

# Nene Goose

## and Accumulated Environmental Impact

by Walter B. Sturgeon, Jr.  
Lee, New Hampshire

Accumulated environmental impact on the Nene, or Hawaiian, Goose commenced with man's occupation of the Islands some 1,200 to 1,400 years ago. During that period, the Nene population fell from an estimated 25,000 birds to an estimated 30 birds by 1949. The losses were due to man's direct activities on the Islands and the impact of other animals and organisms introduced by man.

Restoration of the Nene to a portion of its former range began over 40 years ago and has been only marginally successful. Captive propagation of the Nene, both on and off the islands, played a major role in this restoration effort. The program has suffered from lack of resources, insufficient initial and follow-up field work, and lack of genetic diversity in the captive population.

This early and long running effort to restore the Nene has afforded us an opportunity to reflect on various aspects of the program and apply the lessons learned to more recent attempts involving other species. It is probably not too late to apply some of these lessons to the Nene itself, but efforts appear to be stalled, and we are in danger of losing this species once again. This article will discuss Nene biology, history, predators, restoration, and genetic management and emphasize the lessons learned.

*Continued on page 10*

Photo courtesy of Jerome J. Pratt



*Jerome Pratt with first two pairs of Nene in Nene Park at Haleakala in 1971.*

Photo by W. Sturgeon



*Nene with one-week-old young in Mike Lubbock's collection.*

*Nene in author's collection.*



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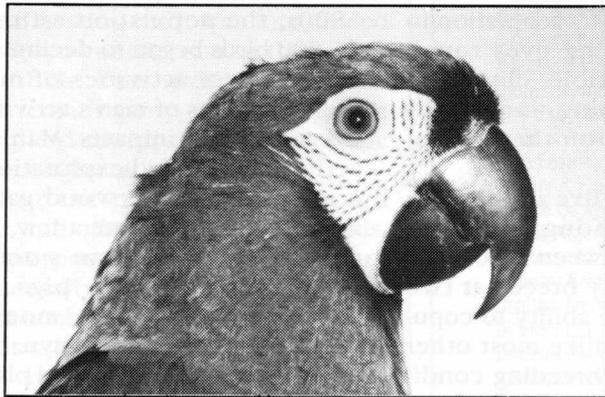
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## Biology

The Nene (*Branta* or *Nesochen sandvicensis*) is one of 30 bird species classified as endangered in Hawaii. It is a member of the sub-family Anserinae which includes whistling ducks, swans and true geese. The origin of this small terrestrial goose has been debated for years, as has its classification. The Nene has been included in the genus *Branta* because of its apparent affinities with the Canada Goose. This possible ancestry is reinforced yearly by the presence of a few Canada Geese and Brant on the Islands in the winter. Others have argued for a southern hemisphere origin, linking it to the Orinoco Goose (*Nesochen jubatus*) or the Cereopsis Goose (*Cereopsis novaehollandiae*). This question should be resolved in the very near future, through rapidly developing DNA classification analysis.

The Nene is nonmigratory even to the extent that it seldom moves from one island to another. It is taller, has shorter wings, and a slightly longer, turned down bill than other geese of similar weight. Additional adaptations to its island habitat include occupying a smaller range than any other goose, standing upright and feeding on berries, herbs and shrubs. The bulk of its legs is 25% greater than other geese, and the tendons of the toes are stronger. Its adaptation to climbing and running over rough ground include flexible, elongated toes, reduced webbing, large nails and protective pads on the soles of the feet.

Currently, Nenes live in kipukas, vegetated areas among the more recent lava flows between 5,000 and 8,000 feet. It usually breeds at two years old and has the ability to copulate out of water. Unlike most other birds, it comes into breeding condition with decreasing day length, which means it breeds on Hawaii starting in October or November and on into February. Nests are usually found under pukeawe bushes. The species lays small clutches, two to three eggs, and the eggs are large in comparison to body size, both of which are typical of island birds. The incubation period is 30 days. The young have a long fledging period, 70 days. The productive life of a wild Nene is usually over by 12 years of age, and an old bird is 15 years. In captivity, the birds live and produce for a longer period. One bird is known to have lived for 42 years.

## History

The Hawaiian Islands began to appear one to ten million years ago with the big island of Hawaii among the youngest. In recent times, the Nene was found only on this island, but there is fossil evidence to suggest that it also occurred on Maui, Kauai and Molokai. The goose ranged from elevations of 8,000 feet down to sea level.

