

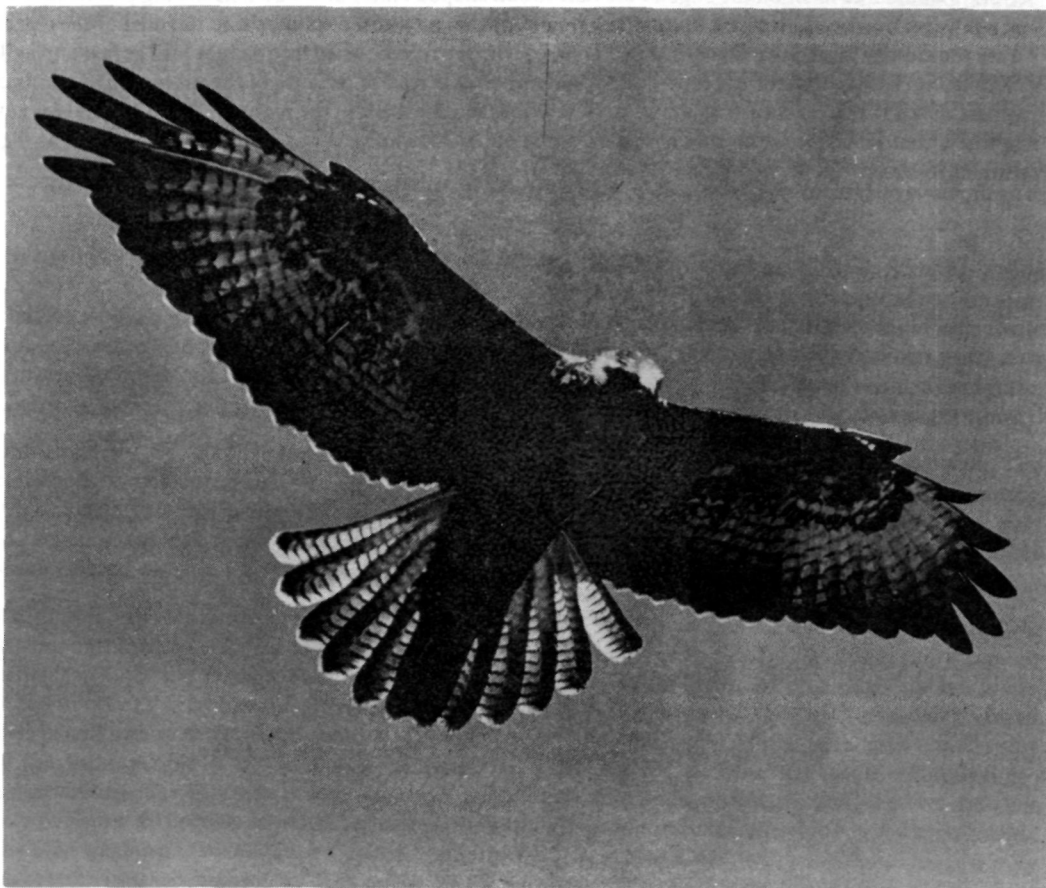
POTENTIAL FOR RESTOCKING GALAPAGOS HAWKS ON ISLANDS WHERE THEY HAVE BEEN EXTIRPATED

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The endemic Galapagos hawk (*Buteo galapagoensis*) formerly occupied all the major islands of the archipelago. Its present status is highly variable from island to island, a fact which may have led to its listing on the white sheet of the Red Data Book of I.U.C.N. Primarily due to human activities, it is now extinct on San Cristobal where there is considerable human settlement; no more than 2 pair may remain from a formerly large population on Santa Cruz and its associated islands of Baltra and North Seymour; and it has long been extinct on Floreana. In contrast, the hawk is still quite common on Santiago, Española, Isabela, Fernandina, Pinta, Marchena and Santa Fe. These populations have been suggested to total 130 breeding pairs or groups.

The absence of this integral component of the terrestrial ecosystem on so many islands is both biologically and aesthetically unfortunate. While doing our studies on the evolution of cooperative polyandry in the Galapagos Hawk, we have been struck that the demographic properties of at least some of the island hawk populations show the presence of a "harvestable" surplus of birds. These birds could be used to restock an island where the bird has been extirpated, without any long-term effect on the source population. While we realize that restocking involves certain risks and numerous considerations other than purely biological ones, we feel the idea should be given serious consideration.



Galapagos Hawk Photo by Fritz Pölking

A Source of Birds

Before any restocking can take place, one needs a source of birds such that removal of some individuals does not injure the source population. Our findings on the demography of the Galapagos Hawk on Santiago suggest a large pool of available birds and similar conditions may exist on other islands. Let us begin by noting that published estimates of the number of breeding pairs or groups (as the hawk is polyandrous) can be misleading in terms of total hawk populations. For example, it has been estimated that Santiago supports breeding birds on 50 territories. Due to cooperative polyandry, we estimate that these territories support 180 adult birds, rather than the 100 one would expect with monogamy. In addition, Santiago supports large numbers of non-breeding, non-territorial birds, mostly juveniles and adult females. These birds live primarily in highland areas where the hawks do not breed. Our counts of these on Santiago often exceed 100 birds. Thus, Santiago alone may support over 250 individual hawks.

