Contrasts in Energy Status and Marine Foraging Strategies of White-Winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. Perspicillata*)

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CONTRASTS IN ENERGY STATUS AND MARINE FORAGING STRATEGIES OF WHITE-WINGED SCOTERS (*MELANITTA FUSCA*) AND SURF SCOTERS (*M. PERSPICILLATA*)

Contrastes del Estado Energético y de las Estrategias de Forrajeo Marino

R .—Con frecuencia se asume que las aves *Melanitta fusca* y *M. perspicillata* dependen de recursos similares. Para evaluar la certeza de esta suposición, contrastamos las distribuciones estacionales, el esfuerzo de forrajeo e indicadores del estado energético (masa y composición corporal, metabolitos plasmáticos) en tres de los principales sitios de alimentación en Puget Sound, Washington, para estas dos especies cogenéricas de patos cuyas poblaciones están disminuyendo rápidamente. Para *M. perspicillata*, la distribución y el estado energético indicaron que un sitio dominado por moluscos era relativamente importante al cominezo del invierno, pero la importancia cambió hacia el final del invierno y la primavera hacia áreas con plantas acuáticas marinas que proveían de desoves de peces o epifauna de invertebrados. A medida que avanzaba el invierno, los movimientos entre las áreas de forrajeo y el aumento del esfuerzo de forrajeo por *M. perspicillata* fueron acompañados por una mayor variabilidad en su estado energético en comparación con *M. fusca*. La masa corporal bajó durante el invierno en más del % en cerca de un tercio de los estudios anteriores sobre *M. perspicillata*, mucho más que el rango de pérdidas observado para *M. fusca*. La menor variabilidad en el estado energético, el esfuerzo de forrajeo y la distribución durante el invierno para *M. fusca* sugiere que esta especie es más capaz de regular su balance energético independientemente de los cambios en las condiciones de forrajeo. La mayor resistencia ante variaciones ambientales estacionales de *M. fusca* puede estar relacionada con su tamaño corporal > % mayor, lo que le confiere menores costos específicos de la masa y acceso a un mayor rango de presas bivalvas. Quizás por su mayor sensibilidad a las condiciones de forrajeo de invierno, *M. perspicillata* parece depender de una mayor variedad de sitios de forrajeo que *M. fusca*.

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C in many species of nearshore marine birds, North American populations of White-winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. perspicillata*) have decreased by ~ % over the past to years (Hodges et al. , Nysewander et al.). e reasons for these declines are mostly unknown, but identifying and conserving adequate marine habitat used during the nonbreeding period is a high priority for both scoter species (Sea Duck Joint Venture). ese species have often been combined and treated identically in population and conservation assessments because they are di cult to distinguish in aerial surveys and their speci"c habitat needs are poorly known. Likewise, little information on di erences in the marine foraging niches of these two species exists, and that which is available suggests that only standing stocks of bivalve prey need be considered when prioritizing critical foraging sites (Brown and Fredrickson , Savard et al.). However, recent "ndings suggest that the importance of non-bivalve foods has been underestimated (Anderson et al.), and assessment of the complex of foraging habitats needed to meet the seasonal energy demands of each species is lacking.

At least two factors suggest that the assumption that foraging niches for White-winged and Surf Scoters are similar may be invalid. First, a reevaluation of diet indicated that, compared with White-winged Scoters, Surf Scoters eat smaller bivalves, have a lower and more variable fraction of bivalve prey in their diet, and consume a decreasing proportion of bivalves as winter progresses (Anderson et al.). Second, because White-winged Scoters are > % larger than Surf Scoters, the foraging strategies

We used two sets of measures that represent di erent time scales of foraging pro“tability to evaluate seasonal changes in energy status of scoters at each site. First, we considered scoter fresh body mass and body composition (total lipid, total protein), which typically re”ect the pro“tability of foraging conditions over a period of weeks (Lovvorn b). Second, we also assessed con-

We sampled blood within min of collection, and completed other parts of dissections within h of collection. A sterile -gauge needle was used to transfer up to mL of heart blood to a heparinized vial for analyses of plasma metabolites. We veri“ed age class and sex using a combination of bursal depth and plumage (Iverson et al.). Fresh body mass (g) and length (mm) of the culmen, wing chord, and tarsus of each scoter were measured.

Fig. 1. Counts of White-winged and Surf scoters for three sites in northern Puget Sound, Washington, during 2003–2006. Counts are reported as total numbers (bars) and as a percentage of peak abundance observed during October through May (circles).

Fig. 2. Foraging observations of White-winged and Surf scoters for two sites in northern Puget Sound, Washington, during November (black bars and circles) and January–February (white bars and circles) of 2003–2004 and 2004–2005 combined. (A) Seasonal percentage of observations for each species by distance-to-waterline classes (a metric of diving depth). Mean seasonal values (±SE) by distance-to-waterline classes for (B) percent time underwater and (C) dives h^{-1}. Test results are for the effect of season on each variable, controlling for distance to waterline in B and C. In A, sample sizes (n) are provided for November and January–February, respectively; in B and C, sample sizes were slightly smaller (see text).

Table

TABLE 4. Contrast of White-winged and Surf scoters in terms of nutritional requirements, prey size constraints, and seasonal changes in body mass and dietere available, means ⇓ SE are provided wit teir ranges (in parentses.

	White-winged Scoter	Surf Scoter	Source
Body mass (g			
Female, December	1,393⇓ 14 (1,178…1,580,n] 41	925 ⇓ 10 (800…1,050,n] 42	Puget Sound, Wasington, and British Columbia (sources include tose cited in Fig. 3

of Polar Programs, and fellowships to E.M.A. from the National Oceanic and Atmospheric Administration National Estuarine Research Reserve System, the Wyoming National Aeronautics and Space Administration Space Grant Consortium, Wyoming NASA EPSCoR, the National Science Foundation GK Program, and the University of Wyoming Robert and Carol Berry Center for Natural History and Co 8(8i)-24.R .46ation.

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