The first Polynesians arrived on the Islands between 500 and 750 A.D., and the accumulated environmental impact we are dealing with today started at that time. This early impact came from the dogs and cats, and possibly pigs and rats, which they brought with them and from man's harvest for food. The lowland populations suffered the most from the encroachment of these settlers. The Nene was able to survive into the historic period on Hawaii and maybe Maui because these were the only islands in the chain with subalpine zones that provided suitable habitat for the Nene but not for Polynesians.

When the sailing ships began to arrive in the late 1600s and early 1700s, the natives gave the geese to the ships' crews, often in exchange for rats, which the Polynesians considered a delicacy. The islanders also domesticated the geese and used them as watch geese. By the early 1800s, the population estimates of 25,000 birds began to decline rapidly as the direct activities of man and indirect agents of man's activities had overwhelming impacts. Man's direct activities included exploration, firearms, harassment, wood gathering and ranching to name a few. The indirect agents of man's activities included rats, goats, pigs, sheep, cattle, horses, donkeys, mongooses, introduced game birds, mynahs, ants, mosquitoes and introduced plants.

From 1900 on, the bird was considered rare and by 1909 was found only in the highlands of the big island. Various agencies' conflicting reports and statements abound on the Nene's status during the first half of this century and had very little field work to support them. However, an 18-month survey in 1946 and 1947 resulted in no wild geese being seen. By 1949, the wild population was estimated at no higher than 30 birds.

## Predators

As mentioned earlier, the initial settlers brought dogs and cats which preyed on both eggs and geese in a

habitat that had previously had no land mammals. The Nene was the biggest land animal in the islands when the settlers arrived. Early sailing ships released grazing animals such as cattle, horses, sheep, goats and donkeys, which destroyed the habitat of the geese. Feral pigs preyed on both eggs and young and would kill an adult goose if caught on the nest. With such a variety of grazers, practically all of the vegetation was utilized by one species or another. To ensure the success of these animals, King Kamehameha declared a 10-year kapu (moratorium) on killing them and, as a result, they multiplied rapidly and moved into the forests to find food. Eventually, these feral animals ranged over the entire habitat of the Nene. From 1921 to 1946, 10,000 of these introduced animals were killed every year in forest reserves alone. They are still found on many of the islands, including Hawaii.

Goats were especially destructive and were able to find all of their requirements in the lava flow areas favored by the Nene. One measure of their success might be the 184,000 goat skins exported between 1885 and 1900. Population estimates in 1971 placed 14,000 goats in Volcano National Park, which includes part of the Nene's present breeding range.

The mongoose, a predator on any ground nesting bird, was introduced in 1883 to control rats in the sugarcane fields. The birds proved to be much easier prey, the mongoose multiplied rapidly, with very little impact on the rat population.

All of the predators mentioned above, and others such as game birds, were purposely introduced by man. Accidentally introduced organisms also contributed to the Nene's demise and continue to restrict its habitat today. Avian pox, probably carried to the Islands by an introduced game bird, was transmitted to the Nene by an introduced mosquito.

Legal hunting of the Nene between September 15 and February 1 was not stopped until 1909, and poaching of the birds, while hunting introduced pheasants, is still a problem today. As late as 1944, game biologists were publishing unjustifiably optimistic statements about how this change in law would allow the species to recover in the mountainous areas.

### Restoration

With estimates of 30 birds in captivity in 1949, the State of Hawaii,

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with some support from the USFWS, started the first formal Nene recovery effort. A rancher, Herbert Shipman, provided the initial two pairs of Nene to the captive breeding facility at Pahakuloa. The birds came from stock that he had kept since 1918 without additional wild blood. One of the two males died before it reproduced, leaving only three founders. At about this time, a poultry farmer, the legendary Ah Fat Lee, was hired to develop and run the facility, which he did for the next 30 odd years. Three additional birds were added later, but the element of genetic diversity was sadly lacking. One trio of birds was sent to the Wildfowl Trust in Slimbridge, England in 1950 and placed under the care of Peter Scott. Between 1949 and 1978, Pahakuloa had raised 1,699 birds. By 1978, some 1,761 were released in the wild, including birds raised at the Wildfowl Trust. All the Wildfowl Trust birds were released on Maui in the Haleakala crater. By 1985, the effort in Hawaii had cost over \$500,000 with very little actually spent on raising the geese. The majority went to maintain various biologists, committees, etc. Through the resourcefulness of Ah Fat Lee in scavenging materials and a lot of volunteer labor, the actual breeding facilities were constructed and maintained on a very small budget.

Techniques included captive pen rearing, hard release, soft release, Nene parks, foster parentage and egg transplant. Birds were banded prior to release so that wild birds and young raised from released birds could be readily identified. The last and best estimate of the wild population (300 on Hawaii, 119 on Maui, and 29 on Kauai) is from data obtained from the State of Hawaii, Department of Land and Natural Resources.

