AUGMENTING SAGE-GROUSE POPULATIONS THROUGH CAPTIVE BREEDING AND OTHER MEANS

WESTERN ASSOCIATION OF FISH AND WILDLIFE AGENCIES

Augmentation of sage-grouse populations has been a management strategy used by state wildlife agencies in limited circumstances since the 1930s. Augmentation has been employed to bolster small and isolated populations, to re-establish populations in historic habitats, or to establish new populations. Augmentation for these purposes has been conducted through transplants of adult and yearling birds, usually trapped on or near leks. Reese and Connelly (1997) reviewed published literature and unpublished reports describing 56 transplants of 7,200 individual sage-grouse conducted in seven states and one Canadian province prior to 1997. They concluded only transplants in Colorado, Idaho, and Utah appeared successful, and populations remained small. More recently, Colorado Parks and Wildlife (CPW) has demonstrated some success enhancing genetic diversity of small populations by translocating Gunnison sage-grouse from a source population in the Gunnison Basin to smaller satellite populations. The Utah Division of Wildlife Resources coupled predator control with a transplant of sage-grouse into a population near Strawberry Reservoir with some success (Baxter et al. 2007).

Reasons for relatively low success rates for transplants are complex and not well documented or necessarily understood. Commonly, large post-release movements can lead to high mortality, and hens may not breed or attempt to nest in the spring following release. In general, if environmental conditions that precipitated sage-grouse declines have not been mitigated, transplants of additional and locally naïve birds is not likely to succeed. Refinements to transplant protocols to address these issues, such as supportive predator control (Baxter et al. 2007), artificial insemination prior to release (Mathews et al. 2016), and transplants of juveniles or yearlings are being incorporated in augmentations and will likely increase success rates.

Sage-grouse have been maintained, hatched and bred in captivity successfully, but only in research settings (Pyrah 1961; Johnson and Boyce 1990, 1991; Spurrier and Boyce 1994, Huwer 2004; Oesterle et al. 2005; Huwer et al. 2008; Thompson et al. 2015; Apa and Wiechman 2015, 2016). Sage-grouse captured in the wild do not adapt well to captive conditions (Ligon 1946, Pyrah 1961, Oesterle et al. 2005). Many adult, and to a lesser degree juvenile, sage-grouse brought into captivity are flighty and stressed, which leads to high mortality rates (Remington and Braun 1988, Oesterle et al. 2005, Apa and Wiechman 2015). Consequently, the most effective approach to establishing a captive breeding flock would start with collection and incubation of eggs from wild nests. Large-scale, programmatic captive breeding efforts have never been attempted for sage-grouse. Attwater's prairie-chicken, listed as endangered since 1967, are sustained through a captive breeding (at seven facilities) and release program facilitated by the U.S. Fish and Wildlife Service. They have effectively been extirpated from almost all of their former range and persist on about 200,000 fragmented acres.

There has only been one published study that evaluated survival of sage-grouse chicks produced in captivity and released to the wild (Thompson et al. 2015). In this study, 1-10 day-old sage-grouse chicks produced in captivity from wild-collected eggs were released to radio-marked hens with an existing brood. Adoption rates overall were 89%; releases in the evening and of chicks younger than 5 days were the most likely to result in successful adoption. Survival of adopted chicks was comparable to that of wild chicks. Although successful, this technique is limited to situations where surrogate hens with broods are available and locatable at short notice (i.e., radio-marked). A more generally applicable approach would be to raise chicks to 12-16 weeks old and release them when they are capable of surviving without a brood hen. There has been no research conducted on survival rates of juvenile (12-16 week old) sage-grouse raised in captivity and released to the wild. Colorado Division of Wildlife did successfully rear Gunnison sage-grouse chicks in captivity to 5- and 7- weeks post-hatch when they were released to the wild, however, none survived (T. Apa, pers. comm.). Survival of male and female wild juvenile sage-grouse in two study areas in Colorado was only 61% from 1 September to 31 March (calculated from Apa et al. 2017). Based on literature related to survival of juvenile ring-necked pheasant over-winter, survival of captive-bred juvenile sage-grouse is likely to be much lower than that of wild juveniles.

