

## S33-2 Conservation of the globally threatened white-headed duck, *Oxyura leucocephala*, in the face of hybridization with the North American ruddy duck, *Oxyura jamaicensis*: results of a control trial

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**Abstract** The North American ruddy duck, introduced into Europe in the 1960s, threatens the globally endangered white-headed duck with extinction through hybridization. A regional control trial, conducted in three areas of Britain, killed over 2,600 birds and led to a significant regional reduction in ruddy duck numbers. Control using firearms was effective but trapping ineffective. Population modeling suggests that the ruddy duck population in Britain can be reduced to fewer than 175 individuals in four to six years using year-round control if access is available to the principal wintering sites. The likely cost of the program is between £3.6 m and £5.4 m.

**Key words** Ruddy duck, White-headed duck, Competition, Population control

### 1 Introduction

In recent years, there has been a growing appreciation of the need to prevent the introduction of, and to control, nonnative organisms that threaten native biodiversity. At the global level, the Global Invasive Species Program was established in 1997 to address threats posed by nonnative species that disrupt ecosystem processes and hence threaten biodiversity, health and economies. The International Union for the Conservation of Nature and Natural Resources (IUCN) has established an Invasive Species Specialist Group that has published guidelines on the prevention of biodiversity loss caused by invasive alien species. At the European level, the Bern Convention has addressed invasive species issues by producing various policy documents, and by holding workshops to increase awareness amongst policy makers. In Britain, a review of the Government's policy on nonnative species is due to report in late 2002.

### 2 Status and distribution of the white-headed duck

The white-headed duck (*Oxyura leucocephala*) is a globally "endangered" species. Numbers in the main central Asian population have declined from around 100 000 to less than 10 000 birds since the 1930s (Green and Hughes, 2001). The Spanish population fell to 400 birds in 1950, then to just 22 birds in 1977. Destruction of habitat and excessive hunting were the main causes. Habitat protection, protection from hunting, and captive breeding have subsequently led to increased numbers in Spain to over 2 500 birds (Hughes, 2006).

### 3 Status and distribution of the ruddy duck

#### 3.1 Britain

Ruddy ducks (*Oxyura jamaicensis*) are common and widespread in their native habitat in North and South America, where there is an increasing population of over half a million birds. It was introduced into Britain from captive collections in the 1950s. In summer, the birds are widely dispersed, but in autumn and winter they congregate on a limited number of large inland water bodies. In January 2000, for example, the top ten sites for ruddy ducks held approximately 67% of the wintering population and the top 25 sites 83%. The total January 2000 winter population was estimated at 6 000 birds, but the rate of increase is now slowing, from 39% per annum between 1966 and 1980, to 8%–9% during the 1980s and to 6%–7% subsequently (Kershaw and Hughes, 2002).

#### 3.2 Europe

In 1965, the first record of a free-flying ruddy duck outside of Britain was reported from Sweden. As population numbers increased in Britain, so did the number of sightings abroad. These came initially from countries closest to Britain, such as France, the Netherlands, Belgium and Ireland, countries which still hold the greatest numbers of records. There have now been over 900 reports of some 1 500 ruddy ducks in 19 western palearctic countries (Hughes et al., 1999). The number of sightings, moreover, is increasing at a mean annual rate of 21% since 1976 (Hughes et al., 1999). Records are concentrated along the North Sea coasts

of The Netherlands, Belgium and Germany, and in France and Spain.

During the breeding season the ducks are now present in eight countries; and annual breeding attempts probably take place in five: Belgium, France, Ireland, The Netherlands, and Morocco, but not Spain where most birds are shot. The number of ruddy ducks that currently attempt to breed annually in continental Europe is still low — less than 10 pairs in 1998–2000 (Wetlands International, unpubl. data). Flocks of wintering birds have recently appeared in Spain and France. In January 1997, about 30 were recorded in northern Spain following a freeze across northern Europe, and 30–80 birds have wintered annually at Lac de Grand-Lieu in northern France since 1995. The feral population in Britain is the most likely source of these birds.

## 4 The threat to the white-headed duck

The biological, social and economic threat caused by nonnative species can be immense. In the USA, for example, nonnative species have contributed to the decline of 42% of threatened species; and exotic animals and plants have been estimated to cost the USA \$137 billion per year (Pimentel et al., 2000). After habitat loss and over-hunting, the impacts of nonnative species are the third most important factor threatening globally endangered waterbirds.

Introduced waterbirds are already known to threaten native populations with extinction through both hybridization and competition. Naturalized mallards (*Anas platyrhynchos*) now threaten seven distinct species or subspecies of other members of the genus *Anas* through introgressive hybridization (Rhymer, 2006). Ruddy duck x white-headed duck hybrids are known to be fertile to at least the second generation, indicating that hybrid breakdown, where F2 hybrids are infertile, does not occur. Wild introgressants to at least second generation have been observed in Spain.