This current wild population is what we have to show for 40 years of effort. The objective of the Nene Recovery Plan, issued by USFWS in 1983, was "2,000 birds on Hawaii and 250 on Maui, well distributed in secure habitat and maintained exclusively by natural reproduction". They did concede that it would require continued control of predators and noxious plants. The program is still a long way from reaching that goal and many individuals who have worked with the population believe that the maintenance of a captive flock will be required indefinitely.

### **Genetic Diversity and Weakness**

The Nene is far from secure even though there are far more of them today than in 1950. They essentially disappeared from the wild in the early 1900s, and the birds that are left are progeny of those held by Herbert Shipman from 1918. The total number of founders when the captive propagation program started in 1949 was less than 10 birds, most of which were already inbred for 30 years. This was the second time they had been through the genetic squeeze. Genetic diversity was lacking to start with due to the postulated evolution of the birds from only a few lost geese eons ago.

In the short span of the 30 to 40 years in which Shipman's birds were absent from the wild, their habitat evolved into something quite different than what it was when they left. Their evolution simply did not keep up.

While many of the following remarks could be used as arguments against aviculture, it is important to recognize some of the problems captive propagation brings with it. The lack of genetic diversity has undoubtedly led to many of the current problems experienced by both captive and wild birds. There is a real case to be made for questioning whether we have the same bird after 10 to 15 generations in captivity. Problems encountered include poor fertility, twisted legs, hairy down on chicks, mean gander syndrome, a high percentage of homozygous lethal genes causing embryo mortality, club feet and others. These genetic defects, which are usually recessive, are more likely to come together in captive inbred populations, and their effects emerge in offspring. In a captive situation, these weak birds have the benefit of medication and modern husbandry techniques that give them a much better chance of survival. In captivity, you also make positive selections to stay away from one trait and often reinforce another.

More subtle genetic changes are also taking place as the Nene continues to evolve in captivity. Only certain birds tolerate captivity and live to breed. These birds tend to be undisturbed by noise and activity or strange objects. They are less aggressive and less wary of predators. Birds that breed in small pens tend to defend less territory. Larger clutches of smaller eggs with shells have

adapted to a different altitude and humidity than that needed in their remaining habitat. Captive birds do not seem to have the ability to digest natural diets and do not recognize edible foods in some instances. Latitude, growing season and breeding season are often changed in captivity. Behavior, especially imprinting, is a concern. Hens or humans are very poor substitutes for Nene parents.

### **Lessons Learned**

The Nene recovery effort is now over 40 years old, and it is important that it be reviewed for lessons learned.

*Island species are particularly vulnerable to accumulated environmental impact.* When attempting rescue, it is necessary to decide what the terms of the effort are: do you reintroduce the species or are you content with a permanent captive population?

*Habitat must be available and suitable for reintroduction.* Putting birds back into a habitat in which they are not successful makes no sense until the cause for their demise is found and corrected. In the case of the Nene, their lack of success in the wild is only generally understood, and a good deal more field work is needed to fully understand the hazards they face.

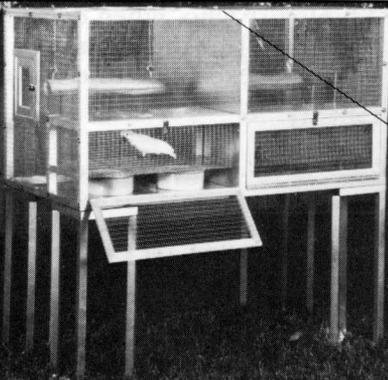
*Particular attention must be paid to the gene pool.* The American Association of Zoological Parks and Aquariums' Species Survival Plan is an attempt to address this problem in some endangered species. This program is computer based and designed to maintain 90% of the genetic diversity for 200 years.

*Preserve a species before heroic efforts are required.* Many current waterfowl populations are nearing the point where reversing the down trend borders on such an effort. Threatened species must be identified and research on their biology and habitat initiated at once.