Our measurements on mortality rates of these two groups of hawks on Santiago show the existence of a harvestable surplus of birds. The territorial birds seem to remain on their territories for the remainder of their lives. Banding studies over a four year period estimate less than a 10% annual mortality rate among these birds. While reproduction is highly variable, it appears that even in the poorest years enough young are produced to match the mortality of breeding birds. In climatically favorable years, a great amount of overproduction may be occurring. During our July 1981 survey of Santiago, we found the poorest reproductive success of our three visits, yet a sample of 12 breeding groups produced 7 fledged or nearly-fledged young. Extrapolating this to the estimated 50 territories would suggest that 29 young were produced. Yet estimated mortality of breeding adults for 50 territories would be only 18 birds. Thus the production of young even during this unusually poor year would have been enough to replace the mortality of breeding adults and this does not include any renestings that may have occurred later in 1981. In contrast, a sample of 8 nests during wet conditions in 1979 produced 14 young. This would extrapolate to the production of over 80 young on the island, an excess of nearly 50 birds over what is needed to replace mortality.

With the production of young exceeding the replacement requirement of the breeding population by such a wide margin, it is not surprising that there is a high mortality rate among this non-territorial population. Non-breeding birds are forced by territorial birds to live in less favorable environments. Analyses of our own and Tjitte de Vries's banding data for the highland birds on Santiago suggest that about 50% of these non-territorial birds die each year, even when accounting liberally for recruitment into the breeding groups. This rate may be artificially low on Santiago due to the goat population there. These goats both serve as food to the scavenging hawks and also tend to open up the vegetation to make food more accessible to foraging birds. In 1981 we found some birds establishing breeding territories in the highlands, something they will not do when these areas have their native covering of fern and bracken. While this non-territorial population fluctuates in size to some degree, our estimates have always exceeded 75 birds. We also have never made counts in November or December, when the young of the year enter this population. Thus, for example, the 1979 production of young may have added 80 juveniles to the 100 birds estimated in the non-territorial population. It is obvious that this is a large, crowded population.

Putting all this together, it appears that removing as many as 30 birds would have little effect on even a single year's population levels. While finding an adequate number of adult males could be a problem, adult females and juvenile males are abundant. Tjitte de Vries has recorded the pairing of an adult female and juvenile male, so using juveniles for restocking may not be a problem.

Potential Problems with Restocking

I can envision no major natural problems with introducing these birds on empty islands where the species occurred previously. While observations of birds on islands with saturated populations suggest relatively little variation in territory dimensions and nest sites, there is evidence that they do shift territory boundaries or add new nests occasionally. In terms of diet, the hawk is generalized enough to adapt to about any combination of available foods on these islands, while all the prey species have coexisted with hawks for many years in the past.

Since the Galapagos Hawk is a tame, generalized predator and scavenger, it does not always interact well with humans. Hawks like to eat chickens and are so tame they will enter yards and even chickenhouses to feed. One of the chief causes of the demise of this species on Santa Cruz was this factor. Where birds are able to establish territories away from human settlement, the hawk-human conflict should be minimal, but in settled areas the introduction of non-territorial birds and their subsequent offspring might well give rise to conflicts. With the increasing awareness of the value of wildlife on these islands, perhaps the public can be induced to protect the hawks. Some sort of compensation for substantiated damage might be possible without too great an expense.

Summary and Potential for Population Increase

Our conservative estimate is that 30 birds could be removed from Santiago annually without affecting breeding populations there. Apparently hawk populations on other islands could also support some removal. It is possible that stocking a mixed population would be a good idea to maximize genetic variation. All of our evidence supports the view that hawk reproduction greatly exceeds the number of adults needed to replace the yearly mortality among the space-limited breeding birds. In fact, the evolution of such a rare mating system as cooperative polyandry is probably a result of this factor. This is definitely a "harvestable" population.

What is the potential for increase in the numbers of the Galapagos Hawk? We can only make an educated guess. It has been suggested that Santa Cruz was once the population center for this species with up to 250 territories there. Less is known about the previous populations on Floreana and San Cristóbal. Assuming the hawks set up territories only in the arid and transition zones (about 300 metres elevation and below) and recognizing that Santa Fe holds 17 territories, I would guess that Floreana could easily support 20-25 breeding groups and San Cristobal 60-75. While it would take many years for these population levels to be achieved, the result could be a tripling of the total population of the Galapagos Hawk. Perhaps as importantly, it would restore the top carnivore to the natural communities of these islands.



Photo by Tjitte De Vries