

## Reply to Hudgens et al.: Bald eagles, no-analog ecological scenarios, and conservation strategies on the Channel Islands

Hudgens et al. (1) raise two issues with our interpretation of past bald eagle diets on the Channel Islands (CI). First, they provide an alternative explanation for the terrestrial isotopic signatures of Pleistocene bald eagles from the CI, suggesting that they regularly fed on pygmy mammoth carrion (1). Although this explanation is plausible, it is not more parsimonious than the one that we provided (2). Movement data of reintroduced bald eagles show evidence of dispersal from the CI to the mainland, and in some cases, individuals return to the islands after using inland habitats across western North America (3). Such movements likely took place in the past and may have been more common when CI bald eagle densities were significantly higher than today (2). The dispersal capabilities of bald eagles, higher eagle densities in the past, and greater diversity and abundance of megafauna on the mainland support our explanation.

The second issue focuses on the potential impact of a growing bald eagle population on recovering island fox populations, some of which are near historic lows because of recent golden eagle predation (4). We did not emphasize that island foxes did or will constitute a major resource for bald eagles and did not state that bald eagle restoration would be “detrimental to island fox conservation” (1). We argued that the marine prey base of the current bald eagle population has been compromised for many of the same reasons that bald eagles had to be reintroduced (e.g., exploitation and contamination). Bald eagles are generalists that consume prey in proportion to local abundance and can modify hunting behaviors to target novel prey. If the aim of reintroduction is to establish a bald eagle population of similar density as historic times, then ensuring an abundant prey base is essential to their long-term viability. The scenario described by ref. 1 provides little insight as to what may happen in the future, because the bald eagle population on Santa Catalina Island has been at very low densities since reintroduction. The current scenario on Santa Rosa Island is potentially more applicable to our model, because (i) fox populations remain low compared

with estimates obtained before golden eagle colonization (5) and (ii) the island still contains an abundant source of terrestrial carrion that reintroduced bald eagles consume during the fall hunt (3). Elk and deer on Santa Rosa will be removed by the end of 2011, eliminating the last nonnative terrestrial mammal subsidies for bald eagles on the northern CI. Under this scenario, bald eagles could possibly depredate foxes, but the impact of this pressure on an island’s fox population primarily depends on the size of fox and bald eagle populations and the availability of other food sources (e.g., seabirds, fish, or pinnipeds).

A broader issue that our study addresses is the impact of centuries and perhaps, millennia of anthropogenic modification to CI marine and terrestrial ecosystems. These modifications continue to produce ecological scenarios for native island flora and fauna that have no past analog but require intensive, expensive, and consistent monitoring to ensure their future conservation.

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- Hudgens BR, Coonan TJ, Faulkner KR, Garcelon DK (2011) Ghost prey and missing conflicts: Reinterpreting the implications of bald eagle diet composition on the California Channel Islands. *Proc Natl Acad Sci USA* 108:E25.
- Newsome SD, et al. (2010) Pleistocene to historic shifts in bald eagle diets on the Channel Islands, California. *Proc Natl Acad Sci USA* 107:9246–9251.
- Sharpe PB (2007) *Bald Eagle Restoration on the Northern Channel Islands, California* (Institute for Wildlife Studies, Arcata, CA).
- Roemer GW, Donlan CJ, Courchamp F (2002) Golden eagles, feral pigs, and insular carnivores: How exotic species turn native predators into prey. *Proc Natl Acad Sci USA* 99:791–796.
- Coonan TJ (2010) *Twelfth Annual Meeting of the Island Fox Working Group* (National Park Service, Ventura, CA), pp 52–53.

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The authors declare no conflict of interest.

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