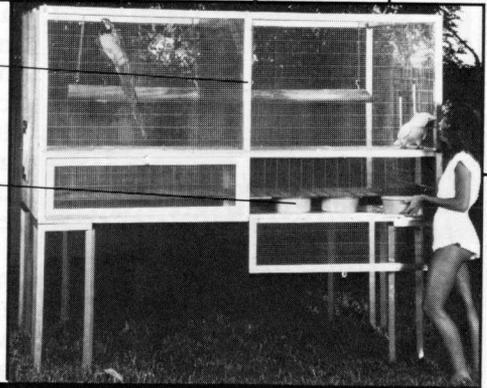
*There must be continuous, consistent, coordinated management of recovery efforts.* In the case of the Nene, cooperation between the U.S. Fish and Wildlife Service and the various state agencies was often lacking. The Nene Recovery Team, which was to have oversight of the effort, is often without a full complement of members and is consequently ineffective. State efforts are often without funds to maintain a consistent effort at the breeding facility and in the

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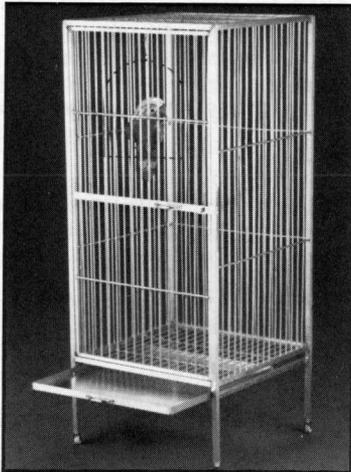
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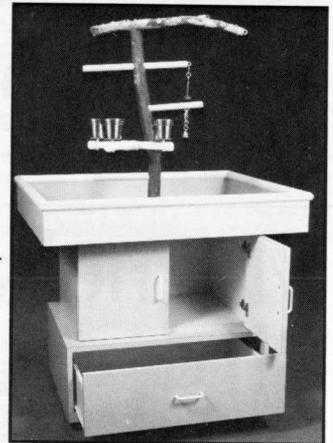
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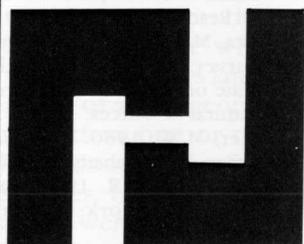
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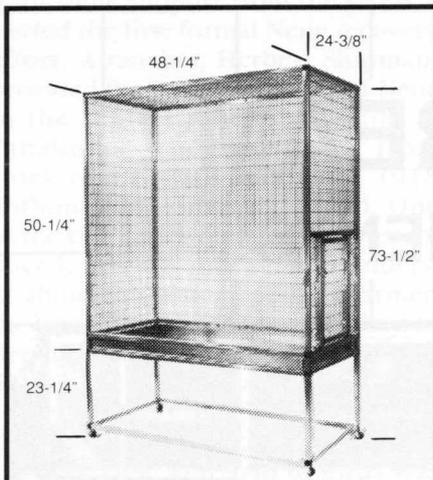
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*Follow-up field work is imperative to monitor success of the recovery effort.* Marking systems must be used consistently. Genealogies of banded wild and captive birds must be compiled.

*The issue of hunting a species toward extinction must be addressed as early as possible.* Case after case of failure to confront both subsistence and sport hunters can be cited. Minimum self-sustaining wild populations must be established and harvest controlled no matter how unpopular. It may be necessary to close entire areas to all hunting to prevent incidental killing or poaching of the endangered species.

*An active education and information program is extremely important in gaining public support and understanding of a restoration effort.* This effort is at least half of a viable wildlife law enforcement program. These programs should concentrate on school students, probably at the grade school level, who can take the message home to their families.

*Alternate habitat should be considered.* Because of the rapid changes that take place in captivity, the possibility of introducing the endangered species to a different but very similar habitat until it can be returned to its own must be thoroughly explored.

*Soft or gradual release programs, such as the Nene Park concept, appear to be much more successful in repopulation efforts.* Parent-reared birds raised close to the natural habitat should be used if at all possible. This type of effort must have the necessary resources, which are often quite extensive, dedicated to it. These resources must be ready when the birds are ready.

*Institutional or private efforts are often far more successful than government efforts.* They circumvent the expensive bureaucracy and channel a much greater percentage of the available resources to the birds themselves.

*The Endangered Species Act and its regulations must be re-evaluated as it relates to native birds.* In the case of the Nene, the protection that was afforded by law has proved very counterproductive. Control of this species in interstate commerce has caused further degradation of the existing gene pool by inbreeding. Due to the lack of ability to move birds, some breeders have given up breeding

the Nene and, in some instances, do not keep them at all. An effort was made to reduce the Nene to threatened status outside of Hawaii, which would have allowed the bird to be traded freely among aviculturists but, in the face of overwhelming support for the idea, the USFWS denied the petition. The only opposition to the petition was a letter from the Governor of Hawaii, written for him by a biologist who, when questioned on the position he took, could offer nothing except that he was opposed to downgrading.

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### About the Author

Walter Sturgeon is the current president of the International Wild Waterfowl Association. He maintains a collection of some 200 birds of 25 species including waterfowl and cranes in Lee, New Hampshire. Walter has maintained and bred a flock of Nene for 15 years. ●