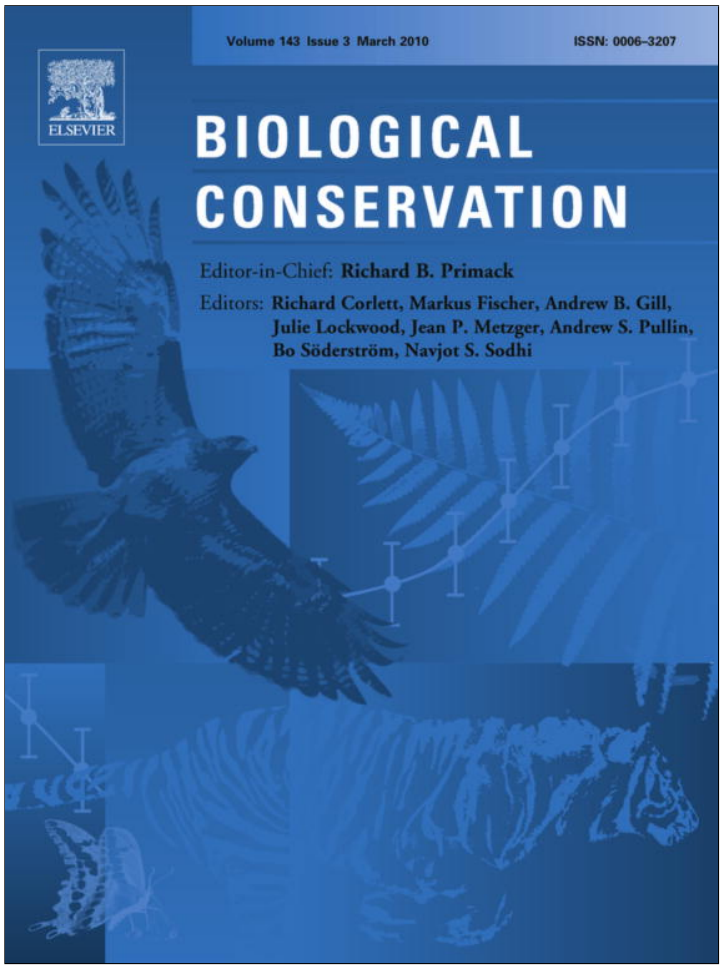

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Letter to the Editor

Isle Royale study affirms ability of wolves to persist

1. Summary

The small, isolated wolf (*Canis lupus*) population of Isle Royale National Park (IR) has persisted for 60 years and has been used as an example of how resilient a small wolf population can be. It was founded by a female and 1–2 males, and has fluctuated between 12 and 50 animals, usually in three packs (Raikkonen et al., 2009). The few founders, limited effective population size (N_e), and lack of immigrants has resulted in inbreeding. The population has withstood canine parvovirus and an 80% decline in its single year-around prey.

Raikkonen et al. (2009) documented that some 58% ($n = 36$) of IR wolves exhibited congenital, lumbosacral, vertebral malformations. Nevertheless, this population has thrived by preying on formidable prey, moose (*Alces alces*). IR wolves live as long as wolves elsewhere, and their key demographic characteristics are comparable to those of non-inbred wolf populations.

However, Raikkonen et al. (2009) attempt to use their findings to argue that reintroduced wolf populations, which typically start large enough to minimize founder effects, genetic drift, and inbreeding, are also threatened by genetic deterioration. Those authors contend that "many conservation professionals and policy makers downplay the threats posed by genetic deterioration". This is unwarranted criticism. In our experience conservation professionals acknowledge these consequences but propose that their probability in reintroduced populations during 50–100 years is small relative to problems with demographics, habitat, and mortality. The Yellowstone National Park (YNP) reintroduction used 41 founders from three populations 360–1200-km apart (Alberta, British Columbia, and Montana) plus 35 founders concurrently reintroduced into Idaho just 360-km away, in addition to naturally immigrating wolves. Already dispersers from the reintroduced populations have bred in each other's ranges. In addition, YNP is within dispersal distance (1000 km) of wolves in Montana and Canada.

In contrast, Isle Royale lies 25 km from the mainland, is rarely connected to the mainland and has only received immigrants once in 51 years, and they failed to reproduce.

The Isle Royale wolves have reduced genetic variation including N_e of 3.8, 60% loss of neutral genetic variation, 50% loss of protein variation, 13% increase in inbreeding coefficient per generation, and skeletal deformities from inbreeding and genetic drift that are consistent with the population's history. Whether these factors reduced individuals' fitness is uncertain but is a reasonable hypothesis. Nevertheless, despite inbreeding, the population has survived, the ultimate test.

Another Raikkonen et al. (2009) hypothesis warranting consideration is their claim that selection against deleterious alleles (purging) will not increase population fitness. They note that purging is unreliable for mitigating inbreeding depression. Although unreliable, selection could still remove deleterious alleles, as evidenced by successful maintenance of zoo populations, domestic breeds and inbred lines. This is especially true if combined with management that enhances genetic variation (e.g., immigration and gene flow). Population fitness depends on many factors, genetic and environmental, beyond the scope of this letter. However, just because selection *may not* prevent inbreeding depression does not necessarily mean it *cannot* be effective. For most managed populations, inbreeding can also be mitigated with immigration. IR is unique in that the population has inbred without intentional introduction of new animals because of its experimental value (Raikkonen et al., 2009).

Compared with Isle Royale, Yellowstone-region wolves are not inbred ($F = -0.051$), $N_e = 22$ (in 2004), have high genetic variation and inbreeding avoidance and high potential for immigration/emigration (Von Holdt et al., 2008). YNP comprises only 14% of the Greater Yellowstone Area, and harbors only 124 of 449 wolves there. Despite this healthy genetic profile, Von Holdt et al. (2008) estimated that inbreeding depression will occur within 100 years in the absence of immigration. This prediction, like Raikkonen et al's. (2009) claim that genetic deterioration is likely a problem in many populations, is speculative and only a possibility for future populations. Reduced genetic variation and potential inbreeding, genetic load, and fitness reduction are possible in any population, but their probability and importance relative to other considerations must be realistically assessed. We do not deny the potential for genetic problems in wild populations: we only recommend thoughtful, thorough, and realistic appraisals of their likelihood and importance.

Raikkonen et al. (2009) performed an excellent study of deformities in inbred wolves. However, the attempt to generalize to introduced populations is speculative and veers from the scientific practice of testing with data for each population. The Isle Royale population is informative but not directly applicable to other populations of wolves or other species. Raikkonen et al. (2009) conclude that their findings show "some [workers] make poor arguments that have the effect of working against conservation". We strongly disagree and invoke the caution of Patterson and Murray (2008:678) that flawed application of research findings "may undermine execution of effective wildlife management and ultimately provides a disservice to conservation biology".

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