to fail unless enclosures are constructed. We review potential methods to control nutria damage in Louisiana. Techniques discussed include: incentive (bounty) payment, chemical control (toxicants), incentive-bonus, induced infertility, trapping, controlled hunting, and chemical repellents. We rank these by feasibility of implementation and their probability of success.

**Key Words:** nutria, coypu, *Myocastor coypus*, rodent control, incentive payment, bounty, toxicants, incentive-bonus, induced infertility, trapping, hunting, repellents

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## INTRODUCTION

The nutria (*Myocastor coypus*) has been listed by the Invasive Species Specialist Group as being one of the top 100 worst invasive species in the world (Lowe et al. 2002). Nutria herbivory in Louisiana and in other areas has been documented on bald cypress *Taxodium distichum* (Conner and Toliver 1987), *Sagittaria latifolia* and *S. platyphylla* (Evers et al. 1998, Grace and Ford 1996), *Spartina patens* and *S. alterniflora* (Taylor et al. 1997, Ford and Grace 1998, Taylor et al. 1994), and many other species of marsh vegetation (Fuller et al. 1985, Taylor and Grace 1995, Foote and Johnson 1992). As a whole, vegetative biomass is decreasing and plant species composition is changing due to nutria herbivory (Ford and Grace 1998, Visser et al. 1999).

Since the price drops of the fur market in the 1980s and a corresponding reduction in trapping effort, nutria have become a growing problem in Louisiana's nationally important wetlands as well as in agricultural crops. Wetlands support many aquatic and terrestrial animals, are the basis for a substantial hunting and fishing industry, and lessen storm impact on infrastructure and communities. All of these wetland values are jeopardized by the massive marsh loss caused by nutria.

Reports of marsh vegetation damage became common in 1987. Following vegetation surveys during the early 1990s, it was observed that nutria were causing damage to many tracts of Louisiana marsh, conservatively totaling over 100,000 acres by the late 1990s (Kinler et al. 2001). With 15% of the freshwater wetlands and 40% of the brackish wetlands in the United States, the state has 3.5 million acres of coastal marsh needing protection from potential nutria impacts. Nutria impact to vegetation leads to potential conversion of vegetated tracts to open water. Once vegetation is

removed, the substrate is exposed to tidal scour, requiring difficult and expensive marsh restoration. Restoration efforts may be to no avail if nutria are not controlled simultaneously; the Department of Natural Resources has already experienced such losses in areas of re-vegetation. To circumvent the problem, nutria exclusion devices have been used that are labor-intensive and increase the cost of such plantings dramatically (Ken Bahlinger, pers. comm.).

Early in the 20th Century, floating mats, a type of vegetative community providing moderation of flood and drought conditions and stable food availability for wildlife in coastal marshes, were recorded to be many feet thick. These mats appear to have decreased over the years and are now only inches thick (Harris and Chabreck 1958, Visser et al. 1999). The loss of biomass may be from continuous nutria feeding over almost 60 years—a result that is only now being recognized. Typical feeding behavior is for nutria to stay in an area until it is denuded of vegetation; such an area is called an “eat-out.”

Unsuccessful attempts have been made to further develop marketing of nutria fur and of nutria meat for human consumption. It is the intention of the state of Louisiana, after careful consideration of several management options, to control nutria numbers to manageable levels of damage, utilizing an annual budget of \$2 million.

## POTENTIAL MANAGEMENT STRATEGIES AND TECHNIQUES

### Incentive Payment Program

The use of an incentive payment (bounty) program has been considered as a tool for nutria control. This program would provide money for each animal taken, usually proven by tails submitted. Trapping, shooting,

and possibly rodenticides could be used to take nutria. The program would likely effect quick decreases in areas where nutria are dense. However, such programs could be counter-productive: the program attaches economic value to the nutria, which may encourage trappers to foster nutria populations through husbandry in order to provide sustainable income Gosling and Baker (1989). Further, trappers would seldom trap to extirpate an area, but rather proceed to other dense areas for a greater return on their effort.

