The eradication of coypus (*Myocastor coypus*) from Britain: the elements required for a successful campaign

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Abstract A population of coypus, *Myocastor coypus,* became established in Britain following escapes from fur farms. The population peaked in the early 1960's at possibly 200,000 animals. Numbers then fell sharply following the start of a co-ordinated trapping campaign and an exceptionally cold winter. This campaign was unsuccessful in eradicating coypus and the population began to rise again during the 1970's. As numbers rose, coypus caused significant damage to native vegetation, damaged flood defences and agricultural crops.

A second campaign was started in 1981 with the objective of eradicating coypus from Britain within 10 years. This campaign was successful and coypus were eradicated by 1989. One of the key features in the success of the campaign was the close linkage between the research and eradication programmes. The research provided estimates of population size to monitor the progress of the campaign and estimates of the variables necessary to model the population. The research also allowed improvements to be made in management techniques and trapping strategies.

The paper summarises the successful eradication campaign and identifies the elements that were key in getting the eradication campaign started and in it reaching a successful outcome.

Keywords: coypu eradication; *Myocastor coypus*; IAS eradication; Britain

HISTORY OF THE UK POPULATION

Coypus are native to South America and have been widely farmed for their fur. There have been numerous escapes from captivity and in some countries animals have been deliberately released to try and establish feral populations that could be cropped (Lever 1985). Feral coypus are now found in North America, the Middle East, Africa, Japan, and the Asiatic part of the former Soviet Union. In Europe there are widespread populations and they are particularly common in France, Germany, and Italy (Mitchell-Jones *et al.* 1999).

Coypus were originally introduced into Britain in 1929 for fur farming. The farms were not, however, profitable and by 1945 the farming of coypus had ceased in Britain. Farms were often little more than poorly fenced off ponds and streams and, as a consequence, escapes were reported from more than 50% of them (Laurie 1946).

From the original escapes coypus became established in two centres. One, based on a sewage works near Slough, disappeared without any known control in 1956. A second group probably originated from three farms near Norwich, close to the rivers Yare and Wensum, in East Anglia (Laurie 1946). This population eventually expanded to cover virtually the whole of East Anglia (Gosling and Baker 1989); a distribution, at its extremes, of approximately 190km from north to south and 150km east to west.

EARLY POPULATION CHANGES

Quantitative estimates of population size using population reconstruction techniques are only available after 1962 (Gosling *et al.* 1981). Before this, the information is anecdotal, but the population probably started in the mid-1930s and grew progressively with two major checks in the severe winters of 1946/7 and 1962/3 (Norris 1967). Centrally organised control started in 1962 and continued at various levels until the start of the eradication campaign in 1981. Numbers of coypus probably reached a peak in the late 1950s. The population was then believed to number 200,000 (Norris 1967) but this may have been an over-estimate (Gosling and Baker 1989).

DAMAGE

Coypus are generalist herbivores and feed on a wide range of native plants and crops. They generally select the parts of plants which contain the highest nutrient concentrations and, where these include basal meristems, the plant is often destroyed. As a result of such feeding, large areas of reed swamp were eliminated in the Norfolk Broads during the 1950s (Boorman and Fuller 1981). Coypus also favour

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particular species, including the great water dock *Rumex hydrolapathum* and cowbane *Cicuta virosa*, which almost disappeared from large areas when coypu were abundant (Ellis 1965). They also damaged a wide variety of crops including cereals, brassicas, sugar beet and other root crops.

The most important damage in purely economic terms was caused by burrowing. Coypus dug extensive burrow systems into the banks of ditches and rivers which disrupted drainage systems and posed the risk of flooding in low-lying East Anglia. As damage by coypus began to increase alarmingly in the late 1950s, there was a widely based call for an official control campaign.

THE FIRST CONTROL CAMPAIGN 1962-1965

The damage caused by coypus led to two initiatives in 1962. The first was to establish the Coypu Research Laboratory in Norwich, and the second to launch a trapping campaign which was to run until 1965 (Norris 1967). Complete eradication was believed to be impossible, and the aim of the campaign was to reduce coypu numbers and confine the remainder to the Norfolk Broads in eastern England. By necessity this campaign was organised in advance of any results from the Laboratory. The area containing most coypus was divided into nine sectors which were trapped successively by a team of up to 14 specially employed trappers. They started at the outside of the control area and worked inwards towards the area where the density of coypus was highest, in the Norfolk Broads. There was also a large amount of trapping ahead of the campaign carried out by the employees of rabbit clearance societies and by some landowners. Outside the main control area, government pest control staff attempted to clear what were regarded as outlying colonies in co-operation with landowners.

It is possible now to see a number of flaws in the strategy; notably that the main trapper force spent much of its time in clearing relatively low density areas rather than attempting to maximise capture rates. Also, although the effect of immigration into cleared areas was considered, it was not given sufficient weight (Gosling and Baker 1989).