## 5 Conservation control action

### 5.1 International

White-headed duck conservation action plans have been produced at a global (Anstey, 1989), continental (Green and Hughes, 1996; Li and Mundkur, 2002), and national levels. In 1996, the Council of Europe published 23 action plans for globally threatened birds in Europe, including the white-headed duck (Green and Hughes, 1996). The white-headed duck action plan urged Britain, *inter alia*, to “undertake its planned regional control program as soon as possible. If the results suggest that it is possible to control ruddy ducks on a large scale, the U.K. should undertake countrywide control measures for ruddy ducks as soon as possible.” The Bern Convention has since produced a strategy for the eradication of the ruddy duck in the western palearctic region (Hughes et al., 1999).

The number of countries taking action against ruddy ducks has increased in recent years. By 2002, at least 11 countries in the western palearctic (excluding Spain and

Britain) were taking, or preparing to take, action against ruddy ducks. This compares with only six countries in 1999. Birds have been controlled in six countries: France, Iceland, Morocco, Portugal, Spain and Britain; and Spain and France have national ruddy duck eradication strategies in place. By the end of 2001, 101 pure ruddy ducks and 58 hybrids had been killed in Spain, and 107 ruddy ducks in France.

### 5.2 Britain

In 1992, a three-phase ruddy duck control program began in Britain. The first phase investigated a range of lethal and nonlethal control techniques and concluded that reduction and control of numbers was possible. Population modeling suggested that shooting during the breeding season could reduce ruddy duck numbers to under 50 individuals in 3–10 years, without significant disturbance to other species or habitats (Hughes, 1996).

The second phase, a regional control trial conducted in three areas of Britain, began in April 1999 and ended in May 2002. The trial aimed to determine whether it was possible to reduce the British population to fewer than 175 individuals within ten years; to determine the likely cost of the program; and to determine whether ready access to control sites could be obtained on a voluntary basis (Central Science Laboratory, 2002). Three regions thought to be representative of the different challenges facing the project were selected for the trial. At Anglesey and in the Western Midlands control was carried out all year round while at Fife it was limited to autumn and early winter. Limited control also took place on waters in Avon, Leicestershire, Northamptonshire because of the need to test control methods on large wintering sites, and in Gloucestershire where breeding season traps were tested (Central Science Laboratory, 2002).

At Anglesey we aimed to reduce the breeding population by the maximum possible, and at least by 70% within three years. The original breeding population of 200 birds was reduced by over 70% within the first twelve months of the trial, and by an estimated 93% within sixteen months. It was achieved by shooting a total of 515 birds (158 females, 225 males and 132 immatures). In the Western Midlands we attempted to reduce the immediate pre-breeding population by the maximum possible. Counts on a subset of 17 sites showed reductions of 28% in the first twelve months. Counts on a subset of 23 sites showed a further 54% reduction in the second twelve months of the trial. These figures represent an overall reduction of 66% in the first two years of the trial. It was achieved by shooting a total of 1 715 birds (495 females, 743 males and 477 immature birds). The aim of the trial in Fife was to kill the maximum number possible of the post-breeding (autumn) population. A total of 216 ruddy ducks were removed during the trial (33 in 1999, 163 in 2000, and 20 in 2001).

Permission to carry out control of ruddy ducks was sought on a voluntary basis for a total of 153 sites, requiring approaches to 193 owners/occupiers. Of those

contacted, 58% gave permission, enabling control to be carried out on 52% of the 153 sites. Shooting was allowed on 48% of all sites, and trapping on a further 4%.

Shooting proved effective on breeding sites and on a range of post-breeding and wintering sites. On average 47% of the ruddy ducks present on breeding sites were killed per visit, with a staff input of 1.98 hours on site per bird killed. On post-breeding and wintering sites less than 1 km<sup>2</sup>, 54% of birds present were shot per visit on average, with a staff input of 1.1 hours per bird killed. On larger waters, the percentage of birds killed was reduced (mean 19%) but staff input only 0.8 hours per bird.

Three traps were constructed at three post-breeding/wintering sites, and fourteen on three breeding sites. Approximately 900 hours of staff effort in construction, maintenance and driving of ducks during the autumn and winter failed to produce any captures. During the breeding season, another ca. 750 hours of staff effort resulted in a total of 17 ruddy ducks (five females and twelve males) being caught, all on just one of the three sites. The results of this work suggest that post-breeding and winter trapping is ineffective, but that breeding season trapping, although far less efficient than shooting, could be effective on some sites.

The overall trial on breeding, post-breeding and various sizes of wintering sites, with over 2 600 birds killed, resulted in a significant reduction in ruddy duck numbers regionally. Control by firearms was effective, and trapping ineffective, in taking large numbers of birds.

A stochastic Monte Carlo simulation model was constructed to project the national ruddy duck population from January 2000 under a variety of control strategies. Three variables were included: efficacy per person (how much one staff could reduce the British population per year), numbers of staff, and changes in ruddy duck population growth rate. Although there may be as many as 1 000 breeding sites across Britain, the forty or so key post-breeding and wintering sites where most of the population concentrates is the key; and access to them will be critical for progressing an effective eradication scheme. If access is gained, modeling suggests that there is an 80% certainty that the popula-

tion can be reduced to fewer than 175 birds in between four and six years, at a cost of between £3.6 m and £5.4 m.

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