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Migration of wild and captive bred Asian houbara

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In Central Asia, the Asian houbara *Chlamydotis macqueenii* has benefited from population reinforcement since 2009 using captive-bred houbara (CBH) of migrant origin produced in conservation breeding programmes in Uzbekistan and Kazakhstan. From 2009 to 2017, about 10 000 migrant houbara were released in several sites in both countries. Different release trials were conducted either in late summer (prior to fall migration) or in spring (after spring migration). 741 captive-bred and 251 wild juveniles were equipped with GPS-satellite transmitters to monitor their survival and migration patterns. Monitoring confirmed that captive bred houbara migrate.

Survival after full migration greatly varied between countries, release sites, years and season of release. After late summer release, return rates ranged from 14.4 to 57.4% in Kazakhstan and from 21.9 to 55.1% in Uzbekistan. After spring release in Uzbekistan, average return rate (51.4%) was higher compared to late summer release (34.5%). Using daily locations from 174 wild juveniles and 282 CBH which completed a full migration, we tested the effects of latitude of release site, bird origin and season of release on departure dates, migration distance, migration duration, duration on stopovers and 'ground time' (time on breeding and wintering grounds). Globally, in Kazakhstan and in Uzbekistan, CBH departed later, migrate shorter distances and spend more time on stop overs as well as on wintering and breeding grounds when compared to wild houbara. However, the latitude of release sites and years also had significant effects on migration parameters while sample sizes between wild and CBH were not balanced through time and space. Interestingly, when controlling for site and year, houbara released in spring departed at the same time than wild juveniles; whereas birds released in fall departed 7 days later.

Our results highlight (1) the importance of the release method (here timing of release) on the performances of translocated animals and (2) the importance and challenge of long-term and large-scale monitoring to uncover spatial and temporal sources of variation of animal demographics and avoid generalizing results gathered locally.