Events were also complicated by the winter of 1962/3; the coldest winter in Britain for over 200 years. The fall in numbers trapped over this winter suggested that 80-90% of all coypus were killed by the cold (Norris 1967). By the end of the campaign in 1965, over 40,000 coypus had been trapped and the main objective had been achieved.

In the absence of a contemporary demographic analysis, it was not clear to what extent trapping was responsible and in retrospect perhaps the main achievement of the trappers was to keep the numbers down to the low levels caused by the cold winter. In ignorance of the quantitative relationship between trapping effort and the population's response, the trapping force that remained was not sufficiently large to prevent an eruption in numbers when a run of mild winters occurred in the early 1970s.

THE COYPU ERADICATION CAMPAIGN 1981-1989.

In 1977 the government set up a committee, The Coypu Strategy Group, to advise on future policy relating to the control of coypus (Anon 1978). In contrast to the earlier campaign, information was available to the Group from the results of a long-term investigation of coypu population ecology, and this was used to plan the 1981 campaign. Over 30,000 coypus were dissected to get information about reproductive biology, age structures and the other information needed to reconstruct past populations and to try to understand why coypu numbers varied.

Results indicated that trapping explains more of the variation in adult populations than winter severity, although the two combined variables accounted for 80% of the variation in the change of coypu numbers (Gosling and Baker 1987). Not all this information was available in the late 1970s, but enough was known to provide an analytical background for simulation models of the population. Simulations were used to assess the effect of employing different numbers of trappers on the population under various climatic circumstances.

A range of these simulations (Gosling *et al.*1983) were available to the Coypu Strategy Group and the option recommended was an attempt to eradicate coypus with a force of 24 trappers. Before the recommendations were accepted by the Government, one more important feature had been demonstrated: that it was possible to eradicate coypus by cage trapping. This was achieved in an exercise carried out on 30km of the river Yare, to the west of Norwich, which included Surlingham Broad. It was possible to demonstrate that coypus could be eradicated by cage trapping on a realistic scale across a range of wetland habitats used by coypus (Gosling *et al.* 1988).

The eradication campaign started in April 1981. Taking into account the reasonable expectation of improvements in trapping techniques and other equipment, it was decided to attempt eradication within ten years. The management and funding of control was also changed. A reconstituted Coypu Control Organisation employed 24 trappers and was funded by the Ministry of Agriculture, Fisheries and Food (50%), Anglian Water Authority (40%) and Association of Drainage Authorities (10%). The

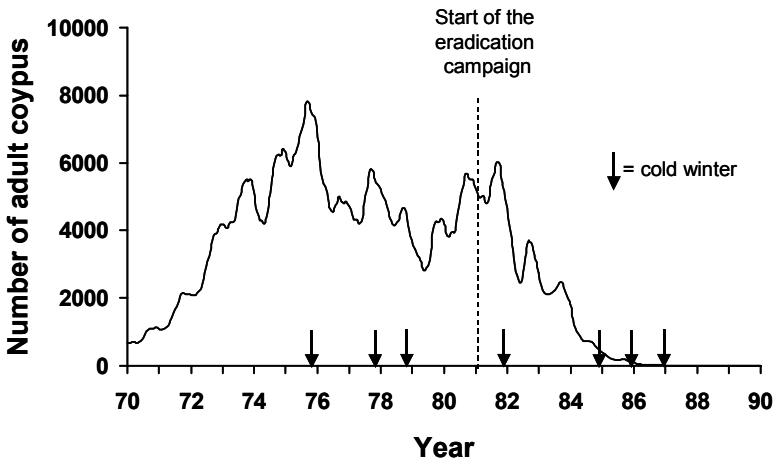

Figure 1 Number of adult coypus present in Britain between 1970 and 1990, reconstructed using the continuous retrospective census technique.

direction of the trapping campaign was also placed under the control of a small management committee that included a representative from the Coypu Research Laboratory. Wider stakeholder interests were represented on a Co-ordinating and Advisory committee, which met periodically to review progress with the campaign and offer guidance.

Staff from the Coypu Research Laboratory gave technical guidance to the control organisation throughout the campaign. An example is the scheme used to deploy trapping effort. Deployment was adjusted every three months using recent capture/trapping effort ratios in each of eight strategic regions. This ratio was weighted to different extents so that effort could be concentrated on high density areas early in the campaign and deployed more widely later on. However, some control was carried out throughout the population, in contrast to the sweep approach adopted in the first campaign against coypus (Gosling and Baker 1989).

The technique used was cage trapping. Traps were inspected every day and any trapped coypus were shot. This technique had the advantage that any non-target animals could be released unharmed. Because of this it was possible to get the co-operation of all landowners, including those with conservation and game interests; this is essential where the objective is whole population removal. During the campaign the trappers achieved an average annual trapping effort of 216,000 trap nights (a trap night is one trap set for one night) (Gosling and Baker 1987) and about 34,900 coypus were caught or otherwise accounted for (Gosling and Baker 1991).