In a meeting of the Basin Management Association, a deer management unit in the Atchafalaya Basin, all board members stated they would eagerly endorse and would participate in such a program. It would provide added revenue for families during the recent layoffs from jobs in south Louisiana. Several large landholders in southern Louisiana stated they were in favor of an incentive payment program to help protect the coastal marshes that they manage (pers. comm.). Additionally, land managers prefer trappers to be present on the land to help track poachers and trespassers.

To establish a workable bounty program for Louisiana, it is speculated that \$4.00 would be paid for each nutria tail, in addition to any price paid for pelts and nutria meat. An estimated take of 400,000 nutria/year would be required for control, for a total of approximately \$1,600,000 (Dunne 2001). While the primary effort would be in southeast Louisiana, established nutria populations in other coastal regions of the state should also be targeted.

The design of such a program should be left open-ended. It would be important to evaluate the success and failures of a program on a yearly basis, and then modify the program as required. The duration of this project could also be modified, but it may be necessary to assure trappers the program would be long-term in order to enlist their full-scale participation.

### **Chemical Control**

Various rodenticides, utilized worldwide with long-term success, can be a cost-effective way of rapidly controlling damage caused by rodent pests. Several may show promise as a tool within a nutria management program.

### **Zinc Phosphide**

Zinc phosphide, the only rodenticide currently registered for the control of nutria, is limited to Certified Pesticide Applicators (LeBlanc 1994). The LD<sub>50</sub> of zinc phosphide to nutria is 15 to 20 mg/kg (Spencer 1957). It is often utilized as a concentrate (63.2%) that is mixed with a carrier (carrots, sweet potatoes, watermelon rind, and/or apples). Various methods of bait application can be effective, but pre-baiting is necessary. Several visits to potential treatment sites are required before exposure of toxic bait. However, using suitable sites, efficacy can exceed 95% (LeBlanc 1994).

Disadvantages of zinc phosphide use include the

possibility of primary poisoning in birds and rabbits (*Sylvilagus* spp.) that consume the bait (Hegdal and Gatz 1977, Savarie 1991). Consumption of poisoned rodents by predators or scavengers may lead to death if undigested zinc phosphide bait is present in the carcasses. While zinc phosphide is effective at controlling a number of species, secondary hazards have been difficult to document (Timm 1994). Zinc phosphide shows promise for use in controlling nutria in limited areas, but large-scale use is cost-prohibitive. When dusted onto fresh baits such as cubed fruits or vegetables, the baits soon lose their attractiveness and the active ingredient often breaks down within a few days (Timm 1994). At the soil-water surface environment, zinc phosphide decomposes readily (Hilton and Robinson 1972). Future development may be required for a more efficient use.

### **Anticoagulants**

Warfarin, primarily used against commensal rodents, has a history of being efficacious yet safe. Other "first generation" anticoagulants possibly could be used for control of nutria. Pival has been successfully used to control muskrats (Miller 1974); both chlorophacinone and diphacinone have been demonstrated as effective compounds with several species of rodents (rats, mice, ground squirrels, voles, pocket gophers). However, in recent years, more toxic anticoagulants have replaced warfarin and other "first generation" compounds. These newer anticoagulants offer increased efficacy because in most cases they can cause mortality after a single feeding, limiting the amount of bait needed. Greater persistence of "second generation" compounds in the bodies of target species can potentially lead to increased risks of secondary poisoning (Timm 1994).

