Management and Conservation Note

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AB AC Breeding propensity, the proportion of sexually mature females that initiate egg production, can be an important demographic trait when considering reproductive performance and, subsequently, population dynamics in birds. We measured egg production using yolk precursor (vitellogenin and very-low-density lipoprotein) analyses and we measured nesting using radiotelemetry to quantify breeding propensity of adult female harlequin ducks (*Histrionicus histrionicus*) in British Columbia, Canada, in 2003 and 2004. Using both methods combined, and accounting for error rates of each, we estimated that breeding propensity of adult females that migrated to breeding streams was 92 . These data suggest that, despite speculation that harlequin ducks have low breeding propensity, almost all adult females on our study site were not constrained in their ability to produce eggs and that influences on reproductive performance at later stages likely have much stronger effects on population dynamics. (JOURNAL OF WILDLIFE MANAGEMENT 72(6):1388–1393; 2008)

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KE D breeding propensity, *Histrionicus histrionicus*, nonbreeders, radiotelemetry, vitellogenin, yolk precursors.

Overall reproductive performance is the product of success across a series of reproductive stages including breeding propensity, which we define as the proportion of females that initiate egg formation (the inverse of nonbreeding). The literature is replete with studies describing rates of avian reproductive performance at most stages, such as nesting success and brood survival; however, breeding propensity has been poorly documented. Estimates of nonbreeding rates suggest that this behavior can be extensive in some species, especially seabirds (Coulson 1984, Cam et al. 1998). Nonbreeding by sexually mature individuals often is viewed in the context of life-history theory as a trade-off between current and future reproductive potential (Stearns 1992, Chastel et al. 1995, Golet et al. 1998). Thus, nonbreeding has been proposed as an adaptive strategy for long-lived species under certain conditions (Wooller et al. 1990). Proximate factors suggested to influence rates of nonbreeding include body condition and inter-individual variation in quality (Drent and Daan 1980, Coulson 1984, Mills 1989, Johnson et al. 1992, Cam et al. 1998). Rates of nonbreeding are likely affected by multiple causes and individual state, as well as external factors such as food availability or severe environmental variability, are both influential (Cam et al. 1998). Documentation of breeding propensity is important from a management perspective, because it allows consideration of the stages and mechanisms by which reproductive effort may be constrained (Cam et al. 1998). For example, low rates of breeding propensity may indicate poor habitat conditions, such as poor food availability or low nest-site availability, whereas poor nesting or brood success may be the result of high predation rates or inclement weather. Differentiating between these stages and causes of poor reproductive performance allows management to be targeted at the appropriate reproductive stage for maximum effect.

Sea ducks generally (Coulson 1984, Goudie et al. 1994, Quakenbush and Suydam 1999), and harlequin ducks (*Histrionicus histrionicus*) specifically (Bengtson and614..

proportions of nonbreeding females likely include some failed nesters and late nesters and, hence, breeding and Carlisle 1991, Williams and Christians 1997). Intra-assay and inter-assay coefficients of variation for VTG were 3.2 and 13.0 (n 6) and for VLDL were 5.1 and 4.3 (n 5), respectively. We analyzed plasma samples from females captured on wintering grounds in the Strait of Georgia, British Columbia, to determine a baseline, non-breeding value for the yolk precursors (n 16).

Both yolk precursors are correlated with egg production; however, VTG has been shown to be a more accurate and reliable indicator of reproductive status than VLDL (Vanderkist et al. 2000, Gorman 2005). Therefore, we considered VTG first for determining whether females were captured during egg production. Although yolk precursors are very low in nonbreeding birds, we determined conservative cut-off levels for breeding and nonbreeding classifications (Salvante and Williams 2002, Vézina and Williams 2003). We categorized individual females into 1 of 3 categories based on VTG results: egg producing, non–egg producing, and unknown. The unknown category included females whose VTG concentration fell within a range we considered uncertain. The lower limit of this uncertain zone was the mean VTG of our wintering females 3 standard deviations (0.44 g/mL), as recommended by McFarlane Tranquilla et al. (2003). Because 0.44 g/mL is low compared to other values in the literature, we also used an upper limit for the unknown category, which was the highest cut-off value reported in the literature (1.4 g/mL; Gorman 2005). We considered any individuals with VTG values . 1.4 g/mL to be egg producers (hence breeders) and we categorized those , 0.44 g/mL as non–egg producers and putative nonbreeders. If we categorized an individual as unknown based on VTG level, we then used VLDL value to evaluate status. As with VTG, we also used VLDL values to categorize these birds as egg producers, non–egg producers, or unknown with the lower limit defined as mean VLDL 3 standard deviations for our wintering females (3.66 mg/mL) and the upper limit of 5.2 mg/mL from published literature (Gorman 2005). If we classified a female as unknown for both VTG and VLDL, data types combined, we designated 3 females on breeding streams as putative nonbreeders, one was unknown, and we confirmed by $\geq$1 method that 30 (91) had initiated egg production. However, this estimate does not include those breeding females that could have been missed by both methods.

Misclassification rates differed by method. Using radio-

Dzinbal, K. A. 1982. Ecology of harlequin ducks in Prince William Sound, Alaska, during summer. Thesis, Oregon State University, Corvallis, USA.