Various improvements were introduced by the Laboratory, including the use of traps on baited rafts. Field trials showed that these were at least 50% more effective than traps set on land and non-target captures were also significantly reduced (Baker and Clarke 1988). Following this work, over 600 rafts were deployed.

The Laboratory also monitored the progress of the campaign both by field checks and by reconstructing the population. The process used to reconstruct the population was a continuous retrospective census, described in detail by Gosling *et al.* (1981). The technique was based on knowing the majority of the adults that were killed and being able to age a sample of these every month using the weight of the dried eye lens to determine age (Gosling, *et al.*1980). A reconstruction of the population between 1970, and the capture of the last coypu known to be caught from the wild (December 1989) is shown in Fig. 1.

There were around 6,000 adult coypus in 1981 at the start of the eradication campaign, but they had effectively been eradicated by the end of 1989. The campaign was helped by an above average number of cold winters. However, it is important to appreciate that cold weather itself would never eradicate all the coypus from Britain; as shown by the recovery after the exceptionally cold winter of 1962/3.

Even when the main technical problems in the operation have been solved, why should the trappers attempt to succeed in an eradication exercise when doing so would also eradicate their jobs? The scheme devised was to restrict funding to a maximum of ten years, and promise the trappers a bonus of up to three times their annual salaries if they succeeded in eradicating the coypu population. The bonus declined progressively after six years to encourage an early end to the campaign. It is impossible to judge the precise effect of this scheme, but we believe it was an essential element. In the end the trappers gained an almost maximum bonus.

It was also necessary to have an independent check on whether or not coypus had been eradicated

as the incentive scheme had the risk of 'encouraging' trappers not to report kills which would potentially reduce their bonus. Laboratory staff carried out an independent check throughout East Anglia for coypus for the last four years of the campaign. The technique used was to put out rafts baited with carrots and check these for signs of coypus, such as droppings and teeth marks. The advantage of this technique was that, unlike using cage traps which must be checked every day they are set, a raft need only be checked once every week to ten days. This allowed a much greater area to be surveyed than would have been possible using additional trapping.

A number of automatic camera rafts were also used to confirm the presence of coypus (Gosling 1989). These were rafts that had an infra-red beam running along each side of the raft, breaking the beam triggered a camera which then took a photograph of the animal that had climbed onto the raft. This additional technique was helpful to provide additional 'proof' of any coypus that might remain in the wild as such animals could potentially have resulted in the trapping force having a significantly reduced bonus.

As you cannot prove a negative, the success of an eradication campaign will only be confirmed some long time after it has actually been achieved. For management purposes success criteria need to be established at an early stage. In this campaign 21 months (a 12 month period plus a nine month period) without any coypus being caught or found was deemed to provide sufficient evidence to disband the trapping force. It was also recognised that it would be unreasonable to start this period again if, for example, a single coypu was caught after a year. In this case trapping would continue throughout the 9 month block and the campaign would finish after there had been a further 6 month period without any coypu being found. The size of the bonus earned by the trappers would be calculated from the date that the 'last' coypu was caught, that determined the end of the control campaign.

In January 1989, 21 months had passed without any coypus being trapped (although two elderly male animals were killed by cars) and the Eradication Campaign officially ended (Gosling 1989). The Coypu Control Organisation was disbanded and the trappers were paid their bonus, however, it was recognised that it was likely that a few coypus would still remain. To help find any remaining animals, three field staff were retained by the Coypu Research Laboratory to search for them. In December 1989 this team confirmed the presence of, and subsequently trapped, what was to be the last coypu found in the wild in Britain. The systematic field effort by the Coypu Research Laboratory ceased in March 1992; eradication had been achieved.

DISCUSSION

The successful coypu eradication campaign would not have been undertaken without detailed technical assessments of the effort, costs and likely chances of success. These could only have been achieved by a long term study of population ecology, targeted to a particular control application. The research also allowed operational experience to be gained and it is significant that the arguments for such practical details as the incentive bonus scheme came from biologists. Population trends and the results of field checks were passed back to the control organisation and helped to direct the campaign and to stimulate the efforts of the trappers.

It is possible to identify at least 7 features that were key to being able to set up an effective eradication campaign and to bring it to a successful conclusion.

1) A clear case for eradication could be made. In this case there was clear damage to native flora, crops and drainage interests. It was considered that this threat would remain and that in the longer term successful eradication would cost less than continuous control (Anon 1978).

