

Age, timing, and a variable environment affect double brooding of a long-lived seabird

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Differences in the number of young produced by animals each year is driven by a combination of environmental, physiological, and behavioral variables. Animals must balance the current reproductive investment against future survival, particularly when resources vary in space and time.

A common strategy for maximizing breeding success in birds is to produce 2 broods in a single season, a behavior known as double brooding. This behavior is not common in seabirds, however.

Cassin's Auklets (*Ptychoramphus aleuticus*) are among the relatively few species of seabirds that use this strategy, but the proportion of breeding pairs that attempt it is highly variable among years.

We investigated the source of this variation using 26 years of data from Southeast Farallon Island (Farallon National Wildlife Refuge) off central

California. We included breeding records from 193 known-age females in the study.

We found that the Auklets double brooded 32% of the time, ranging from 0-90% depending on the year. Female ages in the study ranged from 2 to 18 years, and double brooding was confirmed in all age classes excluding 2 year olds.

The success rates of second broods varied substantially by year but generally increased with female age, and the mean age of females that double brooded (8.5) was higher than those that did not double brood (5.8).

Lay dates of the first clutch for females that attempted double broods averaged April 3 for double-brooded females and April 23 for single-brooded females.

Across all ages, the probability of double brooding increased with high upwelling strength, an

indicator of higher ocean productivity, but older birds were more likely to take advantage of these conditions.

Main Points

Raising two broods of young in a year is common in birds, but rare in seabirds.

Cassin's Auklets on the Farallon Islands double-brooded 32% of the time over our 26 year study

Double brooding was most common in older females, those that had earlier breeding initiation dates, and in years with better ocean productivity.

The extra young birds produced from double brooding may be an important buffer against years of low marine productivity.

Johns ME, Warzybok P, Bradley RW, Jahncke J, Lindberg M, and Breed GA. 2017. Age, timing, and a variable environment affect double brooding of a long-lived seabird. *Marine Ecology Progress Series* 564: 187-197. doi:10.3354/meps11988