The number of sage-grouse or sage-grouse eggs needed to provide 50 sage-grouse for augmentation purposes (a relatively small number) at the beginning of the breeding season from translocation and captive rearing, and the number of birds or eggs required from source populations for each method can be estimated for illustrative and comparative purposes using published estimates of survival, hatchability, and re-nesting rates of wild hens (Table 1). A captive flock of 50 to 150 hens would be required to produce the 429-1,286 eggs needed to produce enough juveniles for release at 12 weeks of age that would result in 50 birds alive and able to breed in March. This estimate assumes post-release survival rates between 10% (based on experiences with game farm pheasants) and 30% (best case; based on Attwater's prairie-chicken long-term average survival given extended soft release protocol and supportive predator control). Establishing a captive flock of this size would require collecting 123 to 369 eggs from the wild, under the simplifying assumption that all birds surviving to 12 weeks survive to lay clutches (this likely greatly overestimates contribution of captive-reared birds to reproduction as Leif (1994) found that captive-reared hen pheasants contributed less than 10% of the reproductive output that wild hens did given much lower survival during the nesting and brood-rearing period and lower nest initiation/incubation rates. There is potential for impacts to source populations in the establishment of a captive flock large enough to provide the number of eggs needed (Table 1). This would be an initial impact that would not recur, although additional removals from source populations would be expected to offset inbreeding depression and loss of genetic diversity in captive flocks.

Number of Sage-grouse or sage-grouse eggs needed to result in 50 sage-grouse at start of breeding season {31 Mar)

Method	Hatchability	Survival to release	Post-release survival to 31 Mar.	Number of birds or eggs needed	Net Removal from source population
Spring transplant	NA	0.95	0.50	105 birds	105 birds
Collect wild eggs, release progeny ≤ 10 days old	0.745	0.792	0.22	378 eggs	239 eggs
Collect wild eggs, release progeny ~ 12 weeks old	0.745	0.52	0.1-0.3	429-1,286 eggs	272-816 eggs
Eggs from captive flock, release progeny ≤ 10 days old	0.565	0.792	0.22	498 eggs	443 eggs
Eggs from captive flock, release progeny ~ 12 weeks old	0.565	0.52	0.1-0.3	565-1696 eggs	503-1508 eggs

It is likely that with experience, hatchability and chick survival in captive-rearing facilities could be improved, which would reduce the number of eggs needed somewhat. Sage-grouse are determinate layers, meaning each individual female will contribute only about 7-10 eggs per year. That, along with relatively high chick mortality and juvenile mortality following release suggests relatively large breeding flocks would need to be maintained and periodically augmented.

Other Considerations. Collection of eggs and/or adult sage-grouse would require permits from state wildlife agencies and, if taken from Federal land, from land management agencies. State regulations, laws and attitudes about private possession of wildlife vary, so this may or may not require regulatory change or legislative approval based on the state. Sage-grouse of all ages are very susceptible to West Nile Virus (WNv), so if a captive flock is established precautions should be taken to prevent exposure of birds to mosquitoes that may carry the WNv by physical exclosures or placement of the facility in areas where WNv is not prevalent. Captive sage-grouse also seem susceptible to salmonella, aspergillosis, and other bacterial, fungal, and viral diseases, so precautions should be taken to prevent introduction of these diseases into wild populations if captive birds are released. Captive breeding facilities for Attwater's prairie-chicken have experienced outbreaks of Reticulendotheliosis viruses (REV), which has resulted in transmission to wild birds upon release (Morrow 2017).

Conclusions

- Sage-grouse can be artificially incubated, hatched, reared, maintained, and bred, and will produce viable eggs in captivity.
- Relatively low hatchability and survival rates in captivity suggest egg collections from wild clutches could be substantial to produce a sizable captive flock for captive egg production.
- Release of 1-5-day old captive-reared chicks to existing brood hens is effective, but is not likely to be a strategy that could be scaled up. Survival of sage-grouse juveniles released at 8-12 weeks has not been evaluated but should be evaluated if releases at this age are contemplated.
- Techniques for captive rearing of sage-grouse are still in their infancy although significant strides have been made in the last 10 years. Methods associated with artificial insemination, controlling bacterial disease, disease prevention and control, and other aspects of husbandry need additional research. Zoos or other conservation partners with a similar mission, in collaboration with state or provincial wildlife agencies, may be in the best position to fund and staff this kind of research.
- Pending refinement and demonstration of the effectiveness of captive breeding and release of sage-grouse, other approaches to augmentation appear to be more certain and likely to be less costly and impactful to source populations.
- Sage-grouse population size varies substantially over time in response to environmental stochasticity. Augmentations by any means are not necessary for recovery from declines in relatively large contiguous habitats in good conditions. Augmentations are unlikely to have any success in small and isolated populations until and unless the environmental conditions that precipitated sage-grouse declines have been mitigated.

Literature cited can be found under the Sagebrush Ecosystem Initiative tab at wafwa.org

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