2) A viable and costed strategy existed. Research into coypu biology and population dynamics and the computer simulations that resulted, allowed the size of the trapping force necessary to achieve eradication to be estimated. The possible time frame within which this might be achieved could also be assessed, although it was recognised that the speed of eradication would depend on the severity of future winters (clearly unpredictable) so accurate prediction would be impossible. Knowing these parameters and the equipment needed to support a trapper allowed realistic estimates of likely future costs to be made. A successful trial eradication exercise, at a realistic scale, gave confidence to those recommending a way forward and those funding the exercise that it could achieve its objectives. There was also the precedent of a successful campaign to eradicate muskrats, *Ondatra zibethicus,* from Britain in the 1930's (Warwick 1934; 1940; Munro 1935; Sheail 1988).

3) An acceptable control technique was used. Cage trapping was demonstrated to be a viable technique for the eradication campaign. Coypus were caught alive and then humanely killed by a single shot to the head from a 0.22 calibre pistol. The technique allowed non-target species to be released unharmed and was one that was generally acceptable to the public at the time. There was very little interference with the trapping campaign although it is likely that protests from 'animal rights' campaigners would be

more significant if a similar campaign was to be repeated now.

4) Existence of sound management structure and finances. Eradication is a long term project and a ten year project plan was put into place to support the campaign. This had the backing of central government and key local interests. It was coupled with local management that had direct input from the Coypu Research Laboratory where research was undertaken into control strategy and techniques.

5) The progress of the campaign could be monitored and there was a process for continual improvement. The continuous retrospective census allowed the progress of the campaign to be monitored. It is essential for the maintenance of a long term campaign that funding bodies have clarity about progress. They would clearly wish to have the opportunity to reconsider their position if it seemed that a campaign was not achieving its objectives. The response of the population to changes in trapping strategy or improved trapping practice can be monitored and the deployment of the trapping force can be altered appropriately.

6) There was an incentive for the trappers to achieve their objective. Those carrying out an eradication exercise will potentially be unemployed if they are successful, this will tend to mitigate against the campaign achieving its objective. Many of the trappers will also spend a long time working hard but not catching anything during the last part of a successful eradication campaign. As catching the target animal is a significant source of positive feedback for a trapper and this may be absent for many months or possibly years, the motivation of the trapping force during the final stages of the campaign is very important. In the coypu eradication campaign an incentive bonus was offered at the start of the campaign to be paid in the event of successful eradication within a ten year period. This appeared to be successful in motivating the trapper force. Other management options may be appropriate in other circumstances but the strategy that will be adopted towards the end of a campaign needs to be considered at an early stage in planning an eradication campaign.

7) It was possible to define the successful end to a campaign. A practical definition was adopted to determine when the eradication campaign was to finish. It is important that trapping effort is not reduced too early or eradication may be jeopardised.

The constructive interaction between applied biology and a centrally organized control operation that characterised the coypu eradication campaign has the potential for wide application in any extensive pest control operation and may be essential for the successful removal of a well established introduced mammal. The success of the campaign should also provide encouragement to future campaigns by confirming that eradication of an introduced mammal is possible even for those with a widespread population.

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2. â€œThe eradication of coypus (Myocastor coypus) from Britain: the elements required for a successful campaignâ€ by S. Baker (p. 142â€“147). 3. â€œPrediction of range expansion and optimum strategy for spatial control of feral using a metapopulation modelâ€ by F. Koike (p. 148â€“156). Part 4. â€œDatabaseâ€ (p. 172â€“211) contains 7 papers from which the following merit attention:. 1. â€Invasion of an alien palm (Trachycarpus fortunei) into large forestâ€ (p. 200â€“203). 2. â€œLine census and gnawing damage of introduced Formosan squirrels (Callosciurus erythraeus taiwanensis) in urban forests of Kamakura. Kanaga Nutria (Myocastor coypus) are large, dark colored, semi aquatic rodents. Nutria are members of the family Myocastoridae and are native to southern South America. They are often mistaken for beavers or muskrats but are actually much smaller than beavers and much larger than muskrats (Link 2004).Â Figure 2. Nutria Myocastor coypus. . Picture was taken at the Beaverton Oregon transit center. Image is from www.conceitedindependence.com.Â It also includes limiting damage, and an eradication program at the watershed level. The plan is in the process of being finalized and funding still needs to be found (Sheffels and Sytsma 2007). Literature Cited. Colona, R., R. Farrar, S. Kendrot, J. McKnight, T. Mollett, D. Murphy, L. Olsen, K. Sullivan. The coypu (from Spanish coipÃº, from Mapudungun koypu; Myocastor coypus), also known as the nutria, is a large, herbivorous, semiaquatic rodent. Classified for a long time as the only member of the family Myocastoridae, Myocastor is now included within Echimyidae, the family of the spiny rats. The coypu lives in burrows alongside stretches of water, and feeds on river plant stems. Originally native to subtropical and temperate South America, it has since been introduced to North America, Europe, Asia