Morin et al. (1990) confirmed that bromadiolone could be used as an effective toxicant for nutria in both acute and chronic doses. When killed with a single, acute dose, nutria had less bromadiolone in the liver and kidney than when killed with multiple (chronic) doses of the same toxicant. The authors showed with chronic exposures that nutria would be unnecessarily loaded with bromadiolone, and this would increase the chance of secondary poisoning to non-target wildlife. Poché (1986) and Fisher et al. (1991) demonstrated that bromadiolone was relatively safe secondarily when used at concentrations of  $\leq 50$  ppm. Bromadiolone (100 ppm) and chlorophacinone (75 ppm) are effectively used in France for control of nutria and voles (*Microtus* spp.), yet secondary deaths have been confirmed by tissue analysis of both anticoagulants in several species (Berny et al. 1997). Secondary hazard to predators and scavengers can be evaluated under laboratory conditions, but the degree of this risk is difficult to evaluate in the field.

In general, there appear to be opportunities for warfarin and other anticoagulant compounds to be used effectively and safely in programs to control nutria, while presenting relatively low primary or secondary risk to non-target species.

### **Bromethalin**

Bromethalin is an acute toxicant that has been used to control rat (*Rattus* spp.) and mouse (*Mus musculus*) populations in the United States. The toxicity data suggests that other mammals are affected by similar doses per body weight. Avian species are much less susceptible and aquatic species are more susceptible. Benefits with this rodenticide include quick control and a good safety factor, in comparison to some other rodenticides. It has also been shown that risk of secondary poisoning in dogs when fed bromethalin-killed rats is very low (Jackson et al. 1982). If this bait is applied similar to the zinc phosphide, risk to non-target animals would be similar, but because of the palatability and stability of the bait, it may prove to be a valid alternative.

### **Fumigants**

Since nutria usually do not inhabit a burrow in the marshes, this would not be an applicable technique; but in agricultural areas, this technique may be helpful where nutria burrow in the weir banks. However, this use is not registered and development would be required.

### **Human Toxicity Risk**

Many of the animals found in the Louisiana's coastal marshes may be food for a small portion of the population— and nutria is even served in several gourmet restaurants. If toxic bait is to be used to control nutria, regulations must be developed to prevent accidental poisoning of humans.

### **Incentive-Bonus Program**

The most widely recognized, successful nutria eradication program occurred in Great Britain, with 34,822 harvested nutria. Initially, this program was projected to cost £2,500,000. Twenty-four full-time trappers, averaging  $48 \pm 20$  trap nights each, were supplied with traps, 4-wheel drive vehicles, and boats. After 9 years of trapping and monitoring, the eradication was officially declared in January 1989 (Gosling and Baker 1987, 1989). Final cost was not given. An unsuccessful eradication attempt occurred in Great Britain on 2,645 mi<sup>2</sup> in the 1960s (Norris 1967); the author expected that it would be impossible for nutria to be eradicated.

The successful program was an “incentive-bonus” program, which provided the trappers/hunters with salaries for their work plus a substantial monetary “bonus” when local eradication was achieved. The bonus reward was a necessary item to prevent trappers from providing husbandry in order to maintain populations for career stability, and to reduce the chance that trappers would become uninterested in achieving success (Gosling and Baker 1987, 1989).

One must be careful when comparing the successful nutria eradication program in Great Britain with a future program in Louisiana. The environments are completely different. Access to sites in Great Britain was by vehicle,

while several different types of boats would be needed in Louisiana where proximity to major roadways is a severe limitation. The size of the infested area in Louisiana (43,556 mi<sup>2</sup>) is about 10 times larger than the area in Great Britain (~4,500 mi<sup>2</sup>). Freezing winter temperatures in Great Britain, including several colder-than-average winters in the mid 1980s, likely aided in controlling the population (Gosling and Baker 1989). Conversely, severe cold or other major habitat disturbances can tend to synchronize nutria reproduction, allowing the rodents to maximize colonization (Doncaster and Micol 1990, Evans 1970).

Statewide eradication is not a viable alternative for Louisiana due to its substantial alligator pelt industry, valued at approximately \$12,000,000 per year (Alan Ensminger, pers. comm.; Linscombe 2000). However, an incentive-bonus program potentially could work as an effective technique for controlling nutria in limited areas and habitats. Contracts would document all incentives and subsidies. Failure to achieve the specified goals would negate the contract and therefore, eliminate the full bonus.

