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学 位 論 文 審 査 の 要 旨

博士（環境科学）

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学 位 論 文 題 名

Comparative studies on recovery histories and conservation strategy for *Grus japonensis*
and *Grus americana*

（タンチョウおよびアメリカ・シロヅルの回復史と保全戦略に関する比較研究）

Southeast Texas/northern Alberta and southeast Hokkaido, Japan are homes to populations of two extremely similar species of cranes with similar conservation stories. The whooping crane of North America, specifically the Aransas-Wood Buffalo (AWB) migratory flock, and the red-crowned crane of Hokkaido were both pushed to the brink of extinction, with surviving populations numbering 21 and 33 individuals, respectively, in 1952 (US Fish and Wildlife Service; Japan Red-Crowned Crane Conservancy). Both species have been subjects of focused rehabilitation efforts led by advanced national governments. While both governments' conservation authorities relied on a variety of conservation methods throughout their programs' histories, the United States Fish and Wildlife Service (FWS) focuses mainly on habitat management, while in Japan the Ministry of the Environment (MOE) and its predecessors lean most heavily on a direct population management strategy via a long-standing winter artificial feeding program. This study compared the recovery histories of these two remarkably similar species to understand the relative efficacy of two primary endangered species management approaches: habitat management vs. direct population management through artificial and supplemental feeding. This study also explored the legacy of the now 50-year-old United States Endangered Species Act, the historical underpinnings behind Japan's unique approaches to wildlife conservation, and the ongoing and emerging threats to the recoveries of both crane species.

An initial review of these two case studies strongly indicated that supplemental feeding in periods of lean food availability likely resulted in much faster overall population recovery in Japan, with the red-crowned crane population expanding at a rate roughly 20 percent faster than the AWB whooping crane population over the 70-year period reviewed in this study. Today, Japan's resident, red-crowned crane population numbers more than triple that of North America's AWB whooping crane population: about 1,800 red-crowned cranes by 2022 according to the Red-Crowned Crane Conservancy (RCCC) vs. 543 AWB whooping cranes as of 2022 per FWS. These results suggest Japanese conservationists may

have uncovered a method for ensuring faster population recovery in an endangered species: sustained long-term artificial feeding during times of least forage availability (in this case, the height of winter). Evidence in the academic literature further points to supplemental or artificial feeding's net positive effect on avian species' rates of reproduction and population growth. For purposes of this study, an ecological definition of "population growth" is given as a net positive increase in the numbers of individuals of a species as recorded in that species' primary habitat in the wild, thus excluding increases in the number of individuals of a species held in captivity.

While other factors that may explain the variance in red-crowned crane vs. AWB whooping crane population recovery, there is no convincing evidence that the AWB whooping crane population has been experiencing higher mortality rates, and a careful review of these other factors leaves the winter-feeding program as the strongest factor and the one that best explains the population growth different outcomes. Prior research has also found that the winter supplemental feeding campaign is principal driving force behind Hokkaido red-crowned crane population growth. This author's study now goes farther by analyzing red-crowned crane population recovery against that of its cousin species, the AWB whooping crane.

This study laid out in detail how the supplemental winter-feeding campaign in Japan best explains the faster rate of population growth (or net positive increase in the numbers of individuals of a species as recorded in that species' primary habitat in the wild) witnessed in Hokkaido's red-crowned crane population. Evidence from the academic literature is drawn to support this conclusion. Furthermore, a detailed assessment of habitat management efforts in Japan is offered to assess Japan's options for managing and protecting the large Hokkaido population of red-crowned cranes moving forward.

Finally, this study compared and contrasted international endangered species laws, including Japan's landmark endangered species statute, against the 50-year-old US Endangered Species to highlight the legacy of the Endangered Species Act and how the respective histories of crane conservation in the US and Japan influenced modern endangered species laws and management practices. This exercise revealed important philosophical and culture differences between approaches to endangered species conservation in the US and Japan, differences that can be interpreted through the lens of these two endangered crane species conservation initiatives.

In addition to the excellent academic knowledge in the research, his academic records throughout the Ph.D. course are outstanding. Based on these pieces of evidence, the committee concluded that Nathaniel Bernard Gronewold deserves to become a Doctor of Environmental Science.