An example that could be used for a regional incentive-bonus eradication program is as follows (Gosling 2001):

- A salary would be provided during the eradication campaign (10 years).
- A sum of 3 times the salary would be paid for successful eradication within 6 years. The bonus would decrease annually after 6 years.
- No money would be available after 10 years.
- A successful eradication would be evaluated by an independent monitoring team by the following means:
  - The date of eradication is defined as the last day on which evidence of nutria is observed.
  - When 1 year elapses from this date without further evidence of nutria, a time period of final validation will be initiated.
  - Final validation is completed if no nutria evidence is observed during 6 months of monitoring.
  - If nutria are observed during this time, trapping will continue until the end of the 6-month period plus an additional 3-month period.
  - If after the additional 3-month period no nutria or nutria evidence is observed, the program will commence locally.
- High trapping pressure must be maintained until the end of the campaign.
- When nutria are detected, massive concentrations of traps must be placed to preserve the integrity of the program. At this time, one must remember eradication is the ultimate goal and failure is not acceptable.

The monitoring team must be independent of the trappers, as the trappers stand to gain the bonus after confirmation of eradication. The team may be composed of government employees with knowledge of the area to be surveyed, or another public or private agency. Monitoring team members must have a thorough knowledge of nutria and its evidence. Monitoring must involve several techniques, to increase the chance of detecting lone nutria.

In the event a false successful eradication is recognized, immediate response is necessary. The location of the observed nutria must be verified, and then the trapping program must be re-initiated. While "animal damage control" typically is synonymous with the reduction of damage to a tolerable level, conversely an eradication effort requires absolute obsession to reach the goal.

If the program were implemented after one or more control techniques had significantly reduced the population, or had isolated small populations from each other, an incentive-bonus program might be a very effective strategy to methodically eradicate local populations. A contingency plan would be required for a quick response to expand the incentive-bonus program, if the opportunity arose.

### **Induced Infertility**

Induced infertility, in theory, is a more effective technique of population management for an r-selected species such as nutria than is lethal control (Dolbeer 1998). For reduced infertility to be effective, the birth rate must be reduced below the death rate. Then, the population will decrease over time. Several compounds may have potential field use for various species. They are listed here beginning with most feasible; however, there exist serious concerns about the use of chemical or biological sterilants in general.

Pestcon Systems, Inc marketed one recently registered contraceptive,  $\alpha$ -chlorohydrin, was under the name Epibloc<sup>®</sup>. This compound was used as a toxicant-sterilant for many rodents (Ericsson 1970, 1982; Ericsson and Connor 1969; Cummins and Wodzicki 1980; Marsh 1988), but the primary mode of sterilization affected only males. At concentrations of 1-2%, it can cause death (Marsh 1973, Meehan and Hum 1979), and any survivors are at least temporarily sterilized. Studies by Genesis Laboratories, Inc. during the mid-1980s showed the product to have sporadic results in reducing reproduction rates. Palatability was a problem (Ericsson et al. 1971, Field 1971), but in recent years it has been encapsulated in a vinyl resin-based material and bait acceptance has improved dramatically (Kirkpatrick and Turner 1987). Nutria have not been tested with this product, but it may serve as a tool in special situations or limited areas.

A temporary black-tailed prairie dog chemosterilant, diethylstilbestrol (DES), was used by Garrett and Franklin (1983). In their study, they realized complete curtailment of reproductive success for 1 year on the

treatment plot, while the control plot animals reproduced normally. The following year, the treatments were reversed with the same success. Control plot expansion was 4 times as much as the treatment plots. Because prairie dogs breed only once a year, only annual applications were needed to control the population. For nutria, this product would have to be applied at least 3 times per year, assuming reproductive synchrony.

Porcine zona pellucida (PZP) is an immuno-contraceptive that coats the egg, and in conjunction with the animal's natural zona pellucida, causes the production of antibodies that prevent fertilization (Dunbar 1997). Successful immunizations allow for normal ovulation but prevent fertilization. It has been used successfully in small and large penned deer herds, with an average decrease in birth rate of 76% and 82%, respectively. Trials with coyotes showed that breeding activity was not decreased, yet the birth rate was decreased by 78%. Because of the ability to maintain long-term effects, fecundity would also be dramatically decreased.

Many compounds have been proven experimentally to inhibit fertility in one or both sexes of mammals, yet many logistical problems remain concerning implementation. While an effective single-dose compound would be preferable, some contraceptives require chronic exposure, dramatically increasing cost. To control nutria reproduction using current technology, aerial applications of bait every 3 months would be required. Such applications would also affect other rodent species such as muskrat, beaver, cotton rats, and various smaller marsh species. A detailed environmental assessment would have to be conducted along with study of potential effects on other important species such as ducks, herons, other aquatic birds, and shrimp.

Second, the use of contraception is potentially feasible in closed or finite populations where the influx of fertile individuals is unlikely. In widespread contiguous populations such as nutria in Louisiana and adjacent states, it is difficult to prevent the invasion of reproductive animals into populations of sterile animals.

Third, improvements in delivery methods of contraceptive devices or drugs are needed; this parallels the concern regarding specificity in the use of toxicants. While contraceptives can be effective in control of large mammals such as feral horses or white-tailed deer, delivery devices (e.g., IUDs, vaginal rings, implants) are labor-intensive and are unfeasible with small rodent populations (Bardin 1987). While the National Wildlife Research Center and others have spent 30 years studying induced infertility, there remain no contraceptive technologies available for field applications (Lowell Miller, pers. comm.). Almost insurmountable hurdles would need to be overcome for registration / approval. Successful products would most likely be used to manage small, isolated populations of animals adjacent to human populations.

In summary, induced infertility as a means of nutria management would be undesirable, relatively impractical,

and could pose substantial environmental implications. This technology has not been developed sufficiently to be a viable means of nutria control in Louisiana.

### **Trapping**

Trapping of nutria can be conducted by many techniques including leg-hold traps, live traps, body-gripping traps, and snares, which can be used in a variety of situations. Louisiana trappers annually harvested 1,115,410 to 1,890,855 nutria from 1962 to 1980. While populations could have dropped locally because of trapping pressure, this sustained harvest over 18 years suggests that the population was stable and that the rate of harvest had little effect on the statewide population. During this period, nutria damage to vegetation was not evident.

Following the peak in price of pelts in (\$8.18 in 1980), the market "bottomed out" in the early 1980s, harvest dropped sharply, and the nutria population initially responded by dramatically increasing. Since that time, pelt price has not rebounded except for short-term price jumps, and the nutria population is believed to be at a much lower level, perhaps due in part to the droughts of 1999 and 2000. Statewide nutria harvest in 2000-2001 was 29,544.

Typically, nutria are harvested only by trappers, and the number of active and experienced trappers has decreased due to the long-term depressed market value. Current pelt market value is approximately \$2.18 per animal. If the market value fails to increase above the cost of processing, which is currently \$5.00 per pelt, trapping pressure and resulting impact on nutria populations would be expected to remain limited.

Nevertheless, trapping as a technique is one of the most valuable tools available to control nutria. If means of exerting sufficient trapping pressure are achieved, trapping can serve to significantly reduce nutria numbers, and it can be used to remove remaining sparse populations at the end of an eradication program that employs multiple control methods in an integrated strategy.

It has been shown that trapping success using live traps is increased as much as 3-fold when traps are placed on floating rafts with carrot bait (Evans et al. 1971, Baker and Clarke 1988). This technique also reduces risk to non-target animals by 50%. However, there are great expanses of marsh in Louisiana that do not have open water allowing use of such rafts (Greg Linscombe, pers. comm.).

### **Controlled Hunting**

Hunters and fishermen, if allowed to harvest nutria, may be able to gain entrance to areas that are not frequented by trappers, resulting in much higher harvest pressure statewide. Presently, thousands of acres are leased from various landowners for hunting deer,

waterfowl, American alligator, furbearers, fishing, or a combination or one more of these. While hunting as a technique could be used to decrease nutria populations locally, its effectiveness is likely limited. With concentrated hunting efforts, one could expect nutria to become shy to hunters, thus becoming very difficult to hunt. However, like trapping, hunting could be a valuable tool as part of an integrated strategy of population reduction using multiple methods. Inclusion of bounty or incentive payments in control strategies would likely increase the use of hunting as a control tool.

### **Chemical Repellents**

Few repellents are available on the U.S. market for mammals, and there are no chemical repellents registered for nutria. Devall and Parresol (*In Press*) are conducting a 2-year study on the effectiveness of Tangelfoot, Ropel, and plastic tree guards to protect bald cypress seedlings. These products may provide some relief from nutria damage, but they will not be practical for large areas. Further, most repellent effects eventually lose effectiveness over time or are ineffective due to animals' hunger. When effective, repellents tend to shift animal damage to other localities or other food sources. Depending on where the displaced animal feeds and on what resource, the problem may or may not be solved, only moved.

*Justicia lanceolata*, identified as being unpalatable to nutria, has been used to revegetate damaged areas, thus serving as a biological repellent. While it is able to confine sediments, it is often quickly out-competed by other species of wetland vegetation; therefore its repellent effect is short-term (Llewellyn and Shaffer 1993).

### **CONCLUSIONS**

We believe that the incentive payment program may be the best option for statewide control of nutria in Louisiana (Table 1). Many of the other techniques have promise of wide success, yet the up-front costs for these techniques are a limiting factor. The incentive payment method, while providing a means to relieve nutria damage in the state, is not subject to large environmental or regulatory hurdles.

It should be clearly understood that the incentive payment program would not exterminate nutria, thus maintaining the benefits they provide, according to the Fur and Alligator Advisory Committee. This program follows the goal of wildlife damage management: to control damage to levels that are acceptable.

Given the projected increase in nutria numbers, immediate attention should be focused on the nutria situation. Should an incentive payment program be implemented, it would be important to see it through to completion. Otherwise, the costs and efforts of implementation would be entirely lost, as nutria numbers would soon revert to pre-management levels.

**Table 1. Cost-effectiveness ranking.**

Ranking	Method	Description	Cost-effectiveness
I	Incentive payment program	A secondary value would be paid for the tail in addition to the pelt or meat.	\$2 million maximum/year. Money paid until yearly stipend is allocated. Control would be based upon area and pressure from trappers/hunters.
II	Chemical control	Use of toxicants to control nutria populations	\$4 million per year. Bait applied to limited areas due to extreme cost. Cost would quickly exceed cap. Efficacy may be good.
III	Incentive-bonus program	Salaried trappers/hunters would control nutria and upon successful eradication, a bonus would be paid	\$2 million maximum/year. If area where trapping occurs were sufficiently concentrated, this would be an effective method.
IV	Trapping	Lethal and non-lethal traps used by licensed trappers	29,544 nutria harvested last year (2000-2001). Lack of trapping due to market value of pelt (\$2.18). Trapping would only succeed if long-term market value for pelt exceeds expenses for processing (\$5.00/pelt). No expense to state or federal agencies, yet efficacy considered extremely low.
V	Hunting	Open season by licensed hunters	No value on price of the pelt for hunter, little nutria would be harvested. No expense to state or federal agencies, yet efficacy considered extremely low.
Not applicable	Induced infertility	Chemical compounds to limit fertility of males or females or both.	Lack of scientific knowledge in this field. Method would not be applicable for nutria control due to lack of delivery methods for sufficient efficacy, and data gaps for state and federal registrations.
Not applicable	Chemical repellents	Using non-lethal compounds to decrease damage. Not effective in many situations.	Lack of efficacy and long-term effects. Will not be considered as a